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EDITORIAL COMMUNICATION

The objective of the special issue of Bioscience Biotechnology Research Communications Vol 13 No (14) 2020 on "**Recent Research on Intelligent Systems, Data Science Communication and Computing**" is to provide a platform to researchers to publish original research work in different avid areas related to Intelligent Systems, Data Science, Communication and Computing.

We are happy to share that quality research work addressing important issues in the field of data science, communication systems, computational intelligence, machine vision, robotics and smart systems etc. are published in this special issue. This Special issue also has articles related to Intelligent System, Communication, Computing, Data Science and applications, COVID-19 have been published in this issue.

This special issue aims to foster the growth of a new research community, acting as an international forum for researchers and practitioners in academia and industry to present research that will definitely play a very important role in changing the landscape of our near future.

The published research articles have been aimed to motivate the next generation researchers working in various emerging research areas. The articles published in this issue will be helpful for the researchers working in these new emerging areas. We express our heartfelt gratitude to all the contributors from different colleges and universities of India and Abroad for giving us an opportunity to publish their research work in this Special Issue on Recent Research Intelligent Systems, Data Science, Communication and Computing.

Guest Editors

Current Research Trends in Management, Science and Technology

Dr. Manoj B. Chandak
Professor & HOD CSE
Shri Ramdeobaba College of Engineering and Management Nagpur - 440013 (Maharashtra)
Email: hodcs@rknec.edu

Dr. Rajesh B. Raut
Associate Professor & HOD ECE
Shri Ramdeobaba College of Engineering and Management Nagpur - 440013 (Maharashtra)
Email: hodec@rknec.edu

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Intelligent Agent for Automatic Engineering Diagram Digitization with Deep Learning

Premanand Ghadekar[1] and Shaunak Joshi[2]
[1]*Head & Associate Professor, Dept. of IT, VIT Pune, India*
[2]*Research Scholar, Dept. of IT, VIT Pune, India*

ABSTRACT

Detailed diagrammatical representations used in the process industry used for representing process flow & piping equipment coupled alongside with instruments and control devices in the process industry are called Piping and Instrumentations Diagrams (P&ID). Up until recently, P&IDs were often handmade, scanned then stored as images and the digitizing of P&IDs used to be a slow time-consuming task, meticulously done by humans. Extracting P&ID data is a challenging task since there are multiple vision challenges associated with it such as the varied resolutions of different P&IDs and the presence of noise in the image. Considering all the issues, traditional computer vision has faced considerable roadblocks in P&ID data extraction. Using the recent advances in deep learning the proposed model proposes an end to end GPU based algorithm with modular subparts which would semantically analyze, extract P&ID data. The accuracy and correctness are of prime importance in the data extraction as it enables the project to be exact on its costing estimates which helps to maintain profitability. The proposed algorithm identifies each instance of valves, equipment's and instruments used in the P&ID and extracts its meta data as well. Then it identifies all the lines and the text present in the P&ID. In the final step all the P&ID components are associated to their respective meta data and link them to their respective pipe-codes which in turn are mapped to the pipelines which the components are hosted. As per the current viability no system does both these tasks end to end with high levels of accuracy.

KEY WORDS: P&ID, OBJECT DETECTION, DOCUMENT SEMANTICS, RETINA NETWORK, FOCAL LOSS, CONVOLUTIONAL NETWORK, GPU.

INTRODUCTION

Piping & Instrumentation Diagrams (P&ID) are a basic building block / integral part of any heavy engineering project. Each project has thousands of P&ID files which are collectively placed in a digital ledger. The accuracy and correctness are of these engineering diagrams are of prime importance as it helps the engineering companies building the project to be exact on their requirements. P&IDs are in use through the entire life cycle of a project beginning at the construction and all including operations phase & in order to convey material needs of the facility, these diagrams are created. In many countries, keeping the P&ID updated is legally required. Since process engineers use the P&ID to plan the industrial facility and analyze its components while using it also to keep a tab on any changes.

All these points make P&ID's an invaluable resource for data with respect to the industrial facility. However, there is little cohesion in these diagrams as they largely stored in archival format as CAD/CAM or PDF files with no metadata describing their components and connections between the different P&IDs. As intelligent sensors based on the IoT have seen increasing use in these industrial plants. The data they generate is often critical to the real

ARTICLE INFORMATION

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time operation of the plant. Sensor contextualization and linking them to external systems is an important part of the puzzle.

Figure 1: The proposed 3-step process for Information extraction from Piping and Instrumentation Diagrams

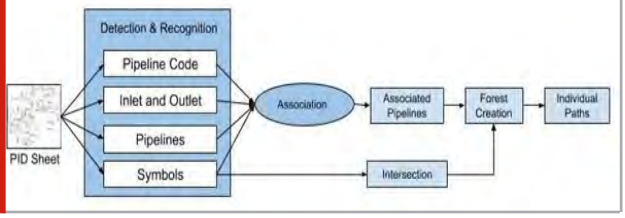
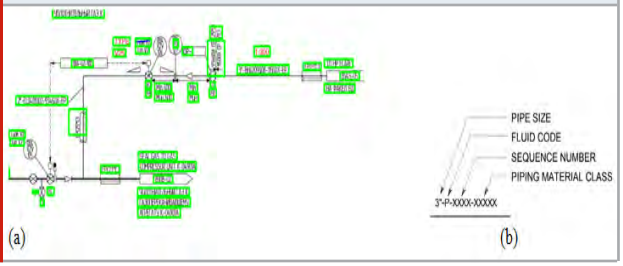


Figure 2: Text detection results from the FOTs based neural network model coupled with the pipecode format used, b. Code format which was used to make the Regex.



This entire step of manually digitizing the P&IDs is error prone and time consuming. This paper proposes exploiting cutting edge techniques in machine intelligence, computer vision and text recognition, to create a GPU based deep learning algorithmic pipeline which creates a hierarchical and structured representation which takes in account the interlinking of various components of the engineering diagram such as and not limited to equipment, pipe codes, text, etc. and give out a high fidelity output which would be component hierarchy. Which can be used for a multitude of tasks such as machine learning analytics, visualization and life cycle management.

Related Algorithms: Until very recently there was very little work done for semantically understanding Piping & Instrumentation Diagram (P&ID), however recently there has been a soft boom in the areas of object detection and classification in terms of digitization of complex engineering diagrams & document recognition. An automated method for converting DXF format to SVG (Adam, S et al., 2000) while preserving meta data. A case-based approach framework for engineering drawing recognition was proposed by (Arroyo, E. et al, 2014). In (Arroyo, E. et al., 2015) tried using vector-graphics-coded engineering documents to automate the extraction of association information. A partial matching method and its spatial relation graph (SRG) used in composite graphics recognition in (Belongie, S. et al., 2002).

Fourier Mellin Transforms were proposed by (Fei, L. et al., 2009) to classify multi-oriented and multi-scaled patterns. Auto Associative neural networks (Fei, L. et al. 2011), Deep Belief networks (Gellaboina, M. K. et al. 2009), and consistent attributed graphs (CAG) (Goh, K. N et al. 2013) were all tried for relation markers. Certain models that use visual feature maps which capture online stroke properties (Gupta, G. et al., 2017) and shape-based (Kiryati, N.et al., 1991). Connected Component (CC) analysis (Koo, H. I. et al.,2013) has been used extensively for extracting characters (Ouyang, T. Y. et al., 2009) from images. To detect text from the given media a CTP Network (Verma, A. et al., 2016) was used.

A Probabilistic Hough Transform (Saha, P. K., et al., 2016) variant was used to detect line segments, PHT is preferred over the standard version as its more robust and efficient while being quicker at inference due to the implementation using random sampling of edge points. In terms of pipelines, (Sung-O Kang et al., 2019) proposed a system, using template matching, sliding window approach and other simplistic methods such as to detect lines, text and symbols. Template matching though easily implemented has issues such as a failure to generalize well due to intra class variations across projects or a need for a large symbol database which captured every variation in every symbol. An innovative approached spearheaded by (Dries Van Daele et al., 2019)used image segmentation and object recognition techniques and tabular data reading techniques to represent the data in a feature vector to enable quick data extraction. For symbol detection and image segmentation traditional classification networks fall short due to which Retina Net (Ren, S. et al., 2015)is used as the symbols found in the P&IDs have a high occurrence of noise and large intraclass and minute inter-class differences coupled with the presence of text present inside the symbols.

Approach & Methodology: The proposed approach involves using Deep learning and Traditional Computer Vision Techniques in tandem coupled with computational algorithms to create a complete picture of the P&ID in highly structured and hierarchically layered data format. The aim of this project is the creation of an artificially intelligent agent which is used to achieve a high degree of accuracy in P&ID data extraction, faster workflow and to save costly man-hours of work. This intelligent agent is proposed as a novel aid to an engineer to make the highly tedious task of reading P&IDs and digitizing them a highly efficient process. The high-level idea of the proposed Algorithm is using GPU based Deep Learning models for Object Recognition & Text Semantics in a graphical compute rich environment coupled with core sub algorithms for semantic understanding and mapping of generated data present in the P&ID.

This is a multistage process in which information extraction from the P&ID sheet is done: (1) Initially, individual identification of all the components in the P&ID is done like the pipelines, pipeline codes, symbols, connectors, instruments, spec breaks & text. Conventional computer vision techniques and geometric algorithms were used here such as Point Detection Algorithms, Hough Transform, to detect and localized the geometric properties of the P&ID components, pipeline codes, deep neural networks-based Symbol detector is

used. (2) For the second step, these components which are separately identified, are mapped and stored in data structures which store the local temporal information about the P&ID component and its meta data. (3) Finally, composite random forest-based data structure is used to link all the components such as lines, pipe codes, symbols, equipment's and instruments by the direction of flow of the pipeline. This data structure represents the different relationships and mappings each component has to other components and give us the P&ID in a hierarchal, data format which is finally refined into a digitized P&ID. Figure 1. Shows the proposed 3step process for Information extraction from Piping and Instrumentation Diagrams.

Detection and Recognition

Pipeline Code Detection: Every pipeline code is unique and used to differentiate and distinguish each pipeline. Hence, the first step in this project is to identify the pipeline code. For images a FOTS (Xuebo Liu et al., 2018) network is used to extract the text. Since pdf is encoded in a .XML tree format, it is converted to a scalable vector graphics (SVG) format. P&I Diagram is plotted in 2D space and spatially encode the text boxes. Finally, geometric transforms are used to understand the orientation, this is done using orientation-based matrices which are multiplied with the co-ordinates of the text box to determine the orientation. This method returns all the possible candidate's components for text in the P&I Diagram sheet with 100% recall however a significant no of texts extracted which are unnecessary are removed later. Since it is known that each pipeline code length is fixed and is of a standard format, powerful regular expressions are used to weed out the spurious text detections. Text detection results from the FOTs based neural network model coupled with the pipecode format used is given in Figure 2.

2 Inlet & Outlet Detection: Any pipelines end or starts are decided by inlets and outlets. An inlet and outlet are made up of 5 vertices the width of 3 times with respect to its height. These exact physical properties were used here to detect the inlet/outlet in a robust manner using some heuristics. For detection of the inlets, first extract the text blobs detected in the previous iteration for further processing. Douglas Ramer algorithm was utilized to identify the polygons. Which are then further used to classify into inlets and outlets. There can only be 4 types of polygons. Using Douglas-Ramer Algorithm it is seen that there are two sides to an inlet/outlet each having 3 or 2 points. Since an inlet or an outlet can be easily deciphered if there is pipeline passing through the side having 3 points and if the side with 2 points is at a sufficient distance with respect to the other side, this test can be used vice versa and finally it is checked by application of a small mask on both sides and verifying if a line passes through it. Figure 3 shows Inlets and outlets in P & D.

3. Detection of Pipeline: Here all the lines from the .XML DOM are extracted from the image, text and the inlets and the outlets which are previously extracted from the images, are removed. The lines are then plotted according to the co-ordinates found in the Scalable Vector Graphics Data. These points are then scaled accordingly and then OTSU thresholding is used to clean up the spurious lines.

Figure 3: Inlets and outlets in P&I Diagrams

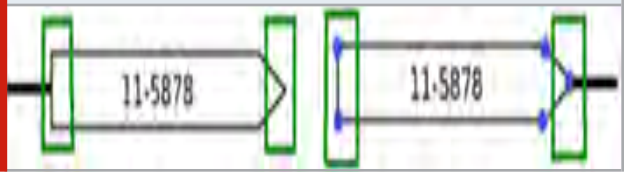


Figure 4: P&ID Sheet symbols which are used as classes

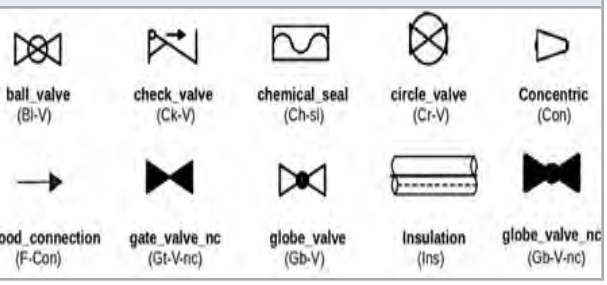
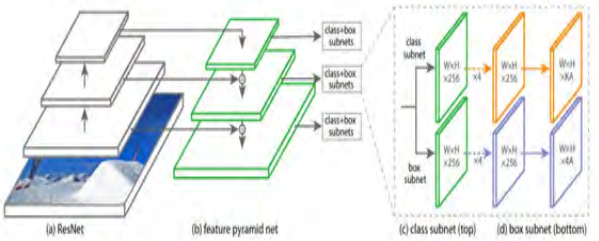


Figure 5: Retina-Net Architecture: (1) Base: Stacked feature network based on ResNet101. (2) Class subnet: finds if the object is present or not. (3) Box Subnet: finds the object location with respect to anchor box if an object exists



4. Symbol detection: In this paper, 30 classes of different equipment's and valves have been explored to be thorough and exhaustive in effort to create an end to end algorithm. The challenge with these symbols was that they had very low interclass difference in their visual appearance, Thus standard off the shelf object detectors based on a traditional computer vision methods are not able to correctly distinguish between them as there is high intraclass variation, this prompted us to create a composite symbol detector based on Deep Learning methods.

Retina Net Architecture would be used for this task. Retina Net is a single, unified network made up of three individual networks, a single base network and two sub tasks specific the base network returns the feature mappings over the whole input, irrespective of the base network size and is a standard convolution network. The first subnet takes in the feature maps from the

first network and does the classification task which is probability of an object being present at a certain spatial location; the second subnet performs convolution bounding box regression using anchor boxes for each ground-truth object.

P&ID sheet symbols which are used as classes shown in Figure 4. Retina_Net Architexture is given in Figure 5.

Meta data and structuring: Now that all the P&ID components are extracted the final step of the algorithm is to create a mapping between each component and represent the P&ID digitally in a data format. This process is done as follows:

Pipeline Code to Pipeline Association: Here at this stage, pipeline and pipe-codes tags are associated. Each decision to associate any component with the other is done heuristically based on Euclidean Norm with respect to the distance between components, with a preference for components with the smallest distance.

Pipe code & tag association: Association of the inlet / outlet.

Pipe code & symbol association: Each component has its L2 Norm distance to all other components mapped and saved. The symbol and pipeline closest to each other based on L2 Norm are associated. The P&ID in its final form is represented as a random forest, each line tag is treated as a base node of the individual tree in the forest and the inlet tags are treated as leaves. Thus, each line would be intermediate nodes. At any given time, there can be trees with common nodes which show the line overlapping. However, each flow path is unique.

Table 1. An overview of experimental results

P&I Diagram Component	Detection Results	
	Detected vs Ground Truth	Accuracy
Pipeline-Code Detection	35 / 74	95.14%
Pipeline Detection	117 / 135	86.66%
Detected Outlets	23 / 24	95.88%
Detected Inlets	35 / 36	95.88%
Associating Pipeline Code	195 / 247	78.00 %
Associating Outlet	19 / 24	90.40%
Associating Inlet	33 / 36	94.11%

Experimental Results: These experiments were performed on a 16Gb Tesla V100 GPU & a private dataset for evaluating the performance of the proposed algorithm which was composed of a digital ledger which had about 1250 flow diagrams, was used. The experimental data was compiled in a tabular format. The experimental data was compiled in a tabular format and given in Table1.

In the above given table, the first entry shows the text detection accuracy given by the FOTS based proposed OCR. 235 / 247 codes are positively found giving an accuracy of 95.14%. A sample visual output of the OCR Model is shown in fig 2. Next, the pipeline detection is handled, here lines are detected with an accuracy of 87%. The proposed heuristics for inlet and outlet-based detection works well giving 95% accuracy. Pipeline code association was at 78% as there is some noise in the data coupled with lack of detection of pipe codes or pipelines or sometimes both. Finally, for inlet and outlet association an average of 92% was found.

Table 2. Symbol detection confusion matrix for Retina Net

	VG	RC	VBF	VF	VC	RX	F	VG	VO	GI	VN
VG	79	5	0	0	0	0	0	4	0	0	0
RC	0	67	0	0	2	0	0	0	0	0	0
VBF	0	0	22	0	0	0	0	0	0	0	0
VF	0	0	0	394	0	0	0	0	0	0	0
VC	0	0	0	0	58	0	0	0	0	0	0
RX	0	0	0	0	0	24	0	0	0	2	0
F	0	0	0	0	0	6	16	0	0	9	0
VG	7	0	0	5	0	0	0	34	0	0	0
VO	0	0	0	0	0	0	0	0	261	0	0
GI	0	0	0	0	0	0	0	0	0	32	0
VN	0	0	8	0	0	0	0	0	3	0	129

Table 3. Retina Net performance metrics on different symbols

	Precision	Recall	F1-Score
VG	0.932	0.945	0.812
RC	0.956	0.941	0.955
VBF	0.99	0.883	0.944
VF	0.98	0.898	0.895
VC	0.97	0.812	0.897
RX	0.927	0.723	0.921
F	0.877	0.99	0.937
VG	0.999	0.922	0.836
VO	0.98	0.921	0.871
GI	0.99	0.789	0.893
VN	0.944	0.99	0.911

An error matrix is used to show the efficacy of symbol detection using Retina Net as seen above. The model is was trained for 8k epochs as pre-stoppage was employed to prevent overfitting coupled with use of simple overfitting prevention methods such as batch norm and data fuzzing. In order to cover maximum types of symbols there 10 unique classes of symbols to be detected, along with one extra class of spurious symbols was kept checking which classes needed extra data in order to get a boost in detection. This class of spurious symbols is used primarily to confuse the detector in order to get a better match in the long run. It has been seen experimentally that Retina Net model did not overfit due to these methods used. In some cases, as evidently seen that some classes have high intra class variation

and low interclass variation. Symbols such as ball valve, globe valve and globe valve (normally closed) as shown in fig are common examples of this phenomena. For example, 3 check valves are detected incorrectly, along with 8 flow arrows, and 4 globe valves. Symbols with high interclass variance such as reducer and flanges are detected without any false positives.

In Table 3, F1 score and the precision and recall values are calculated for symbol classes as seen in table 3. Retina Net was found to have excellent F1 scores with symbols, even those with miniscule variations, for a score of 0.88 an average for each class. While in some cases symbols precision was recorded to be almost 1.0. Training loss along with overall loss, mean Average Precision coupled with regression loss and finally average class loss are given in Figure 6. Figure 7. shows a final color-coded digitized P&ID with connected component analysis.

Figure 6: Training loss along with overall loss, mean Average Precision coupled with regression loss and finally average class loss

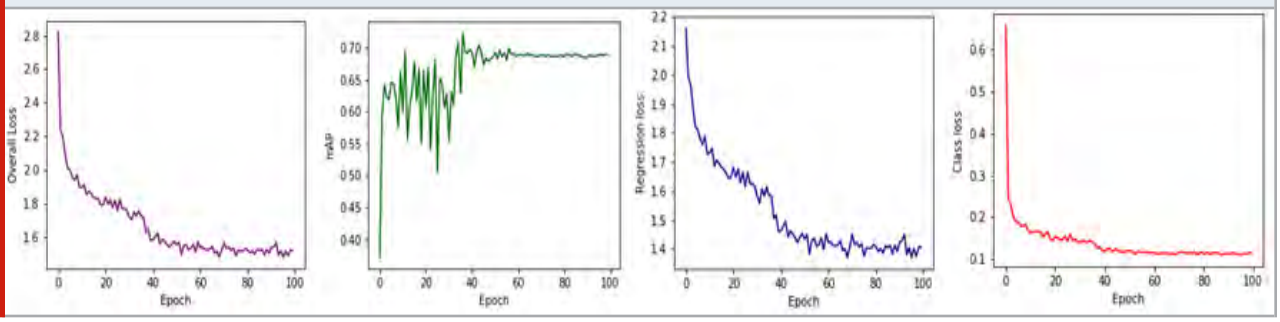
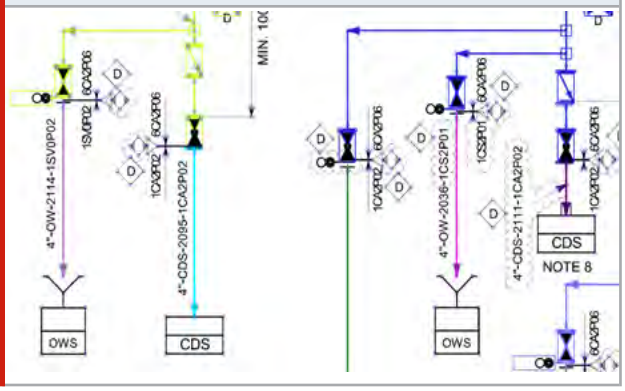


Figure 7: A final color-coded digitized P&ID with connected component analysis



CONCLUSION

In this paper, an algorithmic pipeline approach for P&ID data extraction and automatic digitizing, has been proposed. This proposed process combines current computer vision based and deep learning enabled models to recognize and classify symbols, semantically understand text and detect connections to link different equipment present on pipe runs. Additionally, the proposed symbol detection model is highly extensible and has a high level of precision and very low recall, therefore it can be easily trained on new classes. Geometric algorithms for instrument localization, traditional computer vision algorithms for detection of inlets, outlets and pipelines were used. Retina Net with a ResNet-101 backbone is used for pipeline code and symbol detection.

A random forest data structure is formulated for mapping each P&ID component and tracing the flow of fluid in the appropriate pipeline. There are many directions which pursued here such as, using a 2 class CNN such as to classify whether a region of interest improves performance of symbol classifier in a binary manner as this reduces the sliding window computation. Secondly, one shot learning, leveraging a dataset made up of a handful of examples of each class could be done instead of assembling a dataset made up of hundreds of examples of a single class. The proposed heuristics for inlet and outlet-based detection work provides 95% accuracy. The symbol representations learned can be used in other places such as diagram search across projects and or automatically understanding the maintenance work needed across diagrams. New efficiencies can be found when unstructured data is converted into hierarchical structured data using the proposed pipeline, and benefit to industries is unlocked and the manual workload of documents digitization reduced.

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Driving Licence Registration and Verification System using Smart Contract

Rishikesh Kale[1], Abhijeet R. Raipurkar[2*] and Manoj B. Chandak[3]
[1, 2, 3]*Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Every kind of business depends on the evolving technologies that tend to take advantages of new opportunities. With every new technology, different set of challenges appear. In recent years, numerous blockchain-based applications have been proposed to solve problems in different areas. In this paper, an adaptive strategy is proposed to eliminate driving license frauds using blockchain technology. With second generation of blockchain technologies, smart contracts have helped to develop trust and automated transactions between large numbers of users. Smart Contracts are programs that run on the blockchain to take action on the records. This paper proposes a driving license registration and verification smart contract using Ethereum blockchain. The smart contract mechanism allows for registration of the officers/agents by a higher authority. It can dynamically restrict unregistered officer/fraud agents from generating fake driving license. Also, the smart contract facilitates verification of a registered driving license which includes checking its validity and authorization. It provides special rights to the traffic regulator officer to add remarks to the driving license if the driving license holder is found violating the traffic rules. Since the blockchain is an immutable ledger, this remark cannot be tampered and the apprehended person would be liable to pay the fines. This would result in reduction of traffic accidents and violation of traffic rules. This smart contract opens up doors for more innovations in this field and improves traffic regulation and management.

KEY WORDS: BLOCKCHAIN; ETHEREUM BLOCKCHAIN; SMART CONTRACT NEIGHBOUR.

INTRODUCTION

The traditional system of issuing driving license is centralized and the data is maintained in centralized servers. [Michael Crosby, Pradan Pattanayak, Sanjeev Verma, Vignesh Kalyanaraman, 2016] According to current system, as per the request, organizations are authorized to issue and validate the identities. There are chances of data breaching as under this system, third parties are responsible for keeping the security of the data. The importance of digital identity is very much important. Due to the lack of proper security issues, current scenario does not guarantee the security of the data. So, many users face identity issues that cause a massive problem in their social life as well. To ensure a proper management of system, all the problems including data security need to be focused and solved in fast track manner.

Blockchain is a secure peer-to-peer, or person-to-person, transaction system for transacting money, or other items of value. [Rajarshi Mitra] The blockchain is considered as immutable ledger, which means that once a data is entered into the blockchain it cannot be tampered or erased. Every node in the distributed and decentralized network holds the copy of the blockchain and can view the data entered into the blockchain, which increase the transparency. The decentralized nature of blockchain prohibits the data from being owned by one centralized

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*****Corresponding Author: raipurkarar@rknec.edu
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entity. Blockchain run in a "trustless", open environment. So, this allows for transactions to be completed without a 3rd party to provide trust. On the blockchain, if a value needs to be changed, a new entry is added to the ledger, as a transaction, and the value is updated. The new record does not remove the previous records.

1.1 Smart Contract: A smart contract [Fries, Martin; P. Paal, Boris, 24 May, 2020][Ameer Rosic] is a computer program or a transaction protocol respectively, which is intended to automatically execute, control or document respectively legally relevant events and actions according to the terms of a contract, of an agreement or of a negotiation. The objectives of smart contracts are the reduction of need in trusted intermediates, arbitrations and enforcement costs, fraud losses, as well as the reduction of malicious and accidental exceptions.

1.2 Decentralization: Blockchain is a decentralized system [Raval, Siraj, 2016] because single person cannot control it. Every node in the system has their copy of the blockchain. Nodes are also architecturally decentralized because their infrastructure has no central point of failure, as each node keeps a copy of the blockchain. The data in blockchain is stored across its peer-to-peer network, thus it eliminates a number of risks which come when the data is held centrally. The crackers always target the central points of failure to exploit, however the peer-to-peer blockchain network does not have the centralized points of vulnerability thus provide security from data breach.

2. Literature Survey: Identity is an essential factor in a life of a human being. In our society, daily activities are associated with user's identity. With evolution in technology the traditional system paper-based system is being replaced with digital identity. [Roger Aitken] The idea of a digital identity has several potential benefits, and strengthening it with Blockchain makes it a more fungible and realistic possibility. Blockchain technology provides a decentralized environment and has the ability to transform and replace traditional systems with a highly trusted mechanism which is capable of managing identities. This decentralized environment facilitates the user with greater control over users own identity.

2.1 WEF Known Traveller Digital ID: In collaboration with the WEF, Accenture introduced Known Traveller Digital Identity [The Known Traveller website, January 2018] or KTDI a World Economic Forum initiative which brings together a global consortium of individuals, governments, authorities and the travel industry to enhance security in world travel. It allows the travelers to share documentation and information from one verified identity with partners including government authorities, airlines and hotels. The KTDI allows travelers to play an active role in travel security efforts by sharing their information proactively. Travelers always retain control over what, where and with whom they share their information. Each data element shared by the traveler is verified, accurate and consistent every time. This is made possible by the technologies of distributed ledger, cryptography and biometrics.

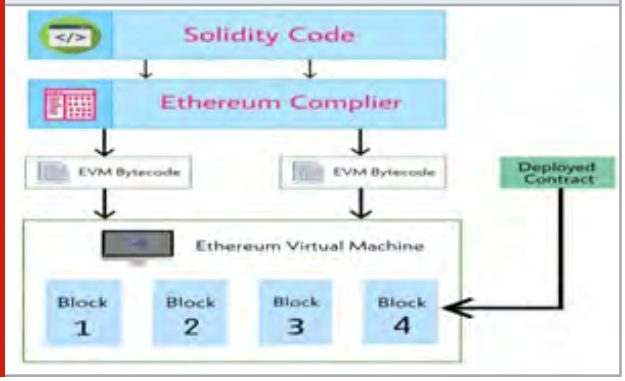
2.2 Sovrin: Sovrin [Drummond Reed, Jason Law & Daniel Hardman, 29 September, 2016] is one of the popular projects offering a self-sovereign identity for the users. In reality, it's a non-profit organization that solely works with decentralized digital identity solutions. With this, user can get personal control, trust, and easy to use digital identities. Basically, it's a metasystem that allows organizations, people the freedom to use any application without worrying about their identities. Moreover, Sovrin also possesses verifiable credentials options.

2.3 Civic: Civic [Vinny Lingham, Jonathan Smith, 2017] is a personal identity verification process that uses blockchain technology to offer digital identities. It proposes an ecosystem, wherein an individual can create his/her own virtual identity along with storing additional information as well. It facilitates on-demand, secure and low-cost access to identity verification services. It requires verification of all credentials of an individual before storing it on the digital identity solutions, however the background and personal information checks will no longer need to be undertaken from ground up every time.

2.4 uPort: ConsenSys developed a self-sovereign identity system, known as uPort, [Dr. Christian Lundkvist, Rouven Heck, Joel Torstensson, Zac Mitton, Michael Sena, 2016] based on Ethereum blockchain. uPort aims to return ownership of digital identity to the individual. It uses blockchain to create an identifier (an Ethereum address) and a public-private key pair for signing transactions. The registry of identities on Ethereum allows for information about an identity - whether that be a degree earned or permission granted to that identity - to be sent to and held by the holder of that identity. The smart contract behind uPort application allows user to create and store personal information and generate their identity, the associated key of the user is held by its mobile application. It assures security and recovery of data in case of loss of device with which the key was linked.

3. System Design And Development On Ethereum Blockchain: Ethereum is a global open source fully distributed "peer-to-peer" computer network. Ethereum runs on a distributed network. Each computer on the network is a peer and has a copy of the ledger with all the data. Distributed networks always ensure the blockchain is up and running and thus a single point of failure in network will not affect the whole system. Ethereum has made it possible to exchange any type of asset or information on a blockchain. Ethereum is a second generation blockchain where users can write applications, called Decentralized Applications, or DApps that transact using digital currency, called Ether (ETH). A decentralized application is a computer application that runs on a distributed computing system.

Figure 1: Ethereum Virtual Machine



The Ethereum Blockchain is one of the distributed ledger technology, where DApps are often referred to as smart contracts. Most experts define first generation blockchains as only transacting their own native currency or token. Second generation blockchains not only manage their own native token, but also any type of asset can be defined. They can also take action on transactions with programs called Smart Contracts. Smart Contracts enforce the rules of the transaction. Smart Contracts are not legal contracts, but computer programs that are activated based on the Ethereum transactions. Ethereum Smart Contracts can be written in Solidity which is a programming language. Smart Contracts which are deployed on Ethereum blockchain are written in object-oriented Solidity programming language. Smart Contracts are compiled to the EVM (Ethereum Virtual Machine), and are deployed to the Ethereum networks.

3.1 Blockchain Based Smart Contracts for Issuing Driving license: The benefits of blockchain are unique to its architecture and construction. Blockchain would be the perfect solution for a transparent driving license registration system. The database of drivers and database of vehicles for different regions is maintained by the [Wikipedia-The Regional Transport Office] Regional Transport Office (RTO) also known as Regional Transport Authority (RTA). It is responsible for administrating various activities like issuing driving licences, registration of vehicles, collection of excise duty which include road tax and road fund license. The RTO also looks after selling of personalized registrations, inspection of vehicle's insurance and clearance of pollution test of vehicles.

Every region has its RTO office which governs the administration of road transport which also includes issuing of driving license. A regional RTO head is a person who administers the RTO office of that region. Several authorized agents/officers operate under his administration. However apart from these agents there are several fraud agents who sell false driving license. Thus, a fraud proof system is required to eliminate fraud agents and identify false driving licences. Blockchain technology has the ability to overcome the problems faced in the traditional system of issuing driving licences.

4. Implementation Details: Every department under RTO can be designed and implemented via blockchain smart contract system. Smart contact system in implementation will be adopted for issuing driving licences and performing verification also. The purpose of designing this smart contract is to facilitate the RTO to overcome the administrative inefficiency. This system will help in eliminating fraud agents and other middlemen and management of complex and large amount of data and procedures. Along with this, it is capable of carrying out necessary transactions which would in turn help to curb corruption and other monetary issues.

Figure 2: Smart Contract for issuing Driving licence and its verification

4.1 Registration of authorized agents/officers: The main goal is to streamline the process of registration of driving license and handling process by eliminating the long waiting time process, removing the fraud agents from the system and reducing the human error rate. Only the regional RTO head will have the authority to appoint agents which would be handling the process of registration and issuing new driving licenses. Thus, any agent outside the blockchain will not be able to carry out transactions in the blockchain and generate any fake license. The Ethereum Smart Contracts act as laws and thus can restrict the unauthorized agents or outsiders.

4.2 The Process for Issuing and Filling Driving Licence: In this process, metadata will be handled which includes registration of driving license via smart contract. The agents will verify the data submitted by the applicant and after verification of the data if found authorized, the authorized agents would generate and add the driving license to the blockchain.

4.3 Verifying the Driving License: Only authorized agents which were registered by the regional RTO head will have the access to view and verify the driving license via smart contract. If a driver is found unfit for driving or violating the traffic rules the agent/traffic regulator has the authority to add remark in the driver's driving license that would impose more strict restrictions on people and encourage them to follow traffic rules and thus prove helpful in reducing the road accidents. The date of issue

and the date till which the license is validated are stored in the form of timestamp which can be converted easily using epoch time converter. With this approach, manual entry errors can be eliminated.

4.4 Other features offered by the driving license smart contact: In case of transfer/retirement of the regional RTO head the smart contract allows transfer of ownership of the smart contract to the new account and this can be done only by old regional RTO head. If an agent is found using wrong means or in case of his retirement/ transfer the regional RTO head has the authority to remove the agent.

4.5 Potential Benefits of Blockchain in Digital Driving License: Once driving license is registered on blockchain, then making payments for traffic violations and fine will become easier and seamless. Often, in case of higher payment fees, the license holder simply issues another new driving license, as there is no mode to check it. However, blockchain provides a mechanism for such payments. The amount of fine can be directly transferred from the license holder's account to one single address i.e. directly to the government. Once the concept of blockchain is introduced in the system of driving license, a whole new portal of innovation opens up.

CONCLUSION

In this paper, a Smart Contract based on decentralized network using blockchain technology is considered to propose an adaptive attack strategy that eliminates the frauds in driving license registration system. The Smart contract system is proposed in order to eliminate the fraud agents from the cycle of driving license registration and generation. Only genuine and eligible drivers would be allowed to drive vehicles, and the verification of the drivers via smart contract will ensure that. This smart contract opens up new opportunities for identifying people and making other process easier like renewing driving license and transacting the fines to a single account. With this system, catching criminals and fugitives will become streamlined and corruption will end.

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Patient Health Monitoring System Using Blue Eye Technology and IoT

Abhijeet Ramesh Thakare[1*] and Nilesh Korde[2]
[1, 2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Technology has now advanced enough for us to sit in front of our personal computer that can feel and monitor human feelings known as "BLUE EYE TECHNOLOGY." The devices which are used in this technology can detect the emotional level of the human body, such as facial and voice recognition, etc. The equipment used in Blue Eye Technologies is capable of recognizing human movements, checks our personality, senses our presents, and begins to communicate with us. In today's world, HealthCare has become one of the essential things in our life. But, the traditional healthcare system faces various problems, especially in the COVID-19 pandemic. Different challenges are faced by the HealthCare domain like scarcity of HealthCare professionals in hospitals; very expensive treatment, lack of healthcare knowledge, and Manual monitoring of patient's health parameters. In this paper, a remote patient monitoring system is proposed which can monitor patients remotely using Blue Eye Technology and IoT. Doctors can monitor effectively patient's moods and emotions (such as sad, joyful, and surprised) by utilizing the Emotion Sensory System of Blue Eye Technology as well as extract Physiological information of the patients such as Blood Pressure, Heart Rate, Temperature, ECG, etc. This information is effectively used by the Doctors for diagnosis and proper treatment of patients.

KEY WORDS: BLUE EYES TECHNOLOGY, CLOUD, IOT, HEALTH CARE MANAGEMENT, SENSORS.

INTRODUCTION

Think about a world where people are communicating with machines. With this capability, machines can interact with human beings using technology like voice and face identification, etc. At the tip of mouse feelings of human beings can also be recognized. The human sense is mainly based upon the ability of audiovisuals and sensors to sense view and incorporate. The BLUE EYES technology is aimed at developing digital devices with visual and sensory capacities close to those of humans. This utilizes a non-obtrusive sensing system, using most conventional video cameras and microphones to recognize the actions of the operator by utilizing sensory capabilities provided. By realizing the emotional or physical situation, the machine will give an appropriate reaction and also identify what is expected from the user (Farzana et.al, 2019). As shown in Fig. 1, an IoT network consists of sensors/devices that "connect" through some kind of connection to the cloud.

If the data enters the server, the app stores it and can then agree to execute an operation, such as delivering a message or changing the sensors/devices automatically without the user needing to. In almost every country, manual methods are utilized for the measurement of various patient health parameters like ECG, Temperature, blood pressure, and Heart Rate (Kumawat et. al, 2018). Also, various hospitals utilize extra HealthCare Software for HealthCare Monitoring of the patients. But, this kind of software provides low reliability and accuracy (Rahman et. al, 2019). Nowadays, Especially in COVID-19 pandemic, a huge number of peoples require healthcare support. But, healthcare systems are going through various problems

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*Corresponding Author: thakarear@rknec.edu
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like less number of healthcare workers and professionals in hospitals, very high cost for treatment, and lack of healthcare knowledge (Oyebola&Toluwani, 2018- Gomes et. al, 2015). So, the main motivation for designing our system is automatic monitoring of the patient's health related parameters from a remote location.

Related Works: In (Dhinakaran et. al, 2020), proposed an Automated Patient Monitoring using Blue Eye Technology (BET) and Cloud Computing. This system is utilized to measure various health parameters of the patients. A "KHealth"- which is a digital healthcare system used for diseased monitoring. This system (Sharma et. al, 2018) is analyzed for Practical Privacy-Preserving Analytics. A potential tradeoff in privacy is also discussed in this work. IOT also plays a major role in health monitoring. By combining IoT with Blue Eye Technology, highly reliable data transmission is achieved.

Various IoT devices generate big amounts of data. This data is further used for analytics purposes by applying different Artificial Intelligence Techniques (Bravo et. al, 2011). Cloud Computing also plays a crucial role in health monitoring. Various services are provided by Cloud Computing. For example, Analytics, Database Storage, Servers, and different kinds of Intelligence over the Internet (Yi & Saniie, 2016). The system proposed in (Wu et. al, 2019) utilizes a wearable body area network (WBAN) for collecting user data and a low-power wide-area network (LPWAN) for collecting the WBAN with the Internet. In this work, a standalone local server (gateway) is used, which can analyze the raw sensor signals and display the environmental and physiological data. It also triggers an alert message if any emergency circumstance is detected for the patient.

Figure 1: Internet of Things (IoT)

Proposed System: Our Proposed system (Figure 2) comprises three main components which are as follows:
1. Data Acquisition Unit (DAU) 2. Central System Unit (CSU) 3. Software

Data Processing Unit: Data Processing Unit consists of two units:-

Data Acquisition Unit (DAU): Data Acquisition unit is one of the chunks of the Blue Eyes System. The key function is to collect the sensor's physiological data and transfer it to the central device for processing. The Data Acquisition Kit contains numerous Atmel 89C52Microcontroller hardware modules, Bluetooth core part (which is based on ROK101008), HD44780 – tiny LCD 24C16 – I2C EEPROM, Jazz Multisensory interface, Indicators comprises of beeper and LED and 6 AA batteries and voltage monitoring capabilities.

Central System Unit (CSU): It is an equipment for Central Network System is the wireless link per second. The package includes a Bluetooth module and a speech data transfer PCM codec. The module uses a parallel, serial, and USB cable to connect to a PC. By utilizing standard mini-jack sockets audio data is accessed.

The Software: The primary role of Blue Eye System Technology is to look after the medical state of the operators which is operating. Actual time tendering and analysis of incoming as well as physiological data to display instance response on the state of Operator, warning firing is performed by the program. The system center with many usable modules is a Blue-Eyes program that supports the transition flow between other device modules (e.g raw data fetching from the Connection Manager to data analyzers, forwarding interpreted data from data analyzers to files, GUI controls, and other data analyzers). Visualization software provides managers with user experience. It is possible to set the Visualization application in an off-line domain. In this case, all the data is fetched from the database. The instructor reconstructs the details selected from the course. Adding exceptional perceptive capabilities to computers will require computers to function as intimate partners with human beings.

This software enables an overview of the chosen video source and associated sound stream monitoring of the operating operators to function as intimate partners with human beings.This software enables an overview of the chosen video source and associated sound stream monitoring of the operating operator's Physiological state. On the incoming warning messages, the Supervisor is signaled immediately each time. An attempt of attaching additional functionality to computers are performed by researchers which permit computers to be communicated as a human being, recognize human objects and also listen to guess, speak, and even listen to human sentiments. It aims to build virtual machines with visual and sensory capacities close to those of humans. The task of the Operator is to watch all the physiological conditions, warnings, video, and audio data captured. Physiological data are displayed using a series of custom-built GUI functions.

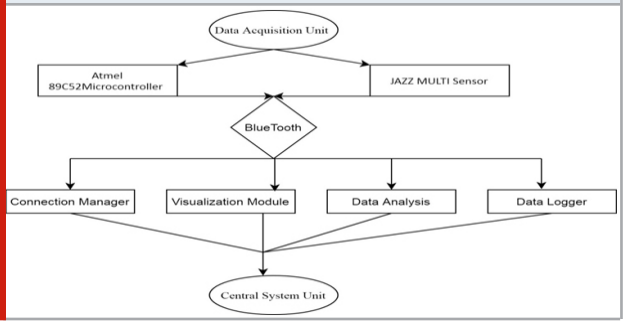
Emotional Sensors:
Emotional Sensors Used for Hand:

Emotion Mouse: The working of Emotion Mouse are movements of the mouse, recognizing finger force when the user presses the mouse button, realizing mouse button click frequency, Extracting various Physiological

information parameters like), Electromyography activity, Skin temperature, Skin electricity, and Heart rate (ECC/EKG).

Sentic Mouse: It is a revised version of a computer mouse that comprises a directional pressure sensor and it is also utilized to help in emotional valence recognition (liking/attraction vs. disliking/avoidance).

Figure 2: Overview of the System



Emotional Sensors Used for Eyes:

Expression Glasses: An interactive tool that helps the user to imagine the wearer's discomfort and excitement rates. Numerous ongoing advances in applied innovations incorporate the endeavor to comprehend the client's advantages just by watching the client PC interface to make sense of what the person is enthusiastic at a particular time. For example, by extracting the person's mood by identifying the type of website e opens/surf, the machine might scan similar websites and predict the user's results.

Magic Pointing; This research explores a new approach of using eye contact for feedback from computers. Gaze tracking has long been used as an alternate or theoretically superior pointing tool for machine input. Two different MAGIC pointing methods, one conservative and one radical have been developed, evaluated, and applied using an eye tracker.

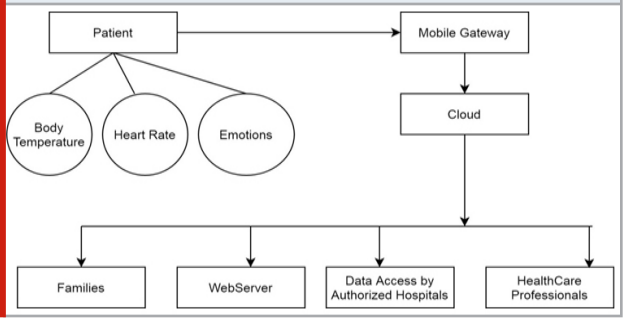
Emotional Sensors Used for Voice:

Artificial Intelligence speech Recognition: Consideration of the context in which the speech recognition system will operate is essential. Artificial Intelligence (AI) has two concepts. First of all, it involves researching the human being's cognitive processes. Then the second is that it involves using devices (like computers, robots) to represent certain systems. AI has also taken the machines smart and made them more useful and less costly than human intelligence. Natural language processing (NLP) is one of the techniques used for artificial intelligence to interact with a computer in a human language such as English. The NLP program takes the data, reads it, and launches operation. Input words are checked and balanced against known words that are processed internally. Acknowledgment of a keyword initiates any practice. That is the way, a person can interact with his or her own machine Language, no special commands or programming languages are needed and, thus, there is no need to write the script in a different language.

Patient Monitoring Scenario: Figure 3 depicts a scenario in which Blue Eye Technology and IoT are utilized for patient monitoring. As shown in Figure 3, A Patient Suffers from Some Diseases like Heart Attack, So We place a Sensors on her Body and a Mobile device can serve as a gateway between the Wireless Body Area Network and the IoT cloud. It is implemented control of power networks using embedded Web servers. To monitor body temperature and heartbeat, wearable sensor nodes can be placed on the outside of the body in various positions. Falls are tracked in the event of an emergency by using an accelerometer on the node. Blue Eyes utilizes software, cameras, and sensors for voice recognition to recognize and respond to emotional levels and the ability to detect subtle variations in human moods.

Biometric sensors are utilized for calculating and investigating various physiological expressions related to feelings. For Example, if the patient is in critical condition, then we will give the health tracking website a warning letter. Using GPS, we can also track the location of the patient. One of the uses of wireless patient health monitoring is that if any individual has a heart attack, the person who is closest to the patient after some time is identified. To keep us from tracking the patient's body parameters continuously, real-time data collection of patients along with assistance by medical professionals is possible by fully eliminating the manual data collection and tracking the enormous amount of patient information. One of IoT's uses is to make healthcare devices more effective by constantly tracking patient health, through which the sensor obtains patient data and we can minimize human error by supporting this method.

Figure 3: Scenario Flow



Implementation: The development of the framework in the clinic includes developing of disengaged wards for every patient who gets conceded and looks for a concentrated oversight. The patient is encircled by a day in and day out checking component which comprises of a high-end camera. This camera consists of a CMOS Sensor [Rahman et. al, 2019] having characteristics of elevated quantum potency. This characteristic will be useful for the remarkable sensing of a patient. To sense the feeling intensity of the patient, a sentic mouse is kept in a visible network with the hand of the victim patient.

The sentic mouse has a collection of sensing elements that includes, an intrinsical pressure sensor accustomed notice the blood pressure, a Galvanic Skin Response sensor – measures the duct gland activities, a temperature sensor – permits body temperature measuring associate degreed a photograph sensor – confirms the absence or presence of an object. AD 8232 graph sensing element is placed on the patient's body surface nearer to the heart for regular measurement of rhythm. Also, a pulse rate sensor is strapped around the patient's chest to record the patient's heart rate in real-time. An electro-acoustic transducer is employed to enable the patient's speech recognition Table 1 describes the reading of two categories of patients. One is Male and another is Female. These readings are taken for every patient after a time interval of 3 hours. Various Health parameters are sensed remotely using our implemented system.

Table 1. Patient Parameter Investigation

ID No.	Age (In Years)	Gender-Specific	Date (DD-MM-YYY)	Time (AM/PM)	Temperature (%F)	Blood Pressure (mm Hg)	ECG	Heart Rate	Emotion
1	25	F	24/05/2020	11.00 AM	97.2°F	118/79 mm Hg	Regular	75 bpm	Sadness
				2.00 PM	97.2°F	121/85 mm Hg	Regular	83 bpm	Sadness
				5.00 PM	98.2°F	125/88 mm Hg	Regular	88 bpm	Happiness
2	60	M	24/05/2020	11.00 AM	99.2°F	133/80 mm Hg	Regular	90 bpm	Fear
				2.00 PM	99.6°F	137/86 mm Hg	Regular	93 bpm	Disgust
				5.00 PM	99.9°F	140/90 mm Hg	Irregular	101 bpm	Anger

CONCLUSION

The BLUE EYES system makes the machine so smart and knowledgeable it behaves like a human being. By offering more comfortable and user-friendly services in electronic apps, it makes human life easier. we've shown the approach so far, the next step is hardware enhancement. Now, that we have proved the process, instead of using bulky devices to gather user information, the use of smaller and less invasive systems would be preferred. the day isn't far from this development working its way into your home keep, making you lazier. It can even touch a mobile device that holds your hand. Blue Eyes Technology along with IoT can be effectively used to remotely monitor the health condition of patients. Health data generated in this system is extracted and analyzed by Health care professionals, Doctors, hospitals for further diagnosis and treatment of patients.

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Parametric Variations of Rectangular Microstrip Patch Antenna Designed for WLAN Application

Archana Tiwari[1] and Dipika Sagne[2]
[1]*Assistant Professor, Electronics Engineering Department, Shri Ramdeobaba College of Engineering & Management, Nagpur, India*
[2]*Reserch Scholar, Indian Institute of Information Technology, Nagpur*

ABSTRACT

Antennas are the key parameter for wireless communication and microstrip patch are the simplest form of planar antennas. Rectangular patch has attracted many applications like Wi-Fi, Wi-max, WLAN etc. The proposed work is concentrated on design, implementation and designing procedure of rectangular microstrip patch antenna with inset feed for Industrial-Scientific-and Medical (ISM) band applications. The paper shows the parametric variation to achieve good return loss at a targeted frequency. The best results in the variation were selected for fabrication. The paper shows the rectangular patch of dimension 28.3×37.5 mm^2 with a finite ground plane 39x 47.5 mm^2. The patch is designed with the substrate FR4 with thickness 1.6 mm, and antenna is fed with inset feeding technique with feed length 3.14 mm. The paper presented with a considerable match between simulated and fabricated antenna results. The antenna is simulated using a CST tool and gain and return loss were obtained as 1.977dBi and -19.25dB respectively. The paper is targeted for Wireless Local Area Network (WLAN) application.

KEY WORDS: MICROSTRIP, PATCH, ANTENNA, INSET FEED, WLAN.

INTRODUCTION

Microstrip antennas are increasing their popularity in wireless communication due to low manufacturing cost, easy to integrate, good accuracy and light weight. In that Rectangular patch antenna are more popular because it is easy to design but it has disadvantage such as narrow impedance bandwidth (typically a few percent). Nowadays Industrial-Scientific-and Medical (ISM) band which is an unlicensed frequency band attracted different applications in wireless communication such as Wireless Local Area Network (WLAN: 2.4–2.484, 5.15–5.25, 5.25–5.35, 5.47–5.725 and5.725–5.850 GHz) and Worldwide Interoperability for Microwave Access (WiMAX: 2.5–2.69, 3.40–3.69 and 5.25–5.85 GHz). One of the frequency bands of the ISM band is 2.40GHz-2.48GHz where the proposed antenna design is presented. The antenna can be fed with different feeding techniques like edge feed, aperture feed, coaxial feed etc.

P. K. Sarkar, I. Rahaman, M. N. Rahman, and Md. F. Hasan, discussed the investigation of compact antenna structure. Ramadan Ali, Al-Husseini Mohammed, Tawky Youssef, KabalanKarim Y., El-ajj Ali presented a frequency and Pattern-reconfigurable Microstrip Antenna for WLAN Applications is presented targeting the 2.4 GHz frequency band. A Compact patch antenna for WLAN application were presented by Natarajamani S, S K Behera& S K Patra. A triangular microstrip patch antenna is proposed by Keon-Myung Lee, Young-Je Sung for multi-band applications, and designed using a chip capacitor and T-shaped slit.

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In the presented design the square patch is fed with the inset line-feed feeding technique, in which the microstrip feed line i.e. conducting strip is connected to the patch antenna, it is slightly inserted inside the microstrip patch. The dimension and the location of microstrip feed line is depends upon matching of impedance and dimensions of feed line is very narrow width as compared to patch antenna.

Figure 1. Rectangular patch antenna Design 5

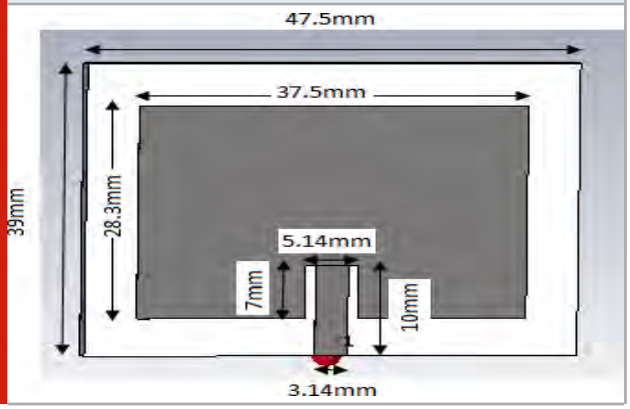


Table 1. Formulae And Calculation Of Rectangular Patch Antenna.

Sr. No.	Antenna Parameters	Formula	Calculated values
1.	Width of the patch	$W = \frac{c}{2fr}\sqrt{\frac{2}{\varepsilon r+1}}$	w=37.26mm
2.	Effective dielectric constant of an antenna	$\varepsilon reff = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}\left[1+12\frac{h}{W}\right]^{\frac{-1}{2}}$	$\varepsilon reff$ =4.082mm
3.	Length of the patch	$L = \frac{c}{2fr\sqrt{\varepsilon reff}} - 2\Delta L$	L=29.72mm
4.	The effective length	$Leff = L + 2\Delta L$	$Leff$ =30.3 mm
5.	The extended length of an antenna	$\Delta L = h*0.412\frac{(\varepsilon reff+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon reff-258)\left(\frac{W}{h}-0.8\right)}$	ΔL =0.29mm

Where, c= velocity of light which is $3*10^8$m/s
εr=dielectric constant of the substrate material

Design Consideration and its Flow: The rectangular patch design is considered with inset feed technique. The antenna design flow is as follows:

A. Selection of Frequency: The square patch antenna is designed to target ISM BAND frequency as its freely available band and there are many applications that work on it i.e. Wi-Fi, Wi-MAX, RF-ID etc. The proposed design is targeted to frequency 2.4GHz i.e 2.40 to 2.48GHz band.

Table 2. Antenna Parameters With Different Variation

Parameter (Unit in mm)	Calculated Parameters (Design 1)	Parameter Variations			
		Design 2	Design 3	Design 4	Design 5
Height of substrate (Hs)	1.6	1.59	1.59	1.6	1.6
Width of substrate (Ws)	60	58	56.9	40	45
Length of substrate (Ls)	60	58	56.9	39	39
Length of Patch (Lp)	29.72	28.45	37.26	28.45	28.3
Width of Patch (Wp)	37.26	28.45	28.45	35	37.5
Width of Feed (Wf)	3.03	3.03	3	3.14	3.14
Length of Feed (Lf)	16.62	16.62	16.62	16.62	10
	Simulation Results				
Impedance(ohm)	30.56	37.02	39	40	49.02
Return loss (dB)	-21.23	-21.98	-6.27	-11.53	-19.25
Directivity (dB)	6.557	6.307	6.536	6.269	5.897
Gain(dB)	-1.997	1.693	1.623	1.529	1.977

B. Selection of Substrate Material: The most economic substrate used for designing purpose is FR-4 epoxy. Hence in the proposed design FR4 (lossy) dielectric is selected, with dielectric constant (ε_r) = 4.4, loss tangent (tan δ) = 0.01 and substrate thickness of (h) = 1.6mm.

C. Calculation of Dimensions of Rectangular Patch Antenna: For 2.4 GHz frequency, the patch antenna parameters like width and length can be calculated using theoretical considerations. The formulas are as follows in table 1.

D. Parametric Variation: While considering above parameters of antenna for designing, the results obtained in terms of resonant frequency, return loss and impedance matching were not satisfactory. Hence to improve results, different parameters of micro-strip patch antenna were modified. In order to match the impedance, changes were made in the width of the feed-line. By decreasing the width of the feed-line, it was observed that the input impedance of the patch antenna is getting matched. Table 2 shows the various parametric variations of microstrip patch antenna and shown its effect on simulated results

in terms of return loss and resonating frequency and figure 1 shows the antenna design 5.

E. Simulation Software: There was many software available like IE3D, CST, HFSS, ADS and CADFEKO etc. For proposed design the simulation results were presented using CST tool. CST is a tool which is specialized for the 3D Electromagnetic high frequency simulation. CST performance in terms of speed and accuracy makes this software more popular amongst technology leading R&D departments. CST are used to analyze the behavior of high frequency devices such as antennas, filters, couplers etc. CST gives users a great flexibility in tackling a wide application range through the variety of available solver technologies. CST uses time Domain solver and the Frequency Domain solver models and it also facilitate to extract spice parameters.

Table 3. Comparison Of Proposed Design With The Existing Designs

Parameters of Comparison	2020	2016	2015	2010	Proposed Design
Size of antenna	40x40	50x50	75x48	25x25	28.3x37.5
Thickness of substrate	1 mm	Not Mentioned	1.6 mm	0.8 mm	1.6 mm
Frequency of operation	4.8337-8.1714	2- 5.6 GHz	890- 2.4 GHz	2.14–2.85, 3.29–4.08, and 5.02–6.09 GHz	2.445 GHz
Substrate	FR4	FR4	FR4	FR4	FR4
Gain of Antenna	3.87dBi	4.4, 3.5 and 2.8 dBi	2–3.5 dBi	1.77 to 2.15 dBi	1.97 dBi
Design structure	CPW Structure	Asymmetrical V slits with circular slot	A compact U-shape radiating patch	CPW-fed planar monopole	Simple Rectangular Patch with inset Feed
Design Complexity	Complex	Complex	Simple	Complex	Simple

Figure 2: Simulated Return loss (S11 parameter) Plot for Design 5

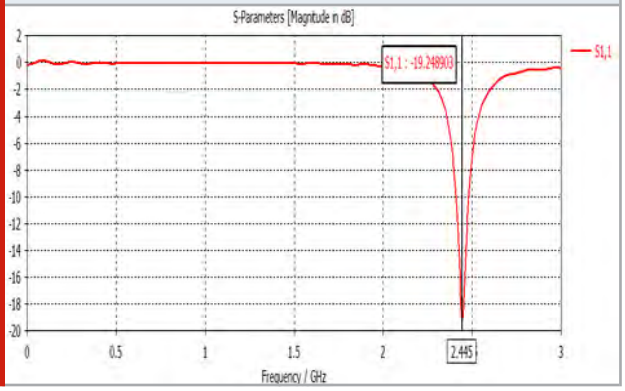


Figure 3: Simulated Impedance plot of design 5 on Smith chart

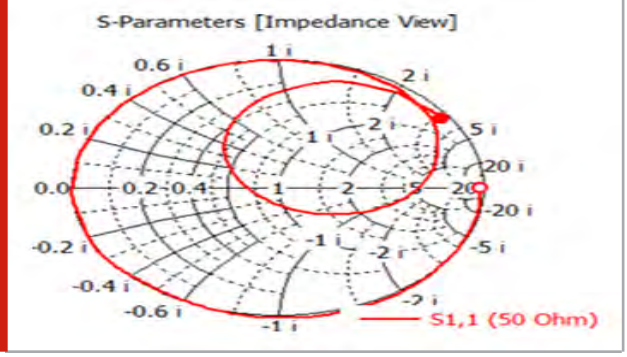


Figure 4: Simulated Radiation pattern of Design 5

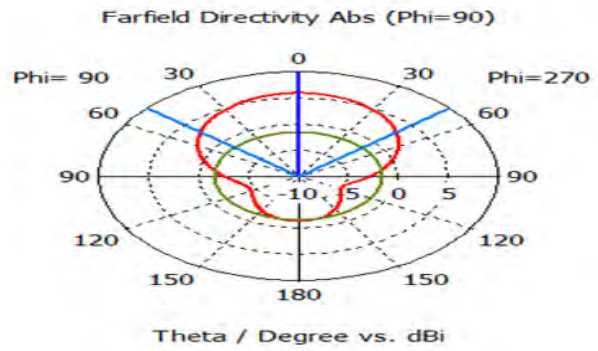
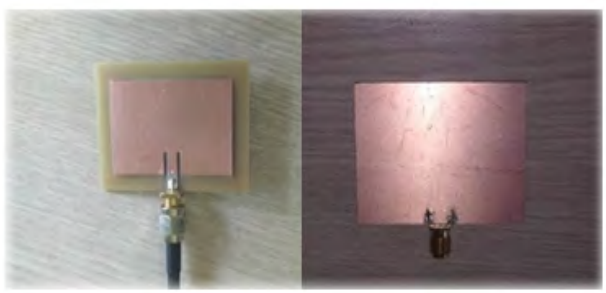


Figure 5 a, b: Top view and Bottom view of Fabricated Rectangular Patch



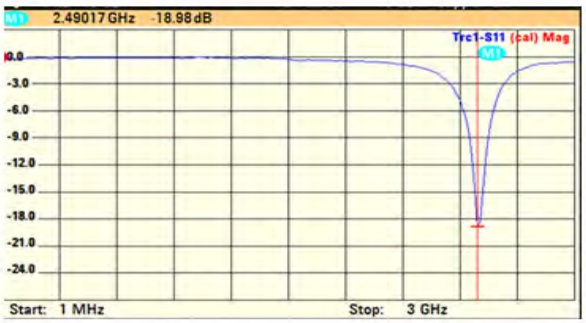
F. Simulation Results: After parametric variation of rectangular patch antenna, the best results were obtained in terms of return loss, impedance and resonating

frequency is for design 5. Figure 2 shows bandwidth and return loss (S11 parameter) of rectangular patch antenna design 5 with central frequency 2.445 and figure 3 and 4 shows the impedance plot on smith chart and radiation pattern of design 5 respectively. The comparison with the existing designs is shown in table 3.

G. Fabricated Antenna Design: Rectangular patch antenna is fabricated on FR4 substrate, taking into consideration of dimensions of design 5. As the simulated results of design 5 were better results in terms of impedance, return loss and resonant frequency. Figure 5a and 5b shows the top layer and bottom layer of fabricated rectangular patch antenna respectively. SMA connector is connected to the feed line having 50 Ohm impedance to connect the measuring instrument like VNA for characterizing the antenna parameter of fabricated patch antenna.

Figure 6: Measurement setup of antenna with VNA

Figure 7: Frequency Vs return loss (S11 parameter) plot



H. Characterization of Fabricated Antenna: The antenna parameters like return loss (S11 parameter), bandwidth and impedance plot of fabricated patch antenna was measured using Vector Network Analyser (VNA). VNA usually performs two types of measurements i.e. transmission and reflection. Transmission measurements pass the VNA stimulus signal through the device under test (DUT), which is then measured by the VNA receivers on the other side [7]. Figure 6 shows the measurement setup of antenna with VNA.

I. Fabrication Results: Figure 7 and 8 shows the frequency VS return loss (S11 parameter) plot and impedance plot

Figure 8: Smith Chart of fabricated Antenna

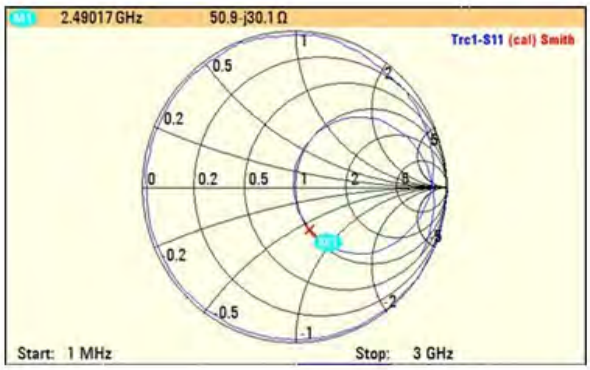


Table 3. Comparison Results Between Simulated And Fabricated Patch Antenna

Parameter of Comparison	Simulated Results of Rectangular Patch	Fabricated Results of Rectangular Patch
Resonant Frequency	2.45 GHz	2.49 GHz
Measured Impedance	49.60 ohm 50.9 ohm	
Return loss	-19.25 dB -18.98 dB	

(smith chart) respectively of the fabricated antenna.

J. Comparison of the Simulated and Fabrication Results: It was observed that the fabricated results have shown considerable matching with the simulated results. Table 3 shows the comparison of both the Antennas i.e. simulated and fabricated rectangular Patch.

CONCLUSION

The design of rectangular patch of dimension 28.3×37.5 mm2 with ground plane 39x 47.5 mm2 was simulated and fabricated. The patch is designed and fabricated on FR4 substrate taking into consideration of thickness 1.6 mm. The patch antenna is having 3.14 mm long inset feed. The patch antenna is simulated using a CST and then after parametric variations of patch the best simulation results obtained was for design 5 as resonant frequency ~2.45 GHz, impedance as 49.6 ohm and return loss of -19.25 dB. Hence design 5 was fabricated and characterized. The results after fabrication were found as resonant frequency 2.49 GHz, impedance as 50.9 ohm and return loss of -18.98 dB. The proposed design for WLAN application has shown considerable match between simulated and implemented results. The disadvantages of this antenna are its low bandwidth, it can be improved by the technique insertion of slit and slot. Also, antenna gain can be also improved with the array formation.

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Internet of Things: Reliablity & Availability of Advanced Queuing Mechanism in RabbitMQ, Issues & challenges

Abhishek D. Pathak[1] and C. Kalaiarasan[2]
[1]*Research Scholar, Presidency University, Bengaluru– 560064, India,*
[2]*Associate Dean, University, Bengaluru– 560064, India,*

ABSTRACT

Internet of Things (IOT) is a evolutionary domain which is impacting the day to day life all over the world. In IOT the non-intellegent peripherals/devices are used for smart applications, as well as for are becoming the sources for getting the needed information. The devices and platforms used in IOT are of different types and uses different platforms which makes the IOT more scalable and parallel more challenging. The standards/protocols used in IOT are basic infrastructure used to combine and synchronize these heterogeneous behavior of devices thus making the communication more reliable and accurate. In this paper an introduction about the basic levels of IOT are highlighted. Publish and subscribe model is discussed with the factors affecting the quality of services. The popular standard AMQP and its client implementation RabbitMQ is discussed with implementation and exception. The method for handling the exception i.e DLX is discussed. The various issues are highlighted. With this paper the critical review on RabbitMQ standard is provided.

KEY WORDS: INTERNET OF THINGS, AMQP, RABBITMQ, DEAD LETTER EXCHANGE

INTRODUCTION

In growing era, Internet of Things (IOT) is emerging technological domain, the technological enhancements is IOT is providing more relevance with societal aspects. In future the wide growth will generate the horizontal needs to infrastructure. Today the infrastructure depends on specific needs but as the use of applications will grow then the heterogeneity with the devices may become difficulty to synchronize all the devices with better performance. The devices works independently, and in future with increase in growth the plug and play infrastructure will be more needed so that wide variety of application may run simultaneously. The need in requirements and infrastructure also create the issues related to interoperability and semantic modelling of devices and standards. Infrastructure should also support and provide the facilities to automatic update of the IOT data whenever new things are available and needed. AS mentioned (by. Dr. Ovidiu Vermesan et al.) The infrastructure should in IOT should support functionalities, plug and play integrations, semantic modelling of things, physical locations and positions and security and privacy.

The devices and platforms used in Internet of Things mostly will be ready to plug and play with the environment and should get easily synchronized with infrastructure and standards used in it. So interoperability becomes important area of consideration. IOT interoperability is a key challenge and will be the center of consideration in future because of the rapid increase in devices of heterogeneous configurations and continuous updating device nature. This will lead to the continuous updates in standardization process. In networking system of IOT the various levels uses different types of standards/protocols. This networking level system can be categorized based on Data linking, Networking & session. The most popular

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**Corresponding Author: abhishekpathak81@rediffmail.com*
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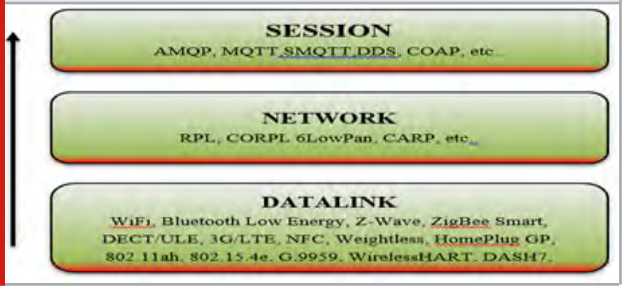
and most commonly used standards are shown in fig.1 As depicted in above diagram the level wise protocols for IOT. The communication system needed for infrastructure can be categorized in three levels of system.

Figure 1: Level wise protocols for IOT



1.1 Datalink Level: This level provides the needed support for connecting two or multiple devices to aggregates the information from the devices for this specialized communicating protocols like 802.11ah, wireless HART, Z-Wave, ZigBee etc. are used to synchronize the operating behavior of heterogeneous devices to access the system.

1.2 Network Level: This layer encapsulates the information to secure for communication as well as decides the routing method. For this various protocols such as RPL, 6LowPan etc. provides the services.

1.3 Session Level: The session level provides the session services for transmission i.e mostly responsible for managing the communication method between the devices. The protocols used at this level are AMQP, MQTT, DDS & COAP.

In this paper we emphasized mostly on session layer protocol AMQP and its client RabbitMQ. These protocols used for management of information at session level can be of simple subscribe and Access i.e. request and response types or of publish subscribe model. Now a days publish and subscribe models are attracting the researchers as it provides more interoperable functionalities to the devices connected infrastructure. Publish subscribe model provides routing logic and more reliable functionalities by making system more scalable and loosely coupled. The major deciding factors i.e. Quality of Service in standards used in IOT communication are Availability, Reliability & Accuracy.

Publish/Subscribe models: Publish/subscribe systems are like messaging systems used in application where messaging is implemented. This approach is most suitable in constrained type of environment as well as provides less congestion of data traffic in communication [2]. There are various protocols like MQTT, XMPP, DDS uses the publish/subscribe model but Advanced Messaging Queuing Protocol (AMQP) is widely accepted and concluded suitable for wide number applications. RabbitMQ and Kafka are the popular implementations of AMQP protocol. The basic architecture of publish and subscribe model consists of broker concept. As shown in fig2.

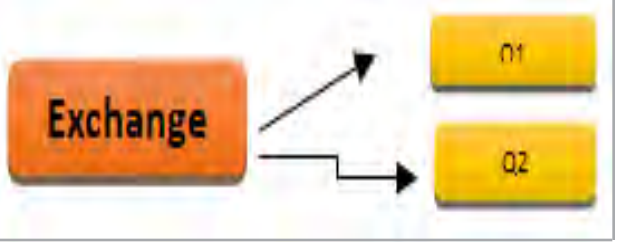
Figure 2: Publish/Subscribe model

2.1 Functionalities: The main functionality of publishers and subscriber is decoupling. Which makes it most suitable for loosely coupled and scalable systems. As Eugster et al. discussed that it can be with the following schemes with dimensions such as.

- **Entity decoupling:** In this scheme publish and subscriber do not need to be aware each other's functionalities. The infrastructure is independent of terminating the process at any time thus reducing the overheads in communication which makes it more suitable for loosely coupled environment
- **Time decoupling:** This schemes allows the infrastructure to passively participate in the process making it stronger in interaction.
- **Synchronization decoupling:** This allows more independent access to both publisher and subscriber, without any synchronous control permissions.

Messaging system in publish and subscriber model uses routing logics to manage the messages, The routing logic is used to bind the queues with the exchanges. The binding process can be of Topic based, Direct, Header base and Fan-out. The most popular implementation of AMQP protocol is RabbitMQ.

Figure 3: RabbitMQ Broker



2.2. RabbitMQ: RabbitMQ is an efficient and scalable implementation of AMQP protocol. In simple way in RabbitMQ multiple queue implementation is possible. Queues are used to temporarily manage the data. Queue can also be implemented with multiple exchanges.

The multiple queues can be implemented and are bind with exchange. The exchange is responsible for arranging the messages in the queue by using routing logic. Mostly round robin logic is used to arrange the messages in the queues. The basic mechanism on which RabbitMQ

works is Queuing mechanism. The queues gets bind with exchanges, exchange routes the messages produced by the producer and consumed by the consumer from queue. These producers and consumers may be of different and varying configurations and applications, which gives rise to the issues related with Accuracy and interoperability. i.e mismatch between number of message packets generated per second by the producer (publisher) and message packets consumer by the consumer because of different configuration platforms. Depending upon applications RabbitMQ can be implemented in following cases.

1. Implementation

In our work we have implemented RabbitMQ 3.7.1. In our work the cases considered are :

- Case1: One Queue with single consumer.
- Case2: One Queue with multiple consumers.
- Case3: Multiple queues with multiple consumers.

In case1: Where single queue with single consumer is bind the messages are moved accessed sequentially as only a single consumer is invoked.

In case2: A single queue gets bind with multiple queues and multiple consumer access the queue.

In case3: Where multiple queues gets bound with multiple consumers

In all three cases mentioned above when multiple consumers are involved the rate of pulling the messages from queues may differ from rate of pushing the messages in queues, which may create the unordered message packets issue i.e. the order in which messages are pulled are different from the order of messages pushed in queues.

2. Exceptions: Consider X New(X-N) & Y New(Y-N) as transactions with their invoice receipts as X Paid(X-P) and Y Paid(Y-P). Arranged in order in queue as shown in figure.

Figure 4: Messages in queue in ordered manner

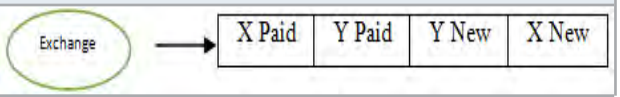
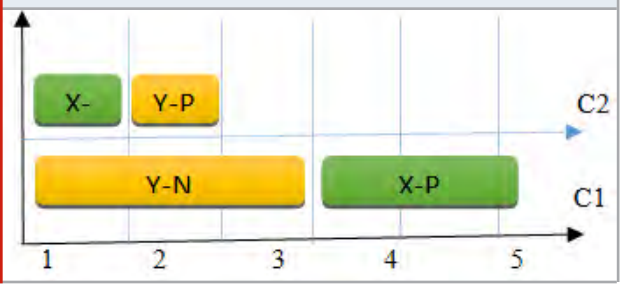


Figure 5: Timeline of no. packets consumed by consumers



Two consumers are bound with queue for consuming the packets. Fig.4 messages in queue in ordered manner So as per Round Robin scheduling. defined in RabbitMQ the 1st and 2nd messages will get distributed to consumer1 and 2nd and 4th messages to consumer2.

In above example consumer (C1) consumes 1st and 2nd message in total 2-T-states and status of Y process is updated as paid and when consumer (C2) consumes another message will complete consuming next message till 3rd T-states, but till that time status of Y is updated as paid by consumer1, So this is because of scheduling the message packets when multiple consumers are involved. The producer will publish messages at faster rate and consumer will consume messages at slower rate, Message can live forever in a queue, if no consumer that consumes message in queue gets crashed, due to this the no messages will piled up in the queue. Due to this queues starts rejecting the messages which may get lost without acknowledging the producer thus gives rise to unreliable communication. As well as the rejection of messages from queue detoriates the queue performance.

Handling Exceptions on Consumer: Messages can live forever in a queue if no consumer consumes it. If no consumer consumes it then message can be discarded. In RabbbitMQ this issue handled in a better way by using a mechanism known as Dead Letter Exchange (DLX). Instead of discarding the messages are arranged to in a queue of DLX. The DLX mechanism republishes the messages for the consumers.The reasons that messages may get republished are:

- The messages is rejected by queue if queue is full.
- The TTL (Time to live) for message expires.
- The queue length limit exceeds the maximum.

This mechanism helps in handling the invalid messages without discarding it. Ex. If image size too large to be handled by the broker then exceptions might happened, So Dead Letter Exchange method (DLX) helps avoids these exceptions. Whenever any message is message rejected by the exchange then it is updated in DLX for once again getting pulled by the consumer this helps in getting true responses about the status of broker.

Drawbacks: DLX mechanism implemented in RabbitMQ is discussed may impact the reliability, availability and accuracy of RabbitMQ standard. In RabbitMQ mechanism if subscriber fails to consume the message then message remains in the queue till it is moved to DLX mechanism or it exceeds the Time to live parameter thus due to the faster publisher/producer, the queue receives the messages with faster rate and thus queue locations gets consumes in very short time. So after this if any message is send by exchange the message gets rejected without acknowledging the publisher and thus gives rise to message unavailability. It also increases the latency level of messages because of which the throughput detoriates. The issue which effects the Quality of Service (QoS) is accuracy. In RabbitMQ due to the faster producers and slower consumer problem the order of messages gets

affected as shown and explained with fig.5. This simply affects the order of receiving and updating the messages, which detoriates the accuracy level in communication.

CONCLUSION

In this paper, RabbitMQ, an implementation of AMQP standard is highlighted. The Publisher and subscriber model is discussed with mechanisms used in RabbitMQ with different case scenarios and the chances of getting issues are discussed. Thus this contribution will help the researchers to view a scope on counter measures of avoiding the issues.

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Suspicious Online Forum Data Detection

Anant Chourasia[1], Mohit Agrawal[2], Sakshi Thakur[3], Ayushi Bais[4], Muskan Singh[5], and Vrushali Bongirwar[6]
[12,3,4,5,6]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India.*

ABSTRACT

The exponential growth seen in the past few years of internet users and its easy access through handy available devices, As a result of which the size of digital content has been growing very rapidly in recent years through messaging applications, posts on social networking sites, vlogs, blogs, online forums and other internet platforms. With the advancement of social media sites over the internet, one's post can be reached all over the world which means it can be used to influence people in both good and bad ways. Although social media has many advantages,people misuse social media to exploit other people. The anonymity offered by internet and flexibility afforded has made it convenient for users to socialize in an aggressive and disrespectful manner over the internet. Text contents are mostly used to perform suspicious activities. Hate speech is currently an interest in the domain of social media. So, one of the most difficult issues for NLP researchers and programmers is to develop an algorithm that can detect text with hate speech automatically and efficiently from its specific contents. So here, a classification based Machine Learning model is proposed to efficiently and automatically classify text into non-suspicious and suspicious categories based on its contents.

KEY WORDS: NLP, NATURAL LANGUAGE PROCESSING, SUSPICIOUS DATA DETECTION, MACHINE LEARNING, TEXT CLASSIFICATION,TEXT MINING, FEATURE EXTRACTION, RANDOM FOREST CLASSIFIER.

INTRODUCTION

People nowadays are compulsively addicted to social networking sites. It has become an important part of our life. These sites are being used as a live platform for expressing our opinions, feelings and for promotional purposes also. Social media has now become one of the mainstream mediums for spreading unlawful and disgraceful criminal activities by fraudsters and scammers. Twitter being at the top among all other social platforms, it delegates it's end users to read, react and send tweets. Tweets are posts which are text-based and a single tweet can be of maximum 140 characters. Communication between multiple parties in a public forum is provided by Twitter, allowing you to get instant response from potential users. Since communication on Twitter is open for everyone. It is observed that often, contents in the tweets are sometimes misleading or even suspicious. In virtue of the popularity of Twitter, it is at risk of users who often try to find a way to spoil it. Of every 21 tweets and every 200 messages on social media is estimated or appraised to be unlawful or spam. A way by which this problem could be tackled is depicted in this paper.

Our proposed approach for the problem which is mentioned in the above paragraph aims on perception and detection of suspicious and hate tweets. To start with this research, we firstly develop our dataset categorising non-suspicious and suspicious texts including a number of public tweets and replies available to developers. Data of any user can be mined from Twitter using Twitter API known as Tweepy. The mined data will be the user extracted tweets. The"TERM FREQUENCY-INVERSE DOCUMENT FREQUENCY" acronymed as TF-IDF are the

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*Corresponding Author: chourasiaa@rknec.edu
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major components of the scores resulting after assigning it to each word. Once this important phase of extracting the features has been done, we used one of the popular machine learning algorithm for classification i.e. Random Forest to classify given tweets into suspicious and non-suspicious ones. We also aimed to perform a relative and comparative evaluation and analysis of these machine learning algorithmic models by utilizing our collected and proposed datasets.

Illustrated below are the key contributions of our proposed and implemented work :

- Developing a corpus consisting of 30000 texts identified and thus labelled as non-suspicious or suspicious.
- Designing a model for classifying tweets into 2 categories being suspicious and non-suspicious on corpus which is previously developed by exploring different combinations of features.
- Comparing the performance of the model proposed by us; with other various ML techniques i.e. Stemming and Lemmatization.
- Analyzing the model's performance on various different distributions of the created dataset.
- Visualizing a comparison on the performance of the model which uses machine learning algorithms (i.e., Random Forest)

We expect and contemplate that the work presented by us in this paper shall play an evolving role in the categorization of suspicious tweets and development of detection systems for suspicious texts on social media.

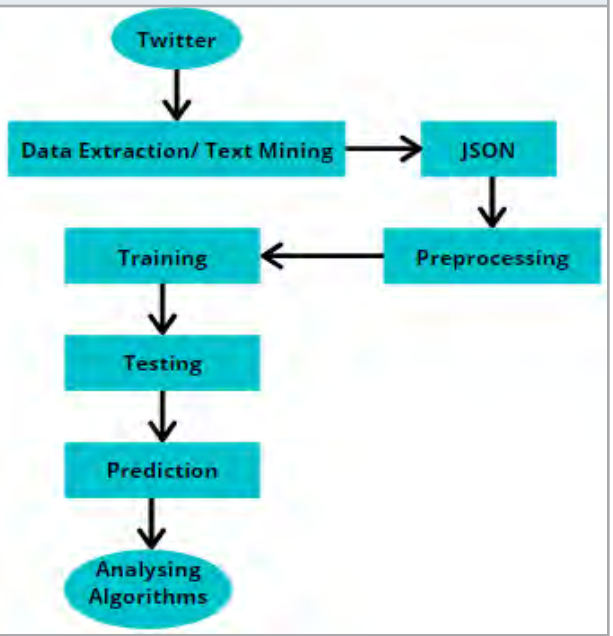
Literature Review: There exist papers which suggest detection of hate tweets using Natural Language Processing techniques; others suggest detection of malicious tweets using statistical analysis. The algorithms generally used by these authors were Naive Bayes, Logistic Regression or a deep learning method named Convolutional Neural Network (CNN). Previous work related to the same is mentioned below in brief:

i. Detecting malicious tweets in trending topics using a statistical analysis of language: In this paper, a great way to detect spam tweets in Twitter's top trending topics is discussed. This paper is an addition of the fundamental language modelling approach used to examine the branching between the language model of the topic and the suspicious messages with respect to that topic. There are five processes: Trending topic collection, spam labelling, Feature extraction, classifier training and spam detection. The result is used along with the machine learning system. The algorithms used in this paper are: Decision Trees, Naive Bayes, Logistic regression, Support Vector Machine. A value of 93.7% and 89.3% is obtained in spam and non-spam accurately classified and 6.3% of non-spam was wrongly classified as spam.

ii. Hate speech detection using language natural processing techniques: In paper, hate speech was detected using NLP. Here, hate speech is considered as abusive and hostile messages. On twitter dataset, a deep learning method named CNN has been applied. CNN consists of various layers like input layer, convolutional layer, embedding layer, pooling layer and fully connected layer. The model's input is a pre-processed tweet. The publicly available Word2Vec word embedding was used to set the weight of the embedding layer having 300 dimensions already trained on 3000 million words. It resulted in good precision and F-score. However, few non-hate speech as hate-speech and the most of hate-speech class is also wrongly identified by the model. In this paper, Keras in python was used for the pre-processing.

iii. Active chat monitoring and suspicious chat detection: This paper consists of a model based on Machine Learning to classify text in Bengali language having suspicious meaning. Various feature extraction techniques with n-gram features are used. Here, pre-processing is performed in three steps: redundant characters removal, tokenization and removal of stop words. The vectorization is done by Bag of Word and term frequency-inverse document frequency technique. The dataset consists of 7000 suspicious and non-suspicious text documents. In this paper five models: Logistic regression, random forest, decision tree, stochastic gradient descent and multinomial naïve bayes are compared with each other considering two feature extraction methods: Bag Of Words and tf-idf. An accuracy of 87.57% was achieved after applying the learning algorithms: Stochastic Gradient Descent(SGD) classifier and term frequency-inverse document frequency feature extraction along with unigram and bigram.

Figure 1: System Architecture



III. Proposed Methodology: In the proposed methodology, the fundamental step is extracting the data from social networks. This data is then pre-processed using regular expressions, stemming , unidecode and stop words are removed using Natural Language Processing. This pre-processed data is further used for text normalization

and data cleaning using stemming. This processed data is further used for data processing which is done by calculating word frequencies using TfidfVectorizer. The vectors are then fed to the classifier to train the model. The trained model is tested on various machine learning algorithms and analysed the accuracy based on predictions of the algorithms. (Fig 1).

A. Data Extraction/Text Mining: For extracting tweets from Twitter, we first need to get access to the Twitter developer account. The developer account provides us the consumer key, access key, consumer secret, and access secret. These keys are of foremost importance as these keys will help in the API authentication. People with Developer accounts are allowed to access tweets by Filtering on specific keywords or requesting a sample of tweets from specific accounts. Later we can use the Tweepy API which allows us to mine the data of any user. It is a user-friendly Python library used for accessing the Twitter data. The data that is downloaded is the tweets extracted from Twitter in JSON format.

B. Pre-processing and Data cleaning: Data preprocessing is an important step in the data mining process. Data preprocessing is a data mining technique that is used to alter the raw data into a useful and efficient format. In our case, the downloaded data contains too much noise per twee. Therefore, pre-processing is done extensively for every tweet. Steps in preprocessing are mentioned below in brief:

Regular Expressions: Data Collected from the interet has some issues i.e. the downloaded data has some dirt and noise. Therefore, there occurs a need to use Regex. Regular expressions are text patterns that describe the search pattern. This is very much familiar or easy to use with text-based data sets.

Removal of stopwords: The removal of Stopwords is not necessary for every NLP task. Removal of Stopwords can be used for text classification. Where the text has to be classified into various categories. Text classification (text categorization or text tagging) is the method of assigning a set of default categories to free-text. Text classifiers can be used to arrange, structure, categorize, and so on. For example, chat conversations can be sorted out by language, and so on. Here, we are organizing based on hate or not. The Stopwords are removed from the text so that we can work mainly on the text that defines the meaning of the text. However, removing stopwords is not advisable to use in tasks like text summarization.

Benefits of removing stopwords: If we remove the stopwords the size of the dataset decreases and it helps in training the model easily.also helps in saving space as the vectors created will consume less space.Removing stop words helps to upgrade the accuracy as there are less meaningful words left. For example, Google removes stopwords for fast and to the point retrieval of data from the database. Data cleaning is the method of detecting incorrect, incomplete, irrelevant, or inaccurate parts of the data and then modifying, replacing, or deleting the garbage data. For data cleaning, we used:

Stemming: It maps a group of words to the same stem. In this process the morphological variants of a root/ base word are produced. The output is called a base or root word even if it is not a valid word. Stemming reduces the suffix from a word like it reduces "retrieval", "retrieves" to "retrieve". Here, we are using Porter's Stemming Algorithm to pure data. It is one of the popular methods proposed in 1980 which is used for the process of removing commoner morphological and inflexional ending from words. Inflexional is basically a process of removing extra letters from nouns, verbs, adjectives.

Lemmatization: It is the process of grouping together the inflected form of words so they can be analyzed as a single item, identified as a lemma. An example of lemmatization is "Studies", "Studying" became "Study". (Fig 2) Stemming and Lemmatization are nearly similar but the difference is stemming only looks at the form of the word whereas lemmatization looks at the meaning of the word. That is after applying lemmatization we get a valid word. WordNet Lemmatizer can be used for this process. WordNet Lemmatizer uses the WordNet Database to look up lemmas of words.

Figure 2: Lemmatization example

Form	Morphological information	Lemma
studies	Third person, singular number, present tense of the verb study	study
studying	Gerund of the verb study	study

C. Data Processing: The next step is Data Processing. We firstly calculated word Frequencies with TfidfVectorizer. The term TF-IDF stands for "Term Frequency – Inverse Document Frequency" which is the vector of the resulting scores assigned to each tweet. TF-IDF (for formula refer fig 2)Term Frequency: Summarizes the number of times or how often any given word appears within a specified document. Inverse Document Frequency: Downscales words that appear a lot of times across the document. Further without getting into the detailed mathematics and statistics, basically TF-IDF vectorizer are scores based on word frequency across the document that tries to give more importance to the words that are more frequently used in a document. TfidfVectorizer will tokenize documents, learn the corpus and therefore the inverse document frequency weightings and thus outputs an encoded vector. These encoded vectors are used directly by a machine learning algorithm for the classification.

D. Classifier Algorithm: The classification algorithm used in the model is Random forest. It is a supervised learning algorithm. Random forest randomly selects data samples and generates decision trees on it. These decision trees collectively are known as forest. In random

forest classification, every tree votes and the final result is the most popular one. More no of trees results in better accuracy. Decision trees are created on randomly selected data samples, after which each tree predicts and the solution is selected by means of voting. It is based on the divide and conquer approach of decision trees generated on a randomly split dataset.

Figure 2: Formula for TF-IDF

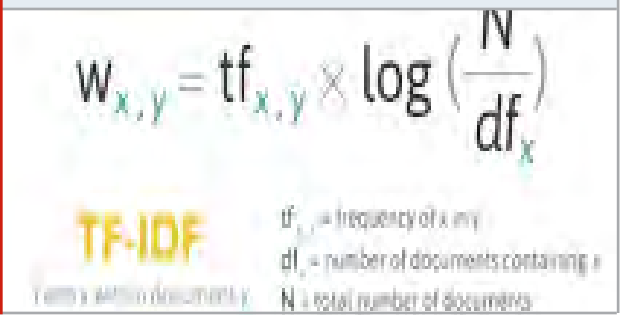


Figure a: Classification report of model

	precision	recall	f1-score	support
0	0.96	1.00	0.98	8916
1	0.90	0.49	0.63	673
accuracy			0.96	9589
macro avg	0.93	0.74	0.81	9589
weighted avg	0.96	0.96	0.95	9589

RESULTS

CONCLUSION

In this paper, we presented a way for detecting suspicious discussions on the online forums, through which we can uncover suspicious activities. Our analysis is based on particular topics, depending on the keywords to filter the streaming data from Twitter. After pre-processing the data, we used TFIDFVECTORIZER for converting text to feature vector which is used as input for our estimator. The classification Algorithm we used here is Random Forest Classifier which gives 96% accuracy. The purpose of this system is to monitor suspicious discussions on online forums and identifying them.

The future goal is to balance the dataset to make it less biased, apply Web Scrapping to work on the Real time streaming data and to test the system with other various models for comparison of accuracy.

Figure b: Confusion matrix

Predicted	0	1
Actual		
0	8878	38
1	345	328

Figure c: Final predictions on downloaded test data.

```
In [81]: M  result
  Out[81]:
```

	Tweet	Label
0	RT "Silent Affirmation" Oil, Gold leaf, and me...	0
1	RT Circumstances don't matter anymore. Mob men...	0
2	Racist, feral scum the lot of them	1
3	RT I wonder if Trump could identify the exact ...	1
5	now all my business in place i think imma get ...	0
7	Why does it look like these cops - many of who...	0
8	I have nothing against gay men, BUT let me be ...	0
9	RT NBA tanking, adios https://t.co/4uZj430HLI	0
11	RT Racial Justice Voters: The protests that fo...	0
12	Black Jeopardy with #ChadwickBoseman - SNL htt...	0
13	THAT REMINDS ME XILAM DIDNT MAKE THEM CANON GA...	0
14	Racism is all they got...	1
15	RT I know racism, experienced it all my life. ...	1
16	RT Google is clearly a globalist and totalitar...	0

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Random forest Classifier

Shanita Biere, "Hate speech detection using language natural processing techniques"

Speech and Language Processing. Daniel Jurafsky & James H. Martin. Copyright c 2019. All rights reserved. Draft of October 2, 2019, for all the process of text preprocessing. https://web.stanford.edu/~jurafsky/slp3/slides/2_TextProc.pdf

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An Approach to Identify Product Purchase Processing Time by Applying Business Intelligence in Steel Coated Production

Anupam Anant Kher[1] and Swati Hira[2]
[1]*Department of Mining Engineering,*
[2]*Department of Computer*
Science & Engineering, [1]*Visvesvaraya National Institute of Technology, ,*
[2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Indirect materials procurement, mostly consist of low volume and high variety still technically they are not a part of the end sale product, even they are having same important as direct material. For example, in an automated production line power grind to a halt without a grinding wheel indirect material, hence procurement and presence of indirect materials at right time is of major importance.The reduction of non-value added activities in this process deduction of non-value added actionswould result in the reduction of lead time and buyers administrative efforts. Hence, this study has been interpretedto improving effectiveness and efficiency of the current procurement process.The objective of this study is to analyze and determine different aspects of the process of Purchase Requisition (PR) to Purchase Order (PO) and their analysis. We use power BI for interactive analysis and visualization. We applied our approach on steel coated products. Proposed approach benefits the procurement process and helps to retainconversion time and reduce the breakdown period.

KEY WORDS: PURCHASE REQUISITION, PURCHASE ORDER, PURCHASE DEPARTMENT, BUSINESS INTELLIGENCE, DATA ANALYSIS

INTRODUCTION

Purchasing department plays a major role in the procurement process [Xue et al., 2012] to procure all necessary materials needed for production or daily operation of the company or government organization. For a manufacturing company, this might include raw materials such as iron, steel, aluminum or plastics, but it also might include tools, machinery, delivery trucks or even the office supplies needed for the secretaries and sales team. In a retail environment, the purchasing department makes sure there is always sufficient product on the shelves or in the warehouses to keep the customers happy and keep the store well-stocked. With a small business, it is especially important to keep inventory ordering at a reasonable level; investing large amounts of capital in excess stock could result in storage problems and in a shortage of capital for other expenditures such as advertising or research and development. A purchasing department also is charged with continuously evaluating whether it is receiving these materials at the best possible price in order to maximize profitability. Figure 1, describes different tasks performed by purchase department.

In our study, we apply our approach on the company [JSW Group] which is India's leading private sector steel producer and among the world's most illustrious steel

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companies. The Steel Coated Products manufacturing organization under study is been divided into 3 main categories as shown in the Figure 2.The above flow chart shows us the three main processes in plant. When we discuss about data analyticsfor procurement and sourcing, basically we're discussing about to making data sensual that is interned by supplier information, systems through the source-to-settle process, relevant supplier third-party data, suppliers, complex categories and markets. Assessing procurement data in this form is of more importance than simple analytics and reporting. Now a days enterprise system generate and capture massive volumes of data with the everyday increase in automation level.

Figure 1: Functionality of purchase department

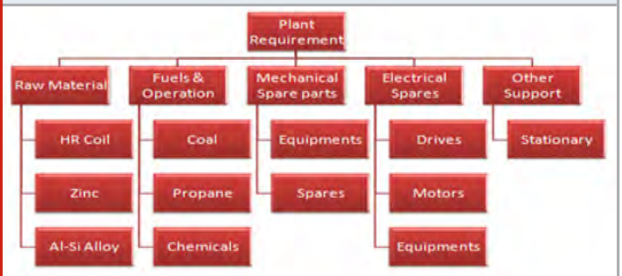
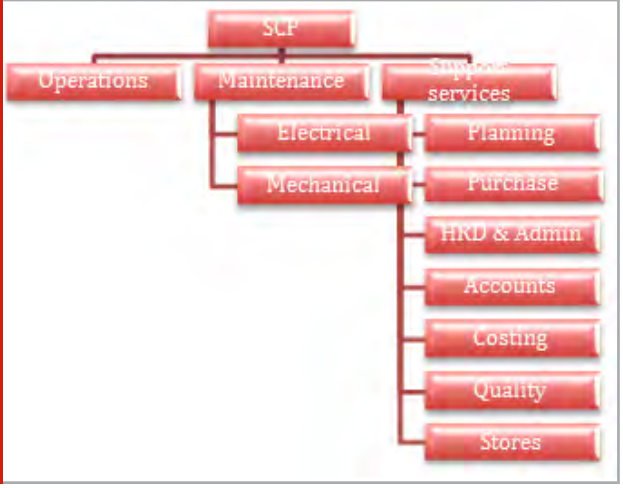


Figure 2: Categorization of steel coated products



Large-scale automation of procurement processes is increasingly producing high volumes of data that can bring new insight into the business, helping it to better understand how the supply chain needs to evolve and adapt [Ballou 2007 and Bowersox 2010].The potential of analytics in procurement is so great that the higher-level value proposition sought by so many working in contemporary procurement becomes a real possibility, be it tackling complex spend categories, proactively mitigating supplier risks or effectively monitoring the performance of suppliers. Overall, analytics can help procurement offer more to the business strategically. So our motivation is to provide an analysis for PR to PO time by providing an interactive visualization. The use of analytics in procurement offers an opportunity for organizations to consolidate, cleanse and connect spend and supplier data across the enterprise. Analytics can provide CPOs with greater visibility and unlock insights, helping them to reduce costs, drive compliance, mitigate risks, improve business intelligence and manage and develop suppliers. When the power of Big Data for Procurement is analyzedproperly, thisgives actionable business intelligence solution by identifying numerous trends and correlations which cannot be identified with traditional data analysis techniques and tools. This paper provides an insight on PR to PO cycle of procurement process.

Purchase Process: Steps involve from PR to PO

- The process starts with generation of requirement in SAP. That means a purchase request has been made by the company people. Then the purchase request gets approved by the head of the department by which purchase request has been generated.
- After the approval the request comes to purchase department. Purchase people now check the purchase request weather material specification is correct or not or quantity, price, or is the material has any past data of it or not.
- After the verification enquiry is sent to different parties for quotation by email. The management believes that there must be a minimum of three quotations for any material.
- After receiving the quotations by e-mail the hard copy of it is sent for technical recommendation to the end user. The user will provide TR ranking to the quotations. TR ranking means the quotation has been rejected completely.
- After the TR ranking initial comparison of the quotations are done, followed by negotiation. Negotiation can be done manually or by reverse auction. After that final comparison of the quotations is done and again the ranks are provided.
- The lowest party wins and note for approval is generated. Once the note is approved PO is created in SAP.

METHODOLOGY

- Before performing the actual analysis on the gathered information, we perform several tasks, listed below as follows:
- Data collection: This collection process involves Plant visit, Discussion with the plant employee and product portfolio to understand purchase process. Thesteel plant has a pickling line, two rolling mills, two galvanizing lines, two colour-coating lines, a Galvalume line, six slitting and 7 cut-to-length lines, two profiling lines and a tile profiling line.

Data preprocessing: Data preprocessing [Famili 1997 and MitraDebnath 2014] involves transforming the raw data into an understandable and efficient format. Real-world data problems can occur in many flavors which involves incompleteness, inconsistency, irrelevant or lacking in certain behaviors or trends, manual data input, wrong

data types, regional formats and is likely to contain many errors. To resolving such issues we first preprocess the company data according to our requirement and make it relevant by handling noise and missing data.Figure 3 describes the necessary steps required to place an order after finalization of the raw material.

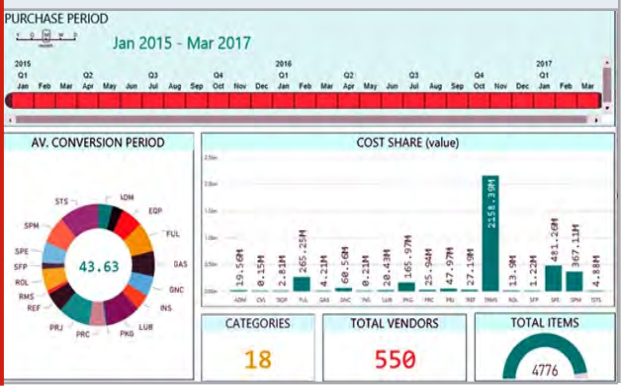
Figure 3: Purchase process (PR to PO)

Data analysis: Analysis refers to breaking a whole into its separate components for individual examination. Data analysis [Keim 2006 and Hira 2015] is a process for obtaining the data and converting it into information useful for decision-making and suggesting conclusions. Data is collected and analyzed to answer questions, test hypotheses or disprove theories. We have used Microsoft Power BI [Lachev 2018 and Raj 2016] business analytics service. It provides attractive and interpretive visualizations with self-service BI capabilities, where dashboards and reports can be created by end users, without having dependency on technical staff (IT) or database administrators.

Experimentation evaluation: In this section, we perform analysis on steel plant dataset using power BI. The analysis were conducted on a Windows 7 machine with 2.30 GHz CPU and 4.00 GB RAM. Here, we first describe the dataset, and then the extracted results of our approach. Power BI makes this categorization and plotting graphs much simpler when compared to excel or some other tool. The Dashboard gives a preview of all comparisons that have been made. In Figure 4, the product are described based on categories, total vendors and total items their cost share for time period 2015-2017. We can see from figure that in dataset we have 18 material categories (such as ADM, SPM, SPE, and RMS etc), 550 vendors and 4776 items. We analyzed all the parameters related with PR to PO process. Various analysis are performed and outcomes are described as follows:

We first categorized the materials into its type and then made it available for sorting and studying. About 20 categories were studied whose PR to PO conversion time was calculated and then the average time was also determined of the same. Average time for these categories ranged from 4 days to nearly 108 days. Categories having average time greater than 80 days were further filtered and products contributing with maximum no of days were determined.In figure 5, maximum and average conversion time and delivery for a material is shown. It means total time required for a material form product requisition to its ordering is displayed. We then tried analyzing the data based on the quantity in which the products were categorized into bulk or regular. Any order above 1000 number was considered as Bulk and otherwise as regular. A total of 5726 orders were placed off which 797 orders were bulk orders i.e. 14%. This 14% bulk purchase was further found contributing 24% of the purchase cost i.e. 24% in the total purchase cost. We further went on and categorized our products bought from vendors stationed in about more than 7 countries. Indian vendor regions were also studied and found out that central region was the most preferred one being the most easily accessible.

Figure 4: Dataset Categorization

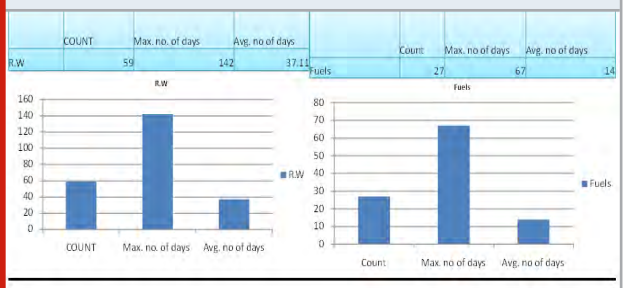


The PR to PO conversion time was calculated by counting the number of days from PR Release to PO Release and this data obtained was further categorized and analyzed of these categories, some were further studied based on the material types, i.e. % contribution of each material type towards completion of these orders within the categorized time.On studying these trends, we found that SPM and SPE (Spare Parts Mechanical and Spare Parts Electrical) had the most conversion time.

The purchase department needs to find a new party/ vendor who can supply the product. This process takes more time, hence PR to PO cycle time for mechanical and electrical spares is more. The reason behind it was the contract for raw material and fuels and consumption were given on yearly basis. But in mechanical and electrical spares, every time an order is a new item. We also plotted the graphs for some categories. After analysis of those graphs we found the result similar to Power BI that maximum numbers of orders are of mechanical

spares and electrical spares, and the average number of days required for these items are also high. The below figure 7shows the number of orders processed in last six months, the maximum numbers of days it took for one order completion and average number of days it took for all the orders to get completed for different categories.

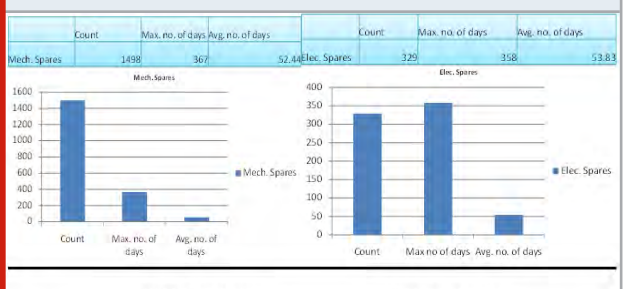
Figure 6



(a) Raw materials (b) Fuels

During the process execution if there is breakdown in the line and spare parts are not readily available, the whole process gets delayed. To overcome with this situation different used standard maintenance strategies are: run to failure, Preventive Maintenance.The parts used for different lines which perform the same function had different diameters. Standardization of these Bridle Rolls will lessen the inventory to be stocked and thus reduce the inventory holding cost.

Figure 7: Detailed analysis of various categories



(c) Mechanical spares (d) Electrical spares

Moreover, in case a breakdown occurs in one line, parts can be replaced from some other line so that the line won't stop and shutdown cost won't be incurred. In future we will provide a solution to reduce PR to PO time that can also help in breakdown issue.

CONCLUSION

This paper deals with various aspects of the process of Purchase Requisition to Purchase Order and their analysis. We sorted and organized the data procured by us and analyzed it in various ways.

- We have analyzed the cycle time required for purchase requisitions to get converted to purchase orders, the average time of which was found to be 44.33 Days.
- The PR to PO conversion time was calculated by counting the number of days from PR release to PO release and this data was further categorized and analyzed. 2147 orders got converted from PR to PO within less than 10 days whereas 285 orders took more than 180 days to get converted from PR to PO, with the highest being 665 days.
- We have analyzed that the average number of days for PR to PO conversion is maximum in mechanical spares and electrical spares, the maximum number of orders were placed for mechanical spares.
- SPM (Spare Parts Mechanical) and SPE (Spare Parts Electrical) were recognized to be contributing to conversion time and also had major contribution in cost. If we reduce this conversion time, the company can benefit a lot.
- On studying the process, we observed that when breakdown occurs and parts aren't available, huge losses are incurred. This can be reduced by standardizing certain parts. This will also benefit the procurement process and reduce the conversion me.In future to identify the lacunas that caused this delay, we will study procurement process in more detail and will apply data mining techniques to extract the time delay cause.The solution will help to reduce PR to PO time that can also help in breakdown.

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Extractive Multi-Document Text Summarization by Using Binary Particle Swarm Optimization

Archana Potnurwar[1*], Anjusha Pimpalshende[2], Shailendra S. Aote[3] and Vrushali Bongirwar[4]

[1]*Priyadarshini Institute of Engineering & &Technology, Nagpur, India*
[3,4]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*CMR College of Engineering & Technology, Hyderabad, India.*

ABSTRACT

The absence of a standard dataset and poor work for Hindi text summarization leads to develop a technique for better results. We have used a combination of Title feature, Sentence length, Sentence position, Numerical Data, Thematic word, Term frequency and Inverse Sentence Frequency for finding the results. Binary PSO is used for finding the optimal values of the features.

KEY WORDS: MULTI-DOCUMENT, TEXT SUMMARIZATION, SWARM INTELLIGENCE.

INTRODUCTION

Now a days, most of the information is searched through the Internet, as it is used as superior information retrieval tool like any search engine. Because of the large increase in the information on the internet and busy schedule of every individual, the summaries information is very important for the user. Summary of any text documents helps to easily understand the concepts and conclude something good out of it. A summary that is created by a human is called manual [Discussion] summarization, whereas, a summary that is created by the machine is called automatic text summarization [ATS].

ATS are typically divided into different approaches. In some techniques, input documents are used for text classification further used for the summary generation.

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The difference between single and multidocument summarization is that the first one uses only one text file for the summary generation, whereas second approach uses more than one text files, probably related to each other in some context. Two types of Summarization methods are mainly found in the literature: extraction and abstraction. An extractive summarization deals with selecting the most important sentences from the source documents and combining them into a summary. Abstractive summarization is a summary, at least some of whose material is not present in the input. Multi-document summarization is also one of the areas, which is used in large scale information retrieval.

Though many same techniques are shared between single and multi-document summarization, there are at least three ways by which they differ.

1. The degree of redundancy of the information present in topically similar documents is much higher than a single document. So the use of the anti-redundancy method is more preferred in multi-document summarization.
2. If the single document summarization demands 15% summary generation, still the multi-document summarization demands nearly the same number of sentences in the final summary. It means, for

10 document summarization it generates 1.5% sentences in the summary. So the compression ratio plays a very important role in a multi-document summary generation.

3. The biggest problem is a coherence problem in multi-document summarization.

In general, finding a multi-document summary is difficult. Common steps used in multi-document summarization are preprocessing, feature extraction, single document summary generation followed by final summary generation.

literature review: A variety of either extractive or abstractive multi-document summarization (MDS) techniques has been developed in recent years. Extractive summarization is about finding scores of each sentences in the documents and selecting the sentences with highest scores. Abstractive summarization is complex w.r.t extractive summarization, because it involves sentence selection, it's fusion, compression and finally all these need to be reformulated. In this study, we focus on extractive summarization. This section aims to present an overview of the basics and types of multi-documents text summarization.

X Wan proposed a novel extractive approach based on the manifold ranking for topic-focused multi-document summarization. Yih and Suzuki tried to give a simple scheme where they first assign a score to each term in the document cluster, using only frequency and position information, and then find the set of sentences in the document cluster that maximizes the sum of these scores, subject to length constraints. Goldstein proposed a multi-document summarization based on a single document summarization by using relational similarity among documents. Most of the available extractive methods generates summary by considering one by one document. Because of which, structure patterns amongst the sentences are less redundant.

Ruifang He proposed a Group Sparse learning framework is proposed for the summarization, where learned group information is used for minimizing the error which in further reconstruct the original documents. A bottom-up approach is proposed for multi-document summarization to capture the association and order of two textual segments by Bolegala D, which is based on chronology, topical-closeness, precedence, and succession. Ordering sentences according to their publication date is also considered to be a superior method for the multi-document summarization. Chronological ordering improvement is proposed by Okazaki (2004).The unsupervised approach based on optimization is proposed by R. M. Alguliyev for automatic document summarization. M Xi, J Sun, W Xu proposed an improved quantum-behaved PSO algorithm by finding weighted mean of best positions. These positions are finding based on the fitness value of each particle.

This algorithm is much faster than other algorithms and better global convergence. A Fuzzy Inference System is proposed by S.Babar, P. Patil for extractive text summarization. This method selects the most relevant sentences and words for summarization. A Support vector-based regression model was proposed by Y. Ouyang, Qin Lu for the sentence ranking in query-focused multi-document summarization. Text summarization for the Nepali language is proposed by Sarkar S. based on the hybrid PSO and k-means clustering technique. The Nepali word net is used for summarization. Inter-cluster similarity and intra-cluster similarity are used as the measure for the performance evaluation of the algorithmA hybrid model of symmetric non-negative matrix factorization (SNMF) and sentence-level semantic analysis (SLSS) is proposed for multi-document summarization. SNMF divides the sentences into groups then SLSS findsrelationships between sentences.

Summerization Algorithm: Hindi is also widely used language in some part of the world, mostly in India. Hindi is normally spoken using a combination of 52 sounds - 12 vowels, 35 consonants, nasalization and a kind of aspiration. Preprocessing of the documents plays a very important role in data mining applications for better results. Preprocessing generally involves three tasks: Tokenization, Stop word removal and stemming. The next step in the summarization is feature extraction. Features are used to extract salient sentences from the text. In the literature, more than 10 features are suggested. Any number of combinations of those features is used in the summarization techniques.But based on the literature, only six features are found to be suitable for a summary generation. Therefore,in this study six features are selected to score each sentence in the document. These features are Title feature [TF], Sentence Length [SL], Sentence Position [SP], Numerical Data [ND], Thematic Word [TW], TermFrequencyInverse Sentence Frequency [TfIsf].

After calculating the value of each feature for each sentence, it is necessary to calculate the overall value of each sentence. The numbers of documents are taken as an input to the algorithm. For each document, initial feature values are calculated. These values are passed to the Binary PSO. At the end of maximum iterations, it sends the optimum feature values back to the algorithm. Add all six feature values for each sentence, to get the final score of each sentence. Sort the sentences in increasing order of the final score. The next step is to find the similarity of each sentence to other sentences to remove redundancy in the final summary. This similarity is simply the final value comparison. If the similarity is more than 70%, then remove the duplicate sentence from the final summary. It is also necessary to arrange the text in the summary coherently.

RESULTS

We have created political news data set, consisting of three documents for each news. We have 5 types of news in each category. Recall, precision and f-measure are used to test the performance automatic summarization.

Recall = (human-generated summary ∩ Automatic summary) / (human-generated summary)

Precision = (human-generated summary ∩ Automatic summary) / (Automatic summary)

F Measure = (2 X precision X recall) / (precision + recall)

Table 1. Shows the precision, recall and f-measure values for the datasets.

News No.	No of sets of Documents	Precision	Recall	F measure
1	2	0.8	0.73	0.76
	3	0.875	0.8	0.84
2	2	0.81	0.8	0.8
	3	0.78	0.76	0.77
3	2	0.825	0.795	0.81
	3	0.79	0.76	0.77
4	2	0.82	0.79	0.8
	3	0.8	0.785	0.79
5	2	0.785	0.775	0.78
	3	0.83	0.82	0.824

CONCLUSION

The multi-document summarization for Hindi documents is a major issue due to very poor work is performed in this direction. We have proposed an algorithm to solve the problem. Six features are used to find the weight value of each sentence. Binary PSO is used to find the optimum value of each feature.

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BERT for Opinion Mining and Sentiment Farming

Arti Buche[1*], and M. B. Chandak[2]
[1]*Shri Ramdeobaba College of Engineering and Management, University Nagpur India*
[2]*Shri Ramdeobaba College of Engineering and Management, University Nagpur India*

ABSTRACT

BERT which is published by Google AI language stands for Bidirectional Encoder Representations from Transformers is a language representation model recently developed has caused a flurry in Machine learning community. The design of BERT consists of pre-training the unlabeled text contextually from both the directions left and right for all the layers, unlike the recent language representation models. For a BERT model which is pre-trained, inclusion of one output layer to the state-of-the-art models for fine tuning is done which facilitates different tasks for language understanding such as opinion mining and question answering so that the task specific architectures are not to be modified. BERT is a key technical innovation which applies bidirectional training of a popular attention model called as Transformer language modelling. The results in the paper represent a language model BERT in which training is done bi-directionally and a deeper sense of context for the language understanding is developed. In the paper, a detailed description of a novel technique of BERT in which training involves Masked Language Model (MLM) and Next Sentence Prediction (NSP) bi-directionally which was previously impossible. [Jacob Devlin, 2019]

KEY WORDS: BERT, BIDIRECTIONAL LANGUAGE MODEL, MASKED LANGUAGE MODEL, NEXT SENTENCE PREDICTION, OPINION MINING.

INTRODUCTION

Natural Language Processing (NLP) applications are ubiquitous these days as they stumble across various websites and applications in one form or another. NLP adoption has rapidly increased thanking to the concept of pre-trained models embedded with transfer learning. Pre-training of language model has shown impressive results for natural language processing tasks. People interested in developing or learning an algorithm on existing framework, pre-trained models are the best source of help for them. It is not possible to build a model from scratch always due to computational constraints or time restriction, that is why, pre-trained models came into picture. The pre-trained models can be used as a benchmark for either improvement of the existing model or testing the developed model against it.

The pre-trained language representations can be applied using two existing strategies feature based and fine tuning to downstream tasks. ELMo is the feature based approach which uses task specific architectures and which are included in pre-trained as additional features. Open AI GPT which is Generative Pre-Trained Transformer is the fine-tuning approach in which the downstream tasks are used for training purpose and all pre-trained parameters for fine tuning and it uses minimal task-specific parameters. The above strategies share the same objective of using unidirectional language models during pre-training to learn general language representations. [Jacob Devlin, 2019]. The point of contend is that the current techniques curb the capacity of pre-trained models, especially for the fin-tune approaches.

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The dominant limitation during pre-training is that the choice of architectures and standard language models which are unidirectional. For example, in OpenAI GPT which consists of self-attention layers, and only in these layers, the researchers have used left to right architecture which provides accessibility of every token to the previous token. The sentence level tasks which consists of such limitation are very much sub-optimal which in turn can be proved harmful during application of the approaches which are fine tuned to token level tasks like question answering task. In such cases it is crucial to incorporate understanding of language context from both the directions.

In this paper, the improvement of the approaches based on fine tuning is done with the help of BERT (Bidirectional Encoder Representations from Transformers. BERT is the key technical innovation in the field of NLP marking it as a beginning of new era. It is a momentous development as it enables to build a powerhouse as a component readily available to use. This innovation has many advantages like it saves time, energy, knowledge and the resources that require training of a language model from scratch. BERT has been built on number of clever ideas which are bubbling up recently in NLP community. The contributions of the paper are as follows:

- BERT alleviates the constraint of unidirectionality by using Masked Language Model (MLM). The demonstration of the importance of bidirectional pre-training for language models which is used by BERT and recent work in pre-training contextual representations is shown.
- Heavily engineered task specific architectures can be reduced with the help pre-trained representations is shown. Many task specific architectures outperform with the help of BERT as it is the first representation model which is fine tune based has achieved state-of-art on token level and sentence level tasks on a large suite
- The main goal is to help researchers with fewer computational resources and encourage the community to build the gap in large amount of data which improve when trained on millions of annotated training examples and variety techniques that are used for training which is called as pre-training concept for general purpose language representation models using unannotated text in a large amount. [Jacob Devlin, 2018]

Related Work: Unsupervised feature based Approaches: An active research area for decades has been widely learning representation of words including non-neural and neural methods. An integral part of modern NLP are pre-trained word embeddings which has shown much improvement significantly over the embeddings which re learned from scratch. The objectives in pre-training word embedding s in language model included left to right training and differentiate between correct and incorrect words in both left and right context. The coarser granularities of the unsupervised feature-based approaches has been generalized into sentence embeddings or paragraph embeddings. The training objectives which were used for sentence representation includes prior work of ranking candidate next sentences, previous sentence representation with the help of left to right generation or by using auto encoder for denoising derived objectives. A step further is ELMo (Embeddings from Language Models) which trains LSTM (Long short-term memory) bi-directionally resulting into a language model which has sense of next as well as previous word.

ELMo performs generalization of traditional word embeddings from different dimension. This language model mainly represents each token based on its context i.e. concatenate representations from left to right and right to left. The existing task-specific architectures integrate these contextual word embeddings which advances ELMo for several important NLP benchmarks including opinion mining, question answering and named entity recognition. In [Oren Melamud, 2016] contextual representations were learned using LSTMs in which prediction of a single word was done through a task for both the contexts left and right. One such model is ELMo which is also feature based like LSTMs but it is not deeply bidirectional.

Unsupervised Fine-tuning Approaches: The feature-based approaches work in direction of pre-training word embeddings from unlabelled text. Recently, the contextual token produced by sentence or document encoders are pre-trained from unlabelled text and are further fine-tuned to a supervised downstream task. These approaches are proved to be an advantage as learning from scratch requires less parameters. Due to part of this advantage OPENAI GPT (Generative Pre-Trained Transformer) model achieved state-of- art results from GLUE (General Language Understanding Evaluation) benchmark on many sentence level tasks. The objectives used for pre-training by such models are auto-encoder and left to right modelling.

Transfer Learning from Supervised Data: Transfer Learning is the technique which enables the researchers and developers to use the pre-trained models developed by others by performing some modifications in it. The methods used for transfer learning in NLP are the main reason of its increased accuracy mainly in Opinion Mining. Transfer learning basically leverages the knowledge which is extracted from big datasets to increase efficiency even if limited training data is available. There are many works done in transfer learning which shows effective transfer of supervised tasks from large datasets such as machine translation and opinion mining summarization. An effective recipe of transfer learning has shown its importance in Computer Vision research also by fine tuning models which as pre-trained with ImageNet. [Lisa Torrey, 2009]

Proposed Work:
BERT (Bidirectional Encoder Representations from Transformers): One of the latest milestones in Natural Language Processing marked as the beginning of a new

era of NLP is the release of BERT (Bidirectional Encoder Representations from Transformers). A new technique was open sourced in NLP for pre-training called as BERT. The core principle of BERT is to use attention modelling so that it understands relationship between different words contextually backed by Transformer. BERT's vanilla form includes a Transformer which has two mechanisms of encoder and decoder for reading input text and outputs prediction for the task respectively. The encoder mechanism is the only requirement of BERT as the main goal is to generate language model. Transformer encoder takes input text and reads at once the entire sequence of words as opposed to the directional models (RNN and LSTM) which read the input text linearly left to right or from right to left. This technique is referred as Bidirectional more accurately non-directional as it allows the model to learn a word's contextual information with respect to complete sentence (left as well as right of the word).

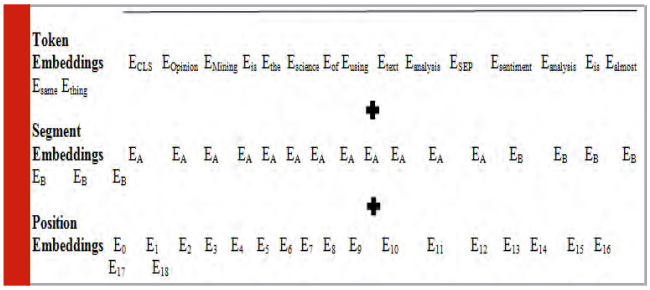
The detailed working of BERT is described as follows: The challenge in training of language models is to define a prediction of a sentence in a text. In a directional approach adopted by many models prediction of next word in a sequence is done but which lacks in context learning. So to overcome this challenge, BERT framework is divided into training steps: pre-training and fine-tuning. In pre-training step, the model undergoes training for different pre-training tasks using unlabeled text. During fine-tuning step, the pre-trained parameters of BERT model are first initialized followed by fine-tuning of all parameters using labelled data from the downstream tasks. Even if the parameters in BERT are firstly initialized with same pre-trained parameters, separate fine-tuned models are generated for each downstream task.

How does BERT work?: The attention mechanism which helps in learning the contextual relationship between words of sentence is the main concept of Transformer which BERT relies on completely. As discussed earlier BERT requires only encoder, as an encoder takes input a sequence of tokens which is followed by conversion into vectors, and further are being processed in the network. To perform this processing, the decoration of inputs is to be done with extra metadata as follows:

- Token Embeddings: A sentence is detected by using tokens namely [CLS] which is placed at starting of the sentence and [SEP] at the end.
- Segment Embeddings: To distinguish between separate sentences, a marker is used like Sentence A or Sentence B so that encoder understands.
- Positional Embeddings: A token is added to sentence in order to indicate the position of the words in the sentence which is called as positional embedding.

Example:
Input = Token Embeddings + Segment Embeddings + Position Embeddings

The transformer maintains a stack of layer in order to output a sequence as 1:1corresponding to it input at the same index. Training in BERT makes usage of following two strategies:



Masked Language Model (MLM): The main idea of masking is "simple". It randomly masks 15%words in the input sentence i.e. replaces those words with [MASK] token. Afterwards the entire sequence is executed through attention based BERT in which the encoder predicts context based information for only the masked words provided by other non-masked words. In this naïve masking approach, the problem is that it predicts only [MASK] tokens instead of predicting correct tokens irrespective of the position of the token in the input sequence. Hence to deal with this issue, among the selected masked tokens of 15%, the tokens which are actually replaced with [MASK] token is 80%, replacement of with a random token is of 10% of time token and10% among those remain unchanged. In the training phase of BERT, prediction of only masked tokens is done and unmasked tokens are ignored. Ultimately results for the model mingle slowly than left to right or vice versa. [Jacob Devlin, 2018]

Next Sentence Prediction (NSP): BERT model also performs prediction of next sentences to understand the relationship between the two sentences. In next sentence prediction, the model which is under training takes input a pair sentences and learns to perform prediction of whether second sentence is related to previously sentence in the original text. As per the previously discussed model of BERT, the input consists of [SEP] token which helps in understanding the separate sentence. The input to the model is two sentences at a time such that 50% first sentence is followed by second one and 50% is a random sentence. In such situation where random sentence occurs, BERT predicts whether the second sentence among the pair of input sentences is random or not, along with the assumption that random sentences and the first sentence are disconnected with each other.

Example:
Input = [CLS][MASK]Opinion Mining is the science of using text analysis [SEP][MASK]Sentiment analysis is almost same thing.

Label = IsNext
Input = [CLS][MASK]Opinion Mining is the science of using text analysis [SEP] A [MASK]database is a collection of information that is organized

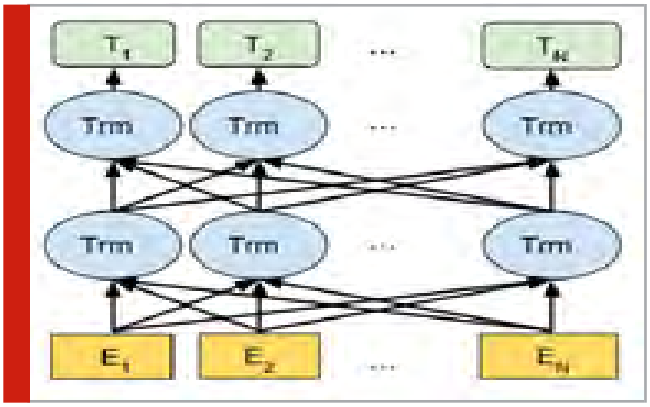
Label = NotNext
The basic working of BERT in prediction of whether first and second sentences are connected which each other or not, for which the input sequence needs to be passed through a transformer based model, in which transformation of the [CLS] token into a vector of shape 2x1 using a simple classification layer and with the help of softmax the NextLabel is assigned to it.

BERT model is trained by using both MLM and NSP in order to minimize the combined loss function, hence, "Together is better". [Jacob Devlin, 2018]

BERT Architecture
BERT model architecture has four pre-trained versions of different types depending on its scale.

- BERT-Base: 12 layer, 768 hidden nodes, 12 attention heads, 110 M parameters
- BERT-Large: 21 layer, 1024 hidden nodes, 16 attention heads, 340 M parameters
- BERT is basically a multilayer bidirectional transformer encoder and requires task specific fine tuning.

Flow of a word in BERT: By considering the above flow diagram, embedding layer starts with a word embedding representation. To create a new intermediate representation of the word, it performs some computation with some multi headed attention in every layer. The intermediate representations thus created are all of same size. In the above flow diagram, E1 represents the embedding representation i.e. position embeddings, intermediate representations of same token are represented by Trm and finally the output is represented by T1. In BERT model of 12 layers, a single token will have 12 intermediate representations as layers will be 12. [Matthew Peters, 2018].



Fine Tuning of BERT: A wide variety of task in general language understanding like opinion mining, natural language summarization, paraphrase detection, are outperformed the state-of-art by BERT. BERT fine-tuning for our own dataset is performed by addition of a single layer on crest of the base model. For example, one of language prediction task is question answering which involves a question as an input and the prediction of the right answer is from some corpus is to be identified. So, a context paragraph is given along with a question, the prediction includes a start and an end token of the paragraph which provides the likely answer to the given question. For such tasks BERT needs two extra vectors which help in marking the start and end of the answer as well. As in next sentence prediction training phase, input consists of two sentences similarly in this task of question answering first sentence is the given question and second sentence is the context paragraph along with two new parameters start and end vectors, created during fine-tuning. Note that in case of BERT fine tuning it is important to transform the input as per the format used during pre-training as discussed above.

Opinion Mining and Text Classification using BERT: Opinion Mining is one of the types of Natural Language Processing which helps in text classification and sentiment analysis. The main goal of Opinion Mining is to determine the polarity of the reviews or textual data as positive, negative or neutral. [Arti Buche, 2013] The steps to be followed for Opinion Mining and Text classification with the help of BERT are as follows:

- BERT model:Pre-trained BERT model is to be decided depending on the weights required for the corpus as discussed in above topic of BERT architecture.
- Preparation of Data: For using BERT model, we need to transform the input as per the format accepted by BERT. Data can be stored a.tsv file format as given below:
  0 Column 0: ID of the row
  0 Column 1: Label of the row in integer format like 0,1,2, 3...etc.
  0 Column 2: Same letter column for all called as throw away column expected by BERT
  0 Column 3: Classification column for test examples
- Training Model using Pre-trained BERT model: Transformation of the input text takes place as per requirement of the BERT with extra tokens as learned earlier. After training completes, an output is generated in which prediction results on test dataset containing probability value for the class labels can be seen.
- Fine tuning of the model: After the training is completed, plug in the task specific inputs and outputs are fine tuning of all the parameters is done from end to end. For the output, the token level tasks such as sequence tagging are fed to an output layer and [CLS] representation is being fed to an output layer for classification tasks such as opinion mining, text summarization. Fine tuning is relatively expensive as compared to pre-training of BERT.

CONCLUSION

A big milestone in the field of Natural Language Processing is BERT which is a powerful language representation model. It has great capacity to perform transfer learning in NLP. It also comes with a great promise to solve 11different NLP tasks suing the same pre-trained successfully. BERT demonstrates, due to transfer learning, rich and for many language understanding systems, unsupervised pre-training has become an integral part.

BERT can be used for prediction in various domain and one such important in which predictions also play a very important part is Stock Market Predictions using Opinion Mining which is trending now days.

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A Review of Image Enhancement Techniques for Underwater Images

Khushboo Khurana[1*] and Neha Tirpude[2]
[1]*Shri Ramdeobaba College of Engineering and Management, Nagpur*
Indian Institute of Information Technology (IIIT), Nagpur, India

ABSTRACT

This paper presents a review of underwater image enhancement techniques which serves as the foundation of a variety of underwater imaging applications including the study of aquatic life forms, underwater object detection and classification or simply an improvement in the appearance of underwater images. Unlike regular imaging in a normal environment, underwater imaging suffers from reduced clarity, entailed by scattering and absorption of light. There are regions with non-uniform illumination and prominent bluish and greenish tones depending on the wavelength of light. The quality of underwater images also depends on the photographic device used to capture the image, turbidity of water. This paper discusses the different types of enhancement brought about by varied underwater image enhancement techniques.

KEY WORDS: UNDERWATER IMAGE ENHANCEMENT, CONTRAST CORRECTION, COLOUR CORRECTION.

INTRODUCTION

Underwater imaging is progressively becoming more significant due to the wide range of applications such as monitoring of underwater structures, to study various aquatic life forms like fishes, coral reefs, etc., to search for the abundant mineral and biological resources present in water bodies, aquatic robot inspection, underwater archaeology and so on. However, the images captured underwater are of degraded quality. The suspended particles in the water cause scattering of light. Also, the light is absorbed differently based on the frequency of light. Moreover, colour distortion, contrast degradation, and low visibility are prominent issues in the underwater images. Colour distortion is mostly caused by the way different light wavelengths travel in water. This makes the colour of underwater images appear bluish-green. Whereas contrast is degraded as the light is randomly attenuated and scattered.

The nature of the underwater image can be corrected and made better for drawing out information for further analysis. The image quality can be enriched by the application of image restoration (Zhang, et. al., 2018) or image enhancement. Image restoration methods proceed by removing the noise and then apply the inverse degradation process to improve the underwater image quality. Whereas, image enhancement deals with the better appearance of the image from the human perspective. This paper presents a review of various underwater image enhancement methods.

Image enhancement techniques refine a given image such that the resulting image is easier to perceive for the human or more likely to be detected by automated image analysis systems. The key issues that need to be addressed by the image enhancement techniques for the underwater image are to improve visibility, enhance the image colour, contrast, to preserve the naturalness of the image, and enhance the object prominence. There are various image enhancing frameworks that are based on

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white balance, colour correction, histogram equalization, fusion-based methods, and Retinex-based Algorithms. In the literature, various underwater images are considered that have low visibility, low contrast, non-uniform illumination, blur, and light spot (Zheng L, et. al., 2016), images affected by blue-green light (Yu, Haifeng, et al., 2020), images having dark and light areas (Soni, Om Kumari, et al., 2020), images with haze (Ancuti, Codruta O., et al., 2017) and acoustic images with non-uniform illumination (Sharumathi, K., and R. Priyadharsini, 2016), etc. Although a variety of images are used, most of the work that addresses the underwater image enhancement use random images from the internet to show the results for their proposed method. There are only a few available public datasets.

An open image dataset called TURBID has been created (Duarte, A., et al., 2016), to add value to research in underwater images. The dataset consists of three groups of images named as Milk (containing 20 images), DeepBlue (containing 20 images) and Chlorophyll (containing 42 images). Another dataset called UIEB dataset includes 890 underwater images that contain both the raw and its respective high-quality images and another set of 60 challenging underwater images (C. Li, et al., 2019). The image enhancement techniques are discussed in the next section followed by our conclusions in section 3.

Literature Review: In literature, the problem of underwater image enhancement is addressed by utilizing either multiple images (Narasimhan SG, Nayar SK, 2003) or a single image. Various techniques take the advantage of the presence of multiple images and apply image fusion to get the enhanced image. One such target enhancement technique is presented in (Tian H, et al., 2018). An algorithm for contrast recovery is proposed (Narasimhan SG, Nayar SK, 2003) for weather degraded images, utilizing two images. Although the methods utilizing two images provide good results, they require multiple images captured from the same scene. Moreover, a point-wise fusion between different images is required, restricting the applicability of these methods to various real-life applications. The image enhancement techniques in which not more than one image is required for further processing are more popular since no supplementary images are needed to proceed. Thereby, we discuss only the single image-based enhancement techniques. A summary of the latest and significant methods is furnished in the table below.

Table 1. Summary of Underwater image enhancement techniques

Technique	Enhancement Handled	Evaluation Parameter
CLAHE and USM (Zheng L, et al., 2016)	Contrast and overall intensity	Histogram
Underwater white balancing and Multi-scale fusion (Ancuti, Codruta O., et al., 2017)	Image dehazing, colour contrast and edge sharpness	Laplacian contrast, weight Saliency weight, Saturation weight
Contourlet transform (Sharumathi, K., and R. Priyadharsini, 2016)	Removal of speckle noise, contrast enhancement for images having dark shadows	Point discontinuities, line, edge, curve, contour
AHE with HE (Duarte, A., et al., 2016) CLAHE and percentile methodologies (Garg, et al., 2018)	Local contrast enhancement Colour and contrast	Histogram and pixel values Root Mean Squared Error (RMSE) and entropy
DCP with ACCLAHE and HF (Dixit, et al., 2016)	Contrast, edge enhancement and blur	PSNR

Amongst underwater image enhancement techniques, the Histogram equalization (HE) method is most sought-after owing to its results and easiness. This method generates an image that has a uniform distribution of probabilities of gray levels. HE helps in improving the image, also it doesn't require additional data regarding the origin of degradation and does not involve the constituents of the image. This technique yields better results in cases where the pixel intensities are spread over coequally across the image, but does not satisfactorily enhance the local details. The traditional HE method was enhanced by (Ketcham, David J., 1976) as the Adaptive Histogram Equalization (AHE). The AHE partitions out the image into blocks, such that every block is subject to computation of histogram equalization mapping. This computed mapping is delegated to its central pixel. In cases of images having areas of comparatively lower range of intensity, the algorithm performs well, it inflates the noise, in all other cases, it has better results.

Another method that works over the resultant two channels RGB and HSV model obtained after modification

of histogram is presented in (Ghani, et al., 2015). The RGB contrast stretching is performed within the bounds of Rayleigh Distribution. The authors demonstrate that there has been an observed increase in the contrast of the tested data with lowered noise levels. This technique (Ghani, et al., 2015) was found to deliver an average mean square error (MSE) as 76.76 and peak signal to noise ratio (PSNR) as 31.13.

The Contrast-Limited Adaptive Histogram Equalization (CLAHE) (Reza A M., et al., 2004) approach reduces noise amplification. It also involves the partitioning of the grayscale image into blocks as in HE method. However, a contrast limiting technique and noise reduction is also applied. Moreover, the amplification in the noise signal is controlled by applying a threshold to the image histogram. Zheng et al. (Zheng L, et al., 2016) worked on a single underwater image by utilizing the CLAHE algorithm and unsharp mask (USM) transforms for image enhancement. The images obtained from these algorithms are fused by simple weighted blending. The enhanced images obtained from this technique are superior to the traditional histogram equalization and homomorphic filters methods.

Diksha Garg, et al. (Garg, et al., 2018) presented an image enhancement method that blends CLAHE and Percentile methodologies. More specifically, CLAHE with RGB and HSV channels are used with percentile technique. The images with degraded contrast and shading quality were enhanced, by correction in colour and contrast. Moreover, the results obtained are better than the Histogram Equalization, Dehazing, Percentile, CLAHE methods. In the survey of underwater image enhancement techniques (Soni, Om Kumari, et al., 2020), it was concluded that CLAHE was better in avoiding excess amplification of noise as compared to AHE alone. The study also inferred that Brightness Preserving Bi-Histogram Equalization (BBHE) was good at preserving the mean brightness alongside assisting in the enhancement of contrast.

Multi–scale fusion: Zhang et al. (Zhang, et al., 2017) have proposed an underwater image enhancement approach based on multi-scale fusion strategy by first applying image restoration and then enhancement. After obtaining the restored image on the base of the underwater image model, white balance is done to get the enhanced image of the restored image. Finally, these two are fused by application of a multi-scale fusion approach. Saturation and contrast metrics are used to weight each input while performing fusion. Also, this technique leads in reduced execution time.

In another technique by Ancuti et al., single images that are degraded due to underwater noise are used as input. Colour-compression and white-balance are applied to the original image to obtain two images. These images are fused, followed by the definition of their corresponding image weight maps so that the details of edges and contrast from the input images are derived in the resultant image (Sharumathi, K., and R. Priyadharsini, 2016). Only lower frequency constituents of the output image are used to restrict sharper weight map transformation followed by multi-scale fusion of images. The technique proposed is not dependent on the configuration of the camera that was used to capture the underwater images and gave better contrast & sharpness.

Other Algorithms for Contrast enhancement and colour cast: Chiang et al. (Chiang, et al., 2017) concluded the effect of particles present in water that make the light rays scatter frequently when it travels underwater and that the colour tone of the water is also affected by varying wavelengths which affect the light absorption feature thus giving underwater images the typical shades of colour and contrast. Moreover, in the research work (Chiang, et al., 2017), underwater images have been assumed to contain the possibility of additional lighting sources. These images are then subject to the process of dehazing, after which the image-depth map is estimated and segmentation of image objects is done. The travelling light rays are prone to events of weakening of the wavelengths and hence are colour-corrected by adjustment of the additional light sources. The article also states that the water-depth levels can be estimated from the background light channels.

In another paper (Sharumathi, K., and R. Priyadharsini, 2016), acoustic images have been considered as candidates for underwater image enhancement. They have observed that acoustic images commonly suffer from noise which is in the form of speckled patterns caused due to the granularity of the sea-bed. The authors mention that the contourlet transform can be used to target discontinuities in points and linear structures by firstly applying the Laplacian pyramid followed by the usage of a directional filter bank. Most of the underwater image enhancement algorithms for image dehazing try to correct the global background light. The Dark Channel Priority (DCP) algorithm has been widely used as an image dehazing algorithm (He K, et al., 2011). However, the DCP algorithm is not sufficient to directly find the image depth. Consequently, the underwater image enhancement algorithms that obtain transmittance are proposed (Peng Y-T, et al., 2017). These methods obtain the depth of the image and depend on a single transmission map to obtain the depth information corresponding to the image, still, limiting the applicability to some specific underwater environment.

Another method for underwater image dehazing is presented in (Soni, Om Kumari, et al., 2020) that uses a double transmission map. It proceeds by performing homomorphic filtering followed by application of double transmission map and finally dual-image wavelet fusion is done. Homomorphic filtering is applied to remove the colour deviation. Depth map calculates the difference between the light and dark channels to produce an enhanced image. The resultant image obtained is combined with the image obtained by dark channel, by application of dual-image wavelet fusion technique. Moreover, CLAHE method is applied to obtain the resultant images with a better contrast. This method

improves the effect on entropy, average gradient and the estimation of the colour image quality. The method surpasses the results obtained by DCP, histogram equalization (HE), and CLAHE algorithms.

A method of image enhancement using dark channel prior (DCP) with adaptively clipped contrast limited histogram equalization (ACCLAHE) and homomorphism filtering (HF) is presented in (Dixit, et al., 2016) for enhancing the image by correcting illumination that is not spread evenly, lowering noise and boosting of contrast. A foggy RGB image is considered as input and the blur region is estimated using DCP and removed. It is done by applying a maximum filter to determine the atmospheric light and to get the transmission map. Then this refined transmission map is used for smoothing the image. After that ACCLAHE is applied to perform image enhancement. From the local histogram of the sub-image, peak bin height is considered and the clipped pixels are spread uniformly to each gray-level. Finally, HF is used to derive better edges.

In (Lu, et al., 2015), the technique proposed focuses on underwater images that have been captured in turbid water. The deviation in attenuation in the route of propagation is balanced out. The technique applies an alternative form of the DCP for estimation of transmission, an ambient light estimator that works on colour lines and a locally adaptive filtering algorithm for enhancing shallow water images. The distortion in colour of underwater images is rectified using a colour correction algorithm targeting the spectrum-based properties to retrieve the colour distortion. The output images resulted in enhanced edges with an enhancement in overall contrast. Underwater images suffer from the presence of noise commonly due to the clarity of water and photography standards. Also, underwater images result in substandard quality because of inferior contrast and absence of well-distributed lighting. P. Sahu et al. (Hung-Yu, et al., 2005) have devised a methodology based on median filtering through which there was an observed reduction in noise grains present in the underwater images. This improvement in the image quality also assisted in decently projecting the water-depth map through the use of forward unsharp masking, early selection of a dark channel and use of colour correction method.

In the underwater ambience, there is a prevalence of colour cast issue that is the dominance of blue/green colour, and a colour equalization method has been proposed to address this problem (Iqbal K, et al., 2010). A scale factor based on the dominating colour plane in the RGB colour space is used to even up the remnant colours. However, this blind colour equalization deteriorates the image colour quality. Beer's law is one of the methods that aims at lowering colour cast. It works by rectifying the pixel intensity through computation of the amount of light absorbed in water. The assumption made is that underwater objects are situated at the same depth level, thus helping computation of missing wavelengths. Although it is not a common situation in many cases that the objects are at the same depth or the medium is homogeneous, the method shows better image enhancement (Narasimhan SG, Nayar SK, 2003).

Retinex-based Algorithms: A Retinex-based variational framework is designed to enhance a single underwater image. A statistical colour correction method is proposed to cater to the problem of colour distortion. This is followed by application of a variational Retinex model to the obtained colour corrected image. Thereby the luminance is decomposed to obtain its constituents-reflectance and illumination. Finally, fuzz and under-exposure are reduced by enhancing the reflectance and the illumination using the histogram method. To address colour shift and contrast degradation, a two-step algorithm is presented in (Fu X, et al. 2017). A colour correcting method that depends on a piecewise linear transformation is introduced to correct the colour. This is followed by application of a contrast improvement strategy that improves the contrast.

CONCLUSION

Thus from the underwater scenarios discussed in this review, it can be concluded that the necessity of enhancing the underwater images arises from the degradation in the quality of those images due to issues in contrast, light-absorption & attenuation, clarity/turbidity of the water, noise present in captured images and also the distance at which the camera has been placed. Further enhancement may be required to target and detect potential objects underwater. It can also be concluded that wavelet and curvelet transformation methods are found to perform better in removing noise from acoustic images. In cases where the fusion principle was used, the image resulting enhancement was found to be useful for tough underwater applications of computer vision. The underwater dehazing and contrast enhancement can be handled better by use of HF, CLAHE along with DCP and transmission maps. Although a remarkable amount of progress has been made in the field of underwater research and investigation, there is a huge scope for the development of image and video processing techniques that can assist this underwater exploration. Moreover, there is a need to build the underwater image datasets, so that the assessment can be carried out on the same set of images.

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Repercussions of Coronavirus on Cyber-Security Threats

Aryan Pandharipande[1*] and Ritik Parashar[2*]
[1,2]*Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Coronavirus outbreak has posed different challenges to society all over the world. The term 'new normal' has emerged and resulted in a change in the working style of society. Countries are using all of their resources to fight the virus. To keep the economy stable, to maintain the continuity, organizations are working from home with limited cyber-security. There is a sense of fear and hysteria among the people about the virus. Such situations are always taken into an advantage by cyber-criminals and the number of cyber- security threats has increased in the pandemic. This paper provides knowledge about cyber-security attacks on people during the COVID'19 pandemic. It provides details about various types of cyber-attacks experienced by people, which people were affected by the threats, reasons behind their vulnerability. We throw light upon specifically the range of cyber attacks and their impact on the workforce. It provides details about how the attacks should be prevented in the future. This paper helps people understand the severity of the attacks, and how these are exercised. We aim to encourage people to remain vigilant against such breaches and prepare them to confront if they witness these types of attacks. The paper is also written with an intention to motivate and support further research related to cyber-crimes during the Coronavirus pandemic.

KEY WORDS: COVID'19, CORONAVIRUS, WORKING FROM HOME, CYBER-CRIMES, CYBER-SECURITY THREATS.

INTRODUCTION

The world has changed. Society has undergone a massive revolution in the year 2020. Novel Coronavirus, also called COVID'19 was first found in Wuhan province of China, at the end of the year 2019. Eventually, it spread across the world. On 11th March 2020, the World Health Organization (WHO) declared the virus as a global pandemic. The virus had a dramatic impact on society, which forced countries to impose 'lock-downs'. Various organizations and companies faced unusual challenges due to the pandemic. People found it difficult to organize their personal as well as professional lives. Term 'new normal' was coined due to the change in lifestyle of people, where organizations were working from home, to remain operable. This also brought a change in the working style of employees, who worked within their comfort zone. People got more involved with technology, but this change came with new cyber risks. It has been observed that the probability and consequences of cyber threat rose in the pandemic, because people did not take cyber-security practices seriously, and organizations were becoming more dependent on digital technology. It has been observed that there is an increase of around 6,000% in spams that were related to the Coronavirus, according to IBM X-Force. Predominantly, people working from home, with limited cyber-security have fallen prey to these scams. Cyber-crime is a criminal offense in which either a computer or a computer network device is targeted or is used as a source. Cyber-criminals may perform both types of cybercrimes simultaneously. They target systems through viruses at the beginning and use those viruses to spread malware to different systems or through different network medium. Malware is short for Malicious Software. Some of the major malware are:

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*Corresponding Author: pandharipandeap@rknec.edu
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1. Virus: It is usually present in an executable file.
2. Trojans: It conceals itself within authorized software.
3. Worms: It infects the whole network of devices by replicating itself.

During the pandemic, the cyber-criminals also attacked health institutions, providing misinformation and fake news on COVID'19 cases. Hackers created fake URLs, providing nothing but fake news and malicious software that would infect the system. Cyber-criminals also distributed fake COVID'19 alerts as well as spread false emails disguising as video calling sites such as Zoom, Google Meet, etc. A lot of Corona virus-related domains are getting created daily. The malicious links infected the systems and created havoc. The Cyber-criminals are taking advantage of the fear of the virus and uncertainty amongst people and using it as bait. There has been a new trend of 'Fearware', where these hackers are attacking through malware and ransomware with the undue advantage of Coronavirus. Bank related frauds have also increased like credit card skimming, including the introduction of Bank malwares such as Anubis Bankbot in malware related to Corona. A new trend of Zoombombing, i.e unwanted intrusion of people in a video conference with an intension of disruption has also taken a toll.

The structure of our paper is as follows: Section II contains Materials used. It describes in detail the types of cyber-attacks, such as Phishing, malware attack, etc. experienced by people. It explains the reason behind the increase in cyber attacks during the COVID'19 pandemic. It briefly describes the target audience. Section III contains Result and Discussion. It provides insights on the impact of the cyber-security threats to people in COVID'19 and what measures can be taken to prevent such threats. Section IV concludes the paper and summarizes the topic.

MATERIAL AND METHODS

Literature survey: Cyber attacks are mostly criminally or politically driven even though, some of the hackers relish to hack computer systems for their entertainment or for a sense of achievement. Politically persuaded cyber-attacks may take place to spread propaganda. With this, they intend to tamper the image of a specific government in the intellect of the citizens. Cyber-attacks may try to achieve destructive outcomes like to disclose sensitive information, confidential communication, or tampering the data. Due to the Coronavirus outbreak, several countries imposed lockdown, which forced organizations to work from home. This made the people turn towards technology for office work, communication and in short, stay connected.

This also resulted in the discontinuance of regular IT support and security to employees which they received in their offices. Many people who were not accustomed to the advances in technology had no other choice but to learn and use it. Cyber-criminals took the advantage of fear amongst the users about Corona and used it as bait. Various Cyber-security threats are taking place in the pandemic era, which includes email spamming, creation of malicious domains, the spread of malware, ransomware attack, BEC (Business Email Compromise), and many more. Threat Actors have always used the opportunity such as this pandemic to implement social engineering (taking advantage of errors by the human to extort sensitive information) techniques. We will see some of the cyber-security threats taking place in the COVID'19 pandemic in detail.

Phishing: Phishing is a cyber attack, which impersonates itself as an email. The email message tricks the user to believe it as an authentic and important email such as banks. There is an attachment with the mail, which if downloaded, malware gets triggered into the system. Phishing also has a goal of obtaining sensitive data of users like passwords. There have been various phishing scams since the outbreak of coronavirus. People are stressed due to the ongoing pandemic and are in constant fear. Any news related to the virus attracts people. The cyber-criminals have taken advantage of the anxiety and fear of people towards the virus. Most of the hackers have targeted health organizations, providing fake news about the pandemic.

Due to lockdown, people have turned towards web conferencing platforms like Zoom, Skype, etc. to continue their workflow. Taking advantage of this, fake notifications of zoom meetings, false COVID-19 alerts have become a common work of hackers. People, who get trapped into the web, end up clicking on the links, and the malware gets triggered into their systems. There have also been cases of fake Skype login pages, where login information collected sensitive information about the user. The reason behind the people falling prey to such emails and notification is their misunderstanding about how they are going to receive official news. According to a survey by IBM security and Morning Consult, around 46% of people think that COVID'19 related official news will be provided via email.

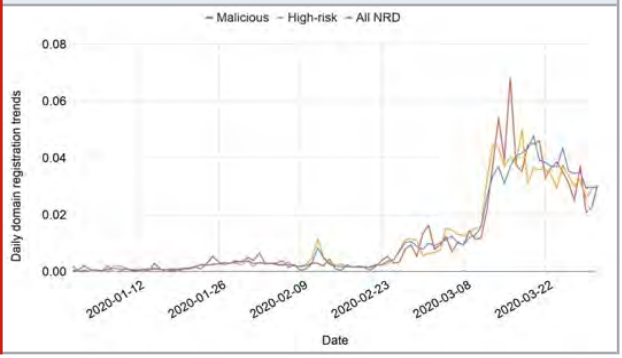
Malicious Websites: As the number of cases of Corona started increasing, people were panicking. The cyber-criminals took advantage of the situation and started creating malicious websites, domains providing false news on COVID'19, etc. These are some of the websites which are found malicious and dangerous to visit.

1. Coronavirusstatus[dot]space
2. Coronavirus-map[dot]com
3. Bestcoronavirusprotect[dot]tk
4. Coronavirusupdate[dot]tk
5. Vaccine-coronavirus[dot]com

Banking Malwares: As the lockdown resulted in the shutdown of local shops and malls, more people started using online shopping on e-commerce websites. Hackers used the opportunity and used many non-authentic sites to gain information such as credit card details, passwords, etc. This led to credit card skimming. There has been a

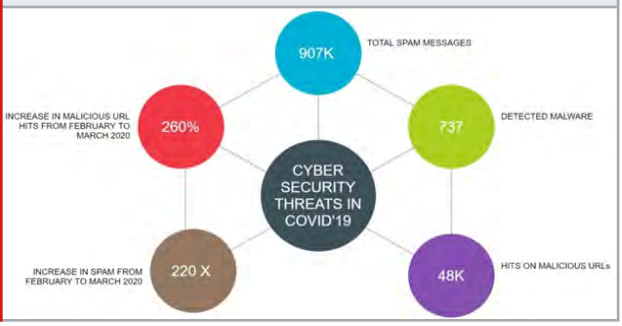
considerable rise in credit card-related fraud since the onset of lockdown. There are various banking malwares which have increased their features relating to Corona Virus. GINP is a banking Trojan which centrally targets Spanish banks. But during the pandemic, the authors introduced new features, called as 'Coronavirus Finder'. When one navigates over the URL, it gets redirected to a webpage called Coronavirus finder.The webpage shows the count of people infected with the Coronavirus around your location.

Figure 1: Graph depicting trends in daily domain registrations relating to COVID-19



It asks users to pay some amount to know the exact location of the infected people. This tracks banking details of the users. An important thing to note that one needs to have GINP Trojan present in the system to open the webpage. Anubis Bankbot disguises as a COVID'19 related alerts application, but it only attracts users towards the application and collects banking details. Cerberus, also a Trojan, sends people an SMS which contains a link to download a malicious application known to track Corona Virus. People who believe the SMS end up downloading the application. With that, a Trojan also gets installed in the system which can steal personal information like username, password, banking details, etc.

Figure 2: Flowchart depicting trends in different types of Cyber-Security threats during COVID'19



Other Malwares related to COVID'19: As discussed, people have been showing keen interest in any news or application relating to Coronavirus. People compromised cyber-security and downloaded various files that were nothing but malicious. Czech cyber-security agency (NUKIB) has published a detailed description of a Coronavirus themed malware. The malware has a file called coronavirus installer. The malware makes the system unbootable. When it gets triggered, the machine restarts, and a Coronavirus themed page opens up with a message. Other functions like the exit button, opening task manager do not respond. When one restarts the system, a message pops up with a link to Discord, where the user can communicate with the hacker and find a solution in return for some ransom. Authors of a spyware known as 'AhMyth' have made an application on Google Play, which depicted coronavirus evolution. After installing the app, a few permissions are forced on the user for the functioning of the app.

As the permissions are given, malicious code runs and enables the creators to access the device, use the camera, click photographs, send and receive texts, know the location, etc. This is one of the most dangerous spying Trojan which has infected in the pandemic era. Vicious panda is a malware which targeted predominantly Mongolian sector. The creators usually send information related to COVID'19 through an RTF file. The main objective of the hackers is to spread RAT that is Remote Access Trojan in systems so that they can access information from the infected systems. Authors of this malware send a message related to a current hot topic, like Coronavirus. The criminals take advantage of pre-existing vulnerabilities in the system and utilize them. After doing so, malware code gets triggered and provides remote access to the attackers. The attackers can have the ability to take Screenshots, Download files, delete files, get passwords and username, etc.

RESULTS AND DISCUSSION

Virtual Private Network (VPN) has become crucial as organizations are functioning online and students are learning in virtual classrooms, therefore, the major aim is the security and their ability to continue their work. Lack of preparedness in an organization will result in misalignment of VPN which may give away crucial information and even fall prey to Distributed Denial of Service (DDoS) attacks. Further to this, many users may use their personal computers to execute official work which could also lead to a great risk for companies and organizations. Misinformation has led to the wastage of a huge amount of time in the course of the pandemic. False information has a more adverse effect than having no formation at all. Almost every individual is required to include technology, therefore it is assumed that everyone is handy to technical skills. Big corporations' VPNs are not able to handle the burden to access the network and thus it has reduced their productivity while working from home. Organizations and individuals also need to take some preventive measures which can reduce their vulnerability.

1. One should avoid clicking on any UNKNOWN messages with links to install an application from mysterious sources.
2. Files should be backed up and stored in devices other than your system (e.g. on an external drive) and sensitive information should be protected.

3. One should cautiously examine any URL or email address they see and download only from authentic sources.
4. One should ensure that they have legitimate and latest anti-virus software installed on their computer and mobile devices.
5. One should be aware of emails and messages that are asking for confidential information.
6. Administrations' vulnerabilities of the system that attackers could exploit should be secured.
7. Organizations are advised to reform at their BCPs and secluded working policies at the same time prioritizing cyber security within post COVID-19 re-strategizing operation.
8. One should always verify that they are on company's legit website before advancing their personal information.

CONCLUSION

Huge amount of change can be seen in criminal activity due to COVID-19. There has been a decrease in crimes such as burglary, pickpocketing but cyber crimes have increased as hackers have taken advantage of fear amongst people about COVID'19. Cyber-criminals are changing their strategy and taking advantage of the anxiety and hysteria amongst people about the virus. As we have seen, hackers made available applications about the pandemic, spread fake news which also came with malicious links, websites, or codes that infect the systems. Many people who work from home do not have adequate cyber-security measures to tackle such attacks. Also, it has been observed that not many people are taking cyber-security seriously. Such people are falling prey to the attack. At this particular time, the main focus should be on cyber-security education among citizens, as it is the most important thing needed right now. Organizations should look after their workforce as it is no more beneath the organization's firewalls, employees of organizations are working from home with limited security. Organizations should make sure to prepare their workforce, so they could protect themselves.

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Towards Identifying Influential Indicators for Predicting Football Club Stock Price

Ashish Chouhan[1*], Tanmay Dhimate[2], Srivathsa Saya[3], Ojal Neelawarna[4], Tripti Pandya[5], Ajinkya Prabhune[6], and Manoj B. Chandak[7]

[1-6]*SRH Hochschule Heidelberg, Germany*
[7]*Ramdeobaba College of Engineering and Management, India*

ABSTRACT

In this paper, we present a novel framework to identify influential indicators necessary for predicting a football club's stock price. The stock price movements are not random, but gets manipulated due to external factors. People's views and reactions on social media platforms are a few of the factors that influence the brand value of an organisation and alters the stock prices in a certain way. Hence, we aim to understand and identify the indicators that affect the stock price of Manchester United Football Club. In order to predict the stock price, the data is collected from social media, stock market, and football event for the 2018-2019 season of English Premier League (EPL). The primary challenge in accurately predicting the stock price is to identify unique features from the sources and explain how they influence the stock market. The framework is designed on the principles of microservices architecture pattern, and consists of five groups of microservices: (a) Data Extraction (b) NLP Pre-processor (c) Financial Indicator (d) Feature Identifier, and (e) Prediction Model Evaluator. For coordinating the execution of the microservices, workflows are orchestrated through the orchestrator component of the framework. For step-wise execution of the workflow, the workflow is divided into four sub-workflows. Finally, after evaluation of the framework, out of various indicators, Financial Indicators (FI) and Sentiment Indicators (SI), are identified as the prominent indicators that show the highest impact for predicting the fluctuation in the stock price of Manchester United football club.

KEY WORDS: MICROSERVICES, FEATURE SELECTION, TOPIC MODELING, STOCK PRICE PREDICTION, NATURAL LANGUAGE PROCESSING

INTRODUCTION

Prediction of a stock price is an important and complex issue in the financial sector as the organisation's current situation and future growth can be interpreted with the help of these values [Sahoo PK, 2015]. The stock prices of an organisation not only depend on the financial status, but also on the socio-economic condition around the globe. Not only the country's economic growth has a direct impact on the stock market, but also the social events have a considerable impact on them [Laidroo L, 2008]. With the advent of social media, people are now expressing their thoughts and reactions about an organisation, its products, and related news on various social media platforms. Similarly, for a game like a football, that is globally followed, fans express their emotions on these platforms. It is safe to assume that these reactions on social media will have an impact on stock variations. Social media is no longer just a medium to connect people but has also become a medium for marketing and advertising.

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*Corresponding Author: 1ashish.chouhan@srh.de
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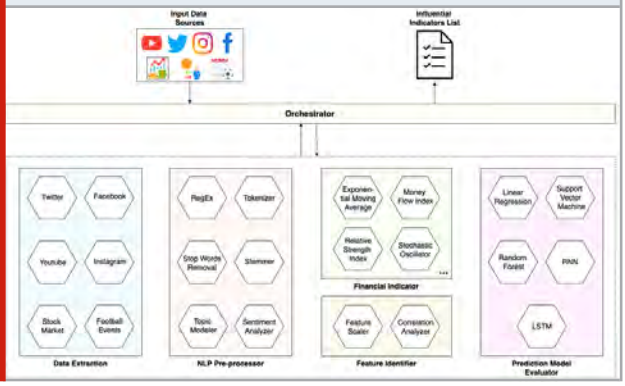
Football clubs have started to view themselves as brands and are getting influenced by the social media platforms that include Facebook, Twitter, Instagram, YouTube, and many more [Appel G, 2020]. Football fans have a relationship with their favourite team, along with a very high level of emotional connection, recognition, and engagement [Abosag I, 2012]. Thus, an aggregation of public reaction, stock price, and football events can be used to predict the stock prices. Sentiment analysis and stock price prediction using Machine Learning (ML) are studied extensively for an organisation's growth prediction and analysis [Park H, 2014]. [Hegazy O, 2013] in their paper, propose an ML model to predict the stock price value after analyzing the historical data on inventories and technical indicators. The paper published by Dipti Sharma et al. [Sharma D, 2019] provides an overview of various techniques that are helpful when working on sentiment analysis of social media data.

Figure 1: Architecture of Framework



In the paper proposed by [Devi KN, 2019], insights regarding the impact of different indicators such as sentiment indicators, financial indicators, and technical indicators on stock price prediction are provided. Stock market information can distort the overall trend even due to small variation in price movements, thus creating noise in the overall prediction. This characteristic is considered as one of the challenges as the stock prices keep fluctuating [Jin Z, 2020]. Since the stock market generates large quantities of data every day, it is difficult for investment managers and stockbrokers to consider all of the present and historical information for estimating future stock patterns [Kalyani J, 2016]. Hence, this research paper aims to identify indicators that can have an impact on the fluctuation of the stock price. Following are the features of the presented framework:

- A microservice-based architecture that allows easy extensibility with the addition of new microservices, and the execution of customized workflows for microservices co-ordination.
- Systematic workflows for identifying indicators for prediction of the stock price.
- The unique set of indicators are calculated and considered in the framework that includes Financial Indicators (FI), Sentiment Indicators (SI), Event Indicators (EI), and Topic Indicators (TI).

The remainder of this paper is structured as follows. Section 2 introduces the framework and the four sub-workflows for identifying the influential indicators for predicting the Manchester United football stock price. In Section 3, we present the evaluation and discussion of the results obtained from a different combination of indicators. Finally, in Section 4, we conclude the paper and give a brief outline of our ongoing work.

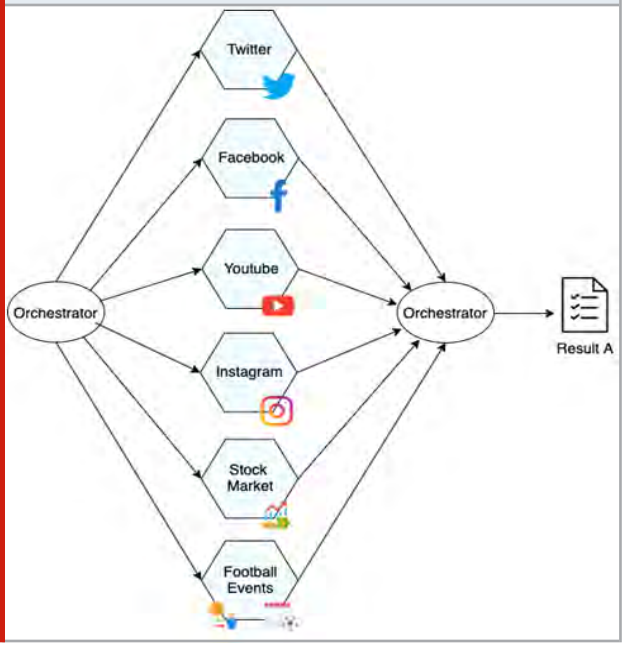
METHODOLOGY

In this section, we present the framework, as shown in Figure 1. This framework is based on the microservice architecture pattern consisting of a systematically arranged group of microservices, where each microservice is responsible for a specific task. The Orchestrator component present in the framework coordinates different microservices in the form of a complex workflow to achieve the task. In the current version of the framework, the workflow is further divided into four sub-workflows that are further explained in this section. The source code of the framework is available online.1

Sub-workflow-A for Data Extraction: This sub-workflow is responsible for extracting the EPL data from social media, stock market, and football event for the 2018-2019 season. The microservices responsible for extracting social media data comprises of Twitter, Facebook, YouTube, and Instagram, where data is extracted through scrapping official social media handles of Manchester United Football Club, namely Twitter2, Instagram3, Facebook4, and YouTube5. The social media data consisted of comments, timestamps, username, profile ID, and number of likes. Out of these extracted social media data, comments and timestamp were considered for further processing in the framework. A total of 8,90,725 comments are collected from social media data sources. Similarly, the Stock Market microservice extracts the financial data of Manchester United Football Club with the help of APIs from Yahoo! Finance6 comprising of an opening price, closing price, low price, high price, and volume of trade for each working day.

The Football Events microservice extracts the betting odds and match results obtained from Oddsportal7 website. This website provides betting data for Manchester United and the opposition team along with the match results. The Football Event microservice also extracts the League Standings of Manchester United for each season from the official EPL8 website. The extracted data from different microservices are further concatenated by the Orchestrator and stored in Result A, as shown in Figure 2.

Figure 2: Sub-workflow-A for Data Extraction



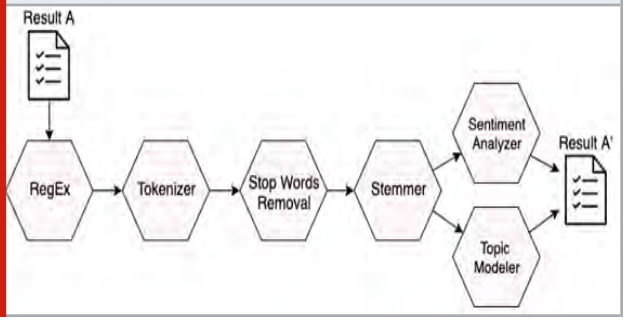
Sub-workflow-B for NLP Pre-processor: The result obtained from sub-workflow-A (Result A as shown in Figure 2) is provided to sub-workflow-B (as shown in Figure 3). In this sub-workflow, the comments collected from different social media platforms are provided to the microservices to perform data cleaning in order to generate SI comprising of sentiment score and TI consisting of the probability distribution of topics on the comments. Since the data extracted from social media comprise of HTML tags, a regular expression removes the HTML tags in RegEx microservice.

1. https://twitter.com/ManUtd
2. https://www.instagram.com/manchesterunited/?hl=en
3. https://www.facebook.com/manchesterunited
4. https://www.youtube.com/channel/UC6yW44UGJJBvYTlfC7CRg2Q
5. https://in.finance.yahoo.com/
6. https://www.oddsportal.com/
7. https://www.premierleague.com/

After the removal of HTML tags, the cleaned comments are provided to the Tokenizer microservice to separate the comments into a token of words using the NLTK library. As stop-words do not have any impact on the sentiment score,

the tokens obtained from Tokenizer microservice is provided to the Stop Words Removal microservice, where stop-words are removed using a stop-words dictionary present in NLTK library. For example, words like is, are, that, the are some of the stop-words that are removed by this microservice. To calculate the precise sentiment score, the tokens must be in their root form. Therefore, the Stemmer microservice is executed to convert the words into their root form. For example, the word 'laziness', when stemmed gives 'lazy'. The tokens obtained from the Stemmer microservice are provided concurrently to two microservices, namely, Sentiment Analyzer, and Topic Modeler. The Sentiment Analyzer microservice focuses on obtaining the sentiment scores, and the Topic Modeler microservice realized using the Non-negative Matrix Factorization (NMF) method provides probabilistic distribution in four important topics that are relevant to the group of comments. The identified four topics include Match Result, Management, Player Transfers, and Birthdays events for the club players. Result A obtained from sub-workflow A gets updated with the SI and TI, and an updated result is obtained (Result A' as shown in Figure 3).

Figure 3: Sub-workflow-B for NLP Pre-processor



Sub-workflow-C for Feature Identifier: In this sub-workflow, the FIs are calculated using the financial data present in Result A'. The input, Result A' as shown in Figure 4, is processed by the Orchestrator to calculate five FIs. The five FIs are determined using the equations stated below.

- Exponential Moving Average (EMA): Using Eq. 1, EMA is a FI that calculates the exponential moving average of a field over a given period [Wan X, 2019].

$$EMA = [\alpha * TClose] + [(1 - \alpha) * YEMA] \quad (1)$$

where TClose is Today's Close value, YEMA is Yesterday's EMA value, and α, a constant smoothing factor between 0 and 1, represents the degree of weighing decrease.

- Money Flow Index (MFI): MFI FI as calculated in Eq.4, measures the strength of money in and out of security [Wan X, 2019].

$$Money\ Flow\ (MF) = Typical\ Price * Volume \quad (2)$$

where Typical Price is given by, Typical Price = (High + Low + Close)/3 and Volume is the amount of trade performed, i.e., selling and buying of stocks.

Money Ratio (MR) = (Positive MF /Negative MF) (3)

If today's Typical Price is greater than yesterday's Typical Price, it is considered Positive Money Flow. If today's Typical Price is less than yesterday's Typical Price, it is considered Negative Money Flow. The Positive Money Flow is the sum of the Positive Money over a specific number of periods, and the Negative Money Flow is the sum of the Negative Money over a specific number of periods.

MFI = 100 – [100 / (1 + MR)] (4)

- Relative Force Index (RSI): RSI FI is calculated using Eq. 5 and is a strong momentum indicator that compares the extent of recent losses to that of recent gains to assess the overbought and oversold conditions of an asset [Wan X, 2019].

RSI = 100 – [100 / (1 + RS)] (5)

where RS = Average of Upward Price Change/Average of Downward Price Change.

- Stochastic Oscillator (%K): %K FI is defined as the measure of the difference between the Current Closing price value of a security and its Lowest Low price, relative to the difference between its Highest High price and its Lowest Low price for a given period as shown in Eq. 6 [Wan X, 2019].

%K = (Current Close - Lowest Low) / (Highest High - Lowest Low) * 100 (6)

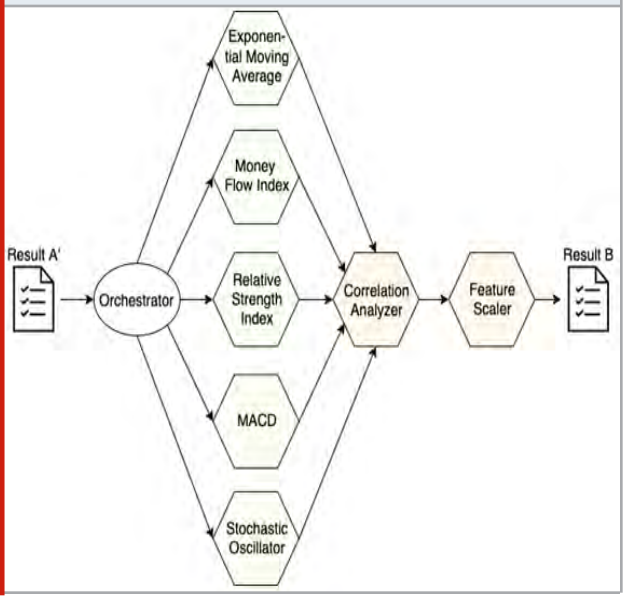
- Moving Average Convergence/Divergence (MACD): MACD FI calculates the difference between a short and a long-term moving average for a given field. The equation for calculating MACD and its signal is as calculated in Eq. 7 and Eq. 8 [Wan X, 2019].

MACD = [0.075 * EMA of Closing prices] – [0.15 * EMA of Closing prices] (7)

Signal Line=0.2*EMA of MACD (8)

After calculating the five FIs, out of these five FIs, the indicators having a strong correlation with the closing stock value of next working day are selected. The Correlation Analyzer microservice carries out the task to evaluate the strength of the relationship between each of these five FIs with the closing stock value of next working day. Based on the correlation score, three out of the five FIs were finalised. These three FIs include EMA, RSI, and MFI. These selected FI, along with SI, TI, and EI, are provided to Feature Scaler microservice. The reason to perform feature scaling is to scale values present in different indicators as a different range of values would affect the efficiency of the model [Kalyani J, 2016]. Therefore, feature scaling is performed to scale the values in the same range for all the indicators by Feature Scaler microservice and Result B as shown in Figure 4 is obtained.

Figure 4: Sub-workflow-C for Feature Identification



Sub-workflow-D for Model Evaluations: This sub-workflow aims to optimise the identification of the indicators by evaluating the framework against five prediction models. These five prediction models include Linear Regression (LR), Random Forest Regression (RF), Support Vector Regression (SVR), Long Short Term Memory (LSTM), and Recurrent Neural Network (RNN). The models are trained with a different combination of indicators to predict the dependent variable, i.e., closing stock value of next working day. As shown in Figure 5, Result B obtained from sub-workflow-C is provided as an input to the Orchestrator. The Orchestrator gives different combinations of FI, SI, TI, and EI to all the five models and obtains RMSE (Root Mean Square Error) score as an output from each model. The obtained RMSE scores are stored in a matrix of m x n (Result C as shown in Figure 5) where different combinations of indicators are present in the row, and prediction models are present in the columns with RMSE scores present in the intersection cells of the rows and columns.

EVALUATION AND DISCUSSION

Table 1 provides the results obtained by the framework on a different combination of indicators for prediction models. For the evaluation of models, RMSE (Root Mean Square Error) evaluation technique is used [Willmott CJ, 2005]. In Table 1, the columns LR, RF, SVR, RNN, and LSTM refer to the Prediction models, namely, Linear Regression, Random Forest Regression, Support Vector

Regression, Recurrent Neural Network, and Long Short Term Memory respectively. Similarly, FI indicates the financial indicators (EMA, MFI, RSI), and SI indicates the sentiment indicators (sentiment scores). Event indicators and topic indicators are represented as EI and TI respectively, followed by CI that represents the combination of all four indicators, i.e., FI, SI, TI, and EI. Various combinations of these indicators were provided to the models, and the evaluation results

Figure 5: Sub-workflow-D for Model Evaluation

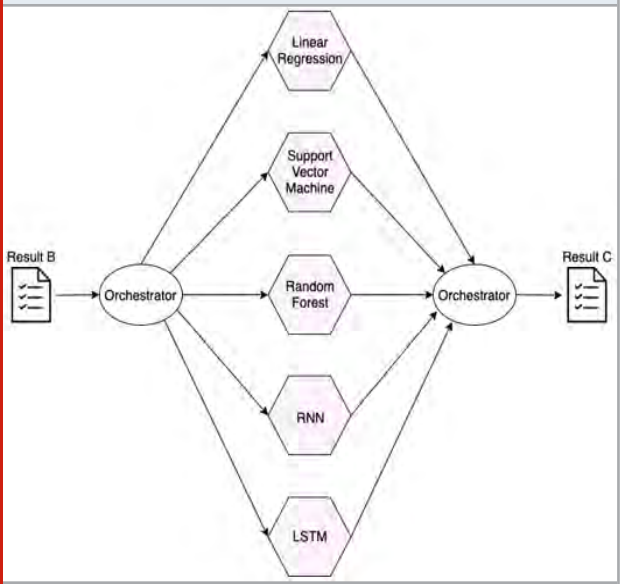


Table 1. RMSE scores for Prediction models

Indicators	LR	RF	SVR	RNN	LSTM
SI	3.2015	0.4453	2.6540	0.0496	**0.0121**
FI	0.1429	0.0158	0.1084	0.3117	0.3117
TI	3.1442	0.4640	2.3138	0.0216	0.0164
EI	3.3765	2.1485	3.6382	0.1925	0.1925
FI +SI	0.1429	0.0174	0.1153	0.3117	0.3117
EI + SI	3.2578	0.2961	3.4889	0.1925	0.0139
EI + FI	0.1443	**0.0136**	0.1386	0.3117	0.1015
TI + FI	0.1441	0.0203	0.1214	0.3089	0.3117
TI +EI	3.1743	0.3391	3.1235	0.0216	0.0216
TI +SI	3.3953	0.4814	2.3259	0.0216	0.0175
FI + SI + EI	0.1439	0.0151	0.1338	0.1141	0.1118
SI + EI + TI	3.4553	0.3801	3.1020	0.0216	0.0216
FI + SI + TI	0.1457	0.0191	0.1224	0.3117	0.3117
FI + EI + TI	0.1452	0.0190	0.1323	0.3117	0.0961
CI	0.1473	**0.0168**	0.1310	0.3117	0.1064

were obtained. From Table 1, it can be observed that the RMSE scores are lower for most of the indicators combination for the RF and LSTM models. However, our focus is on identifying the indicators that have an impact on predicting the Manchester United Football Club stock price. When FI, SI, TI, and EI are evaluated individually, then SI performs better with LSTM model having the RMSE score of 0.0121. For evaluation of a combination of indicators, a combination of FI and EI performed better for RF model with the RMSE score of 0.0136. For CI, i.e., a combination of all indicators, RF is the best performing model with the RMSE score of 0.0168.

CONCLUSION

In this paper, we presented a framework to identify the indicators influencing the stock prices of Manchester United Football Club. The framework is designed on the microservices architecture pattern for allowing easy extensibility when adding or updating the framework with new features. The functionality of the framework is split into different groups of microservices. The presented version of the framework has five groups of microservices: (a) Data Extraction, (b) NLP Pre-processor, (c) Financial Indicator, (d) Feature Identifier, and (e) Prediction Model Evaluator. To handle these microservices, the framework provides an Orchestrator component. The Orchestrator allows users to describe workflows, register microservices, and coordinate their execution.

The framework is designed to calculate the FI, SI, TI, and EI from social media, stock market, and football event for the 2018-2019 season of English Premier League (EPL). Various combination of indicators are evaluated against prediction models using the RMSE scores. For the different combination of indicators, from the RMSE score, LSTM and RF models were the most efficient models. The framework finds out that the deep learning model LSTM has given an RMSE score of 0.0121 for SI followed by a combination of FI and EI with RF giving the RMSE score of 0.0136. Considering all the indicators, i.e., FI, SI, TI, and EI, RF prediction model is performing better with RMSE score of 0.0168. In our ongoing work, we are working to extend the indicators by considering the news articles, attendance of the people for matches, and sponsorship details.

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Long Short Term Memory Network Using Grey Wolf Optimization for Stock Price Prediction

Pravinkumar M. Sonsare[1*], Praful R. Pardhi[2] and Roshni S. Khedgaonkar[3]

[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

[3]*Yeshwantrao Chavan College of Engineering, Nagpur, India*

ABSTRACT

Stock market is backbone of nation's economy. Stable and improving stock market is very important for economy. Stock price prediction is one of the trending topics in data science for researcher. Scientist, analyst, traders are looking for efficient method of prediction of stock price. For profit many investors are keen to know the future of stock market. So, powerful prediction method is required for shareholder. Many methods are implemented using machine learning and deep learning techniques. In this work, we proposed a hybrid framework. This framework consists of Long Short Term Memory Network (LSTM) with a Grey Wolf Optimizer (GWO) which is utilized to estimate stock costs. This proposed framework would improve exactness of prediction of stock cost and helps the investors. We designed traditional LSTM and LSTM with GWO. The results of LSTM with GWO shows better result than LSTM.

KEY WORDS: STOCK PRICE, RECURRENT NEURAL NETWORK, GREY WOLF OPTIMIZER, LONG SHORT TERM MEMORY NETWORK.

INTRODUCTION

In computer science, "Prediction "is most difficult part to work. It is a goal to achieve for most of the researcher. Stock market is very important part of countries economy. So that prediction of stock is one of the topic in which many researcher wants to work. Many models are found for stock prediction. There are many factors available for prediction of stock. External macroeconomic factors are used to predict stock(Lin, Chu, & Wang, 2018).Value, quantity and financial facts are used by most of the researcher to predict cost of stock (B. Mendelsohn Louis, 2000).

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Many statistical methods are used for testing market efficiency(SteveHogan,Robert Jarrow,MelvynTeo, 2003). Nowadays many machine learning algorithms are used to predict stock price. Support vector regression and principal component analysis are used to analyze share at London stock market(Fu & Patra, 2009).Long short term memory network is deployed on S & P 500 for prediction of financial market prediction task. This method is used to select profitable trading in market. Simplified ruled based trading strategy is devised for LSTM prediction(Fischer & Krauss, 2018).Hybrid training model consists of Artificial Neural Network and Genetic Algorithm to predict Thailand SET50 index trend.

This method is used on data collected from 2009 to 2014(Inthachot, Boonjing, & Intakosum, 2016).Artificial neural network is used to predict ISE index and Dow Jones index (E. Birgul, M. Ozturan, 2003)(J. Bollen, H. Mao, 2011). Trend deterministic data of technical indicators is proposed to train model. It showed better result than conventional methods. This imported data is used for various machine learning algorithm to analyze CNX Nifty and S&P Bombay Stock Exchange markets(J.

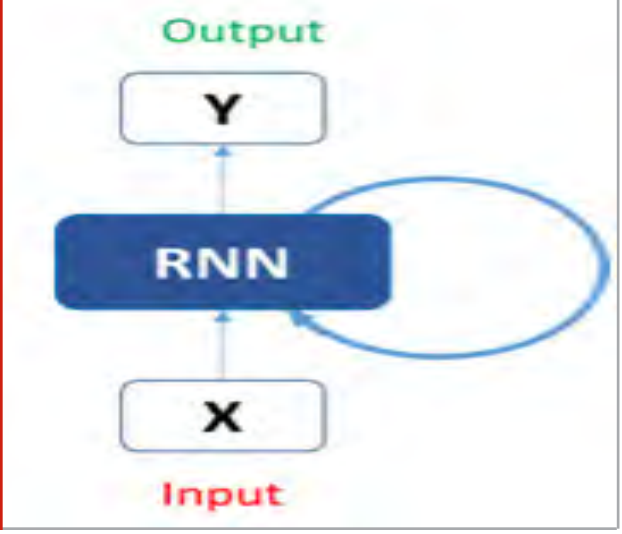
Patel, S. Shah, P. Thakkar, 2015).Stacked autoencoders with LSTM is used to forecast stock price(Bao, WeiYue, Jun, 2017).

Neural networks are used for faster convergence with the help of learning rates. The problem associated with neural network is to select appropriate learning rate. Fast or slow learning rate causes an erroneous result in linear or nonlinear network. Network undergoes many epochs to get optimal solution by reinitializing the weights(Sikder MF, Uddin MJ, 2016)(Sonsare & Gunavathi, 2019). The stochastic algorithms which are inspired from behavior of animal avoids problems occur in neural network with backpropagation. These algorithms used initial solution which will be optimized using various iterations. Our aim is to predict the future stock prices using the data from 'N' days. This dataset will be evaluated for better predictions using Machine Learning Techniques with Python to predict the future stock prices with high degree of accuracy. We designed long short term memory network with grey wolf optimizer to predict stock price.

Preliminaries: One of the challenging problems in data science is sequence prediction. This domain has wide range of problem in various fields like natural language processing, bioinformatics, stock market etc. The recent development in data science shows long short term memory (LSTM) network which gives most effective solution. This is because of network's ability to remember pattern of sequence for long duration of time. Due to this property of LSTM, it overcomes conventional neural network and recurrent neural network.

Recurrent Neural Network: Many traditional networks do not have memory to learn pattern in a sequence. Recurrent Neural Network is perfect solution to learn pattern in sequences. Data which has been learned by recurrent neural network are maintained by loop as shown in fig 2.1.

Figure 2.1: Recurrent Neural Network (RNN)



The RNN produce output based on iterations performs on input sequence over time. The RNN requires current time and current state which is previous output for generating output. The RNN perform transformation on input matrices using weight and bias matrices. The pseudocode of the RNN is as follows(CHOLLET, 2018).

first_state = 0
for sequence_t in stock_sequence:
sequence_t = activation(dot(W, sequence_t) + dot(U, Initial_t) + bias)
initial_t = secstr_t

RNN works effectively for sequence where there are short term dependencies. But RNN fails in long term dependencies. RNN does not consider context of sequence because of vanishing gradient problem. This problem makes training of layer difficult because small part of derivative multiplies error many times while reaching towards first layer.

Long Short term Memory Cell: The solution to avoid vanishing gradient problem is use of LSTM network. The LSTM cells are used to carry information along every timesteps. LSTM prevents older signals from gradually vanishing during the learning process. This saves information for future processing. In LSTM, data is carried across timesteps (Ct) which converts the current output to next state. LSTM experiences three distinct transformations in the form of RNN. All three transformations have different weight matrices. Pseudocode for RNN with LSTM as follows(CHOLLET, 2018).

secstr_t = activation(dot(initial_t, Uo) + dot(sequence_t, Wo) + dot(Carry_t, Vo) + bias)
a_t = activation(dot(initial_t, Ui) + dot(sequence_t, Wi) + biasa)
b_t = activation(dot(initial_t, Uf) + dot(sequence_t, Wf) + biasb)
c_t = activation(dot(initial_t, Uk) + dot(sequence_t, Wk) + biasc)
Next carry_t can be obtained by
carry_t+1 = a_t * c_t + carry_t * b_t

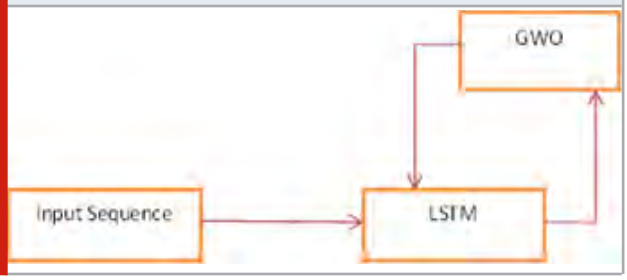
Grey Wolf Optimization: Grey wolf optimizer is introduced by Mirjalili (Mirjalili, Mirjalili, & Lewis, 2014). This swarm based algorithm is inspired from hunting style of grey wolf. Grey wolves are divided into Alpha (a), Beta (ß), Delta (d), and Omega (ω). Alpha (a), Beta (ß), Delta (d) are considered as finest fitting wolves and guide Omega (ω) to optimal search area. This optimization is guided by Alpha (a), Beta (ß), and Delta (d). The position of wolves changes around finest fitting wolves. The position of wolves may change relative to change in position of prey. The grey wolves are continuing hunting till prey does not stop moving. Omega's (ω) updates it's position relative to Alpha (a), Beta (ß), Delta (d). Prey is moving in area which is encircled. The pseudo code of optimization process can be stated as follows(Mirjalili et al., 2014):

Consider Pi is the grey wolf population
Initialize the search agent position

Each search agent's fitness is computed
SA1,SA2,SA3 are first ,second and third search agent respectively
Repeat until iteration reaches to maximum
for each search agent
Modify position and compute fitness
Increment iteration
End repetition
return finest search agent

Modified LSTM with GWO: The sequence is fed up to long short term memory cell for training. After numbers of iterations total mean square error (TMSE) is computed. This TMSE is passed to grey wolf optimizer. GWO assess TMSE around the fitness of Alpha (a), Beta (ß), and Delta (d). Best wolves represent the search agent. Best wolves are identified by its fitness and position. Weight and bias matrices indicates search agent's position. Position is adjusted iteratively. Adjustment is based on the number of search agents. In this way GWO updates the weights and biases. The updated weights and biases are finally passed to the LSTM.

Figure 2.2: LSTM with GWO



Proposed Methodology: We have processed NSE data from 01.01.2011 to 31.12.2016. We preprocessed dataset.

Figure 3.1: Proposed Methodology

We perform discretization and normalization of data. Data cleaning is done by replacing the missing values. There are many features in dataset. We extracted few important features like date, open, high, low, close and volume. These features are fed up to neural network. We designed three layer long short term memory and one dense layer network. We train this model with initial bias and weight matrix. We used grey wolf optimizer to update weights and sigmoid activation function for dense output layer.

Table 1. Comparison of LSTM with and without GWO

Features	No of iterations	LSTM		LSTM with GWO	
		Train RMSE	Test RMSE	Train RMSE	Test RMSE
O/C	100	0.032	0.029	0.021	0.019
O/C	200	0.030	0.028	0.014	0.012
O/C	300	0.027	0.025	0.010	0.006
H/L	100	0.028	0.025	0.022	0.020
H/L	200	0.026	0.024	0.020	0.018
H/L	300	0.025	0.022	0.018	0.015
H/L/C	100	0.022	0.019	0.013	0.011
H/L/C	200	0.019	0.017	0.008	0.007
H/L/C	300	0.016	0.013	0.005	0.004

RESULTS AND DISCUSSION

We used 1312 sequence from dataset. Out of these sequences we have used 1180 samples for training and 132 samples for testing. We have used different set of parameter to measure the efficiency of model. We checked the efficiency of model using root mean square method. Root mean square error is square root of sum of all error. We used python for training with Keras as frontend and Tensorflow as backend. We used features like open-close (O/C), high-low (H/L), high-low-close (H/L/C) We used LSTM and LSTM with grey wolf optimizer for training

model. The result of model using different parameter set and epochs shown in Table1.

We have modeled LSTM and LSTM with Grey wolf parameter. We used these models for feature set like Open/Close, High/Low and High/Low/Close. We observed that LSTM with GWO gives better result than traditional LSTM. We also found that feature set High/Low/Close is an optimized set of features to produce better result.

CONCLUSION

Nowadays researchers are encouraged for prediction of stock price. This is because of growing popularity of stock market. These prediction methods are helpful for investors to play in stock market as well as researcher to predict stock price more accurately. In this regard we devised method consists of LSTM with GWO. This method will be helpful for brokers, researchers or any person who want to play stock market. This method may help investors to know future situation of stock market.

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A Novel Model for Healthcare Emergency using Fog Computing

Ashish Virendra Chandak[1*], Rakesh K. Kadu[2] and D. S. Adane[3]
[1,2,3]*Department of Information Technology, Shri Ramdeobaba College of Engineering and Management Nagpur, India*

ABSTRACT

The number of road accidents is continuously increasing and immediate help is required during an accident. VANET are connected internet and they contain sensor which is activated during an accident. These sensor share accident location. We proposed a model in which the sensor passes data to the fog layer for quick processing. The fog layer contains fog nodes which is used for computation. These nodes process sensor data and find nearby possible immediately. Our proposed model is compared with the cloud computing model based on response time and network bandwidth. Simulation results show that the proposed model outperforms the cloud computing model.

KEY WORDS: FOG COMPUTING, VANET, HEALTHCARE

INTRODUCTION

The objective of Vehicular Adhoc Network is used to improve the safety of driver and VANET are sharing data among each other viz. traffic condition, traffic signals. Now a days the number of road accidents has been increased significantly and the patient will have to rush to the hospital as early as possible. But hospital finds it difficult to send an ambulance from the hospital to patient's location and if there is a serious case then the patient might even die if not taken to the hospital in time. Hence system is required which find a nearby hospital in case of an accident in real-time. Vehicular Cloud Computing (VCC) can be used to perform data storage and computation in real-time. In general, VANET are connected to the cloud for data storage and computation but there may communication latency for data computation but it does provide concrete solution due to latency-sensitive requirement. Hence computation nodes are required which are close to VANET and perform processing of data immediately. Fog computing can be used which is place close to the proximity of the application. It contains computing nodes that are placed near to application and perform computation in real-time.

In this paper, we used fog computing to provide quick response in case of road accident. All VANET contains a collision sensor and are connected to fog computing. If an accident happens then sensors in VANET share location, images, and videos to fog nodes. Fog nodes perform computation of data and find nearby hospitals from the accident location. It share accident location, images and video to nearby hospital and calling out for emergency care. We have also used cloud computing to compare the performance with the fog computing model on the basis of response time and latency for communication on the basis of response time and network bandwidth.

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*****Corresponding Author: achandak.nitrkl@gmail.com
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The objective of the paper is follows

- To develop faster and better Emergency Healthcare Services.
- To develop a fog computing architecture for faster processing of request.
- To develop a model to reduce response time and latency for processing of request.

The rest of the paper is organized as follows. Section 2 describes related work while the proposed model is discussed in Section 3. Performance evaluation describe in Section 4 while Section 5 concludes the paper.

Related Work: Numerous article has been published for application of fog computing in various domains. They are as follows. Fog computing in face identification has been discussed in [Hu P,2017]. Fog computing used in military applications to take spontaneous decision making by the military officials [Lanka D,2017]. Fog computing can be used for smart services in smart cities [Giordano A, 2016]. Kim et. al.[O. T. T. Kim, 2015] presented the use of fog and cloud computing for solving the parking problem. The proposed model by the author relieve traffic congestion, reduce air pollution, and enhance the driving experience. Up to know our best knowledge, we are the first to propose a fog computing model for providing emergency help during road accidents.

Figure 1: Proposed Architecture

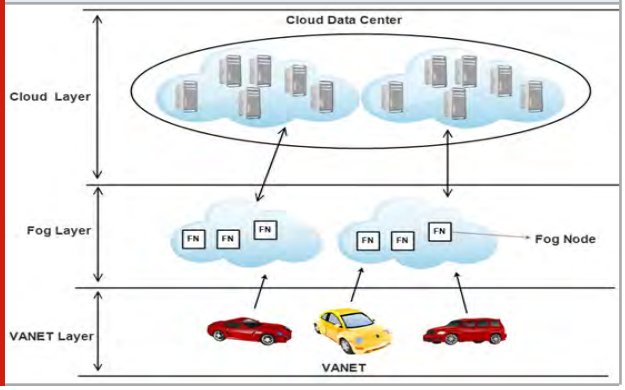
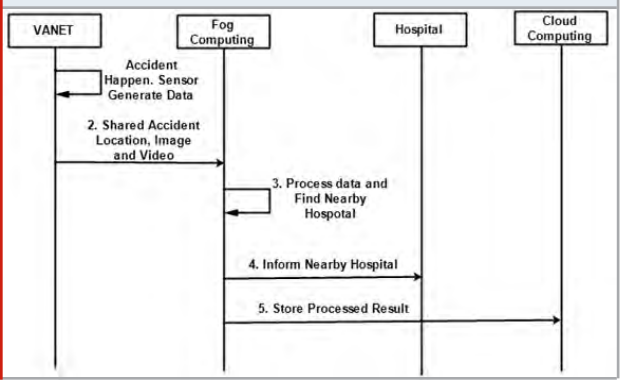


Figure 2: Sequence Diagram of Proposed Model



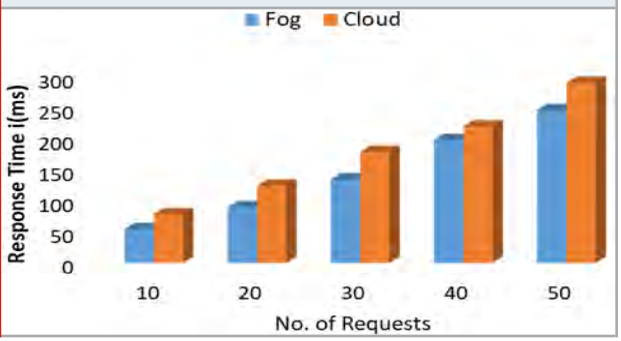
Proposed Architecture: Proposed architecture is shown in Figure 1. It consist of three layers viz. VANET layer, fog layer and cloud computing layer. Sequence diagram for proposed model shown in Figure 2.

- Layer 1 (VANET): This layer consist of Vehicular Adhoc Network (VANET) which are connected to internet. It consist of sensor and they get activated during accident. These sensor share accident location, images and video to fog computing.
- Layer 2 (Fog Computing): This layer contains fog nodes for computation. Data send from VANET has been processed in this layer and it find nearby hospital as well as contact for emergency care. If required, it also send to cloud computing for storage.
- Layer 3 (Cloud Computing): This layer contains data server for permanent storage of data. Data pass from fog layer has been stored in this layer permanently.

Table 1. Simulation Parameters

Model	Intel PC
Processor	2.00 GHz Intel(R) Core(TM) i3-5005U
Operating System	Windows 10
RAM	4 GB
Number of Nodes	10
Task Arrival	Poisson Distribution
RAM	512 MB
MIPS	1000
Simulation start at	10 request
Simulation end at	50 request

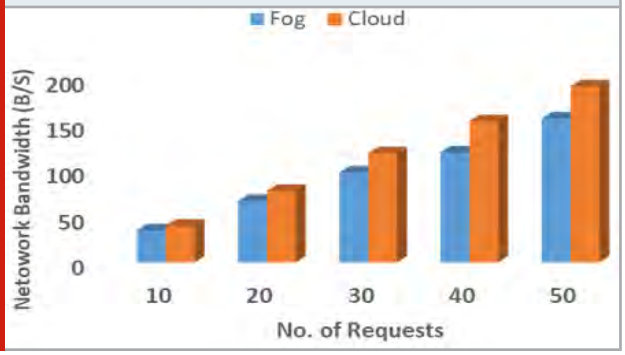
Figure 3: Response Time Comparison



SIMULATION RESULTS

The proposed model is implemented in iFogSim Simulator which is configured on Intel Machine. Simulation consist of ten computing node for fog and cloud environment. The number of requests are varied from 10 to 50 in the interval of 10. Table I shows simulation parameters.

Figure 4: Bandwidth Comparison



Response Time Comparison: Here request are processed in fog and cloud environment and from Figure 3, it is observed that that fog computing provides quick response for processing of request as compared to cloud computing. Bandwidth Comparison: We have compared the network bandwidth required for the processing of requests in fog and cloud environments. With the increase in the number of requests, network bandwidth also increases. In figure 4, the x-axis represents the number of requests and the y-axis represents bandwidth. From simulation results, it is observed that less bandwidth is required for processing requests in fog computing as compared to cloud computing.

CONCLUSION

Immediate help is required during an accident and latency is not desirable. All VANET are connected to the internet and contain sensors that share accident location and other information to the fog layer. The fog layer performs data processing and find nearby emergency hospital. The proposed model has been compared with the cloud computing model and simulation results show that the proposed model outperforms the cloud computing model in terms of response time and network bandwidth.

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Multimodal Biometric Using Fusion of Fingerprint, Finger Knuckle Print and Palm Print

Shubhangi Neware
Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur (M.S.), India

ABSTRACT

Human recognition based on combination of various biometric traits is useful for considerably improving the performance accuracy. This paper is presenting different hand biometric traits used to identify a person. The objective of this paper is to propose multimodal biometric system using multiple biometric traits such as finger print, finger knuckle print (FKP) and palm print. The Convolution Neural Network and Softmax classifier is proposed to generate score of each modality separately and then fusion at decision level can be done. If final score is less than threshold value then person identity will be rejected. Fusion of different modalities at decision level will improve the performance of person identification system. Performance analysis is given for decision level fusion used with different modalities.

KEY WORDS: FINGER PRINT, FINGER KNUCKLE PRINT (FKP), PALM PRINT, CONVOLUTION NEURAL NETWORK (CNN), SOFTMAX.

INTRODUCTION

Use of credentials in various applications may leads to forgery. On the other hand biometric traits such as fingerprint, palm print, face and iris would not be theft, copied or lost. As a result adoption of biometrics technology is increasing rapidly in different areas. In India government has been started national identification scheme called "Aadhaar" card and it is the voluminous biometric database in the entire globe. Biometrics in reference to biological science has been studied since the early twentieth century. But now the meaning of word biometrics has been broadened to include the learning of methods for distinctly identifying or recognizing a person depending upon his/her one or more physiological or behavioral properties/traits.

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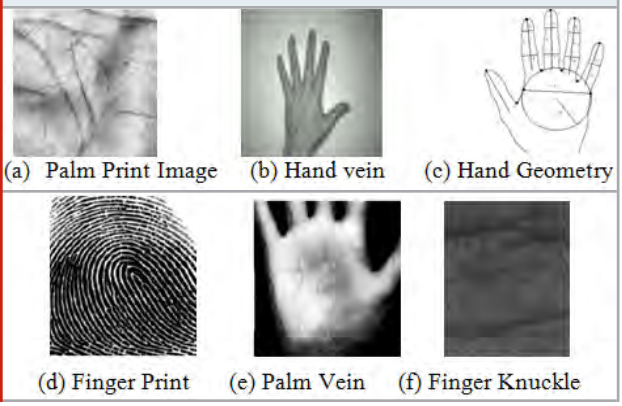
Biometrics is the science and technology used to analyze and measure biological data of human being. Biometrics is the most accurate form of identifiers and it can greatly simplify life if used properly. Biometric systems recognize user depending on their physiological and behavioral properties/traits. Hand based biometrics is physiological biometric system. In this human hand can be used as traits to identify person. Different technologies comes under hand based biometrics is recognition of person using hand geometry, hand vein, palm, palm vein, finger print, finger geometry, knuckle print etc. Researchers are using different hand traits to identify a person. This paper is proposing an idea to use multiple modality of hand to recognize a person.

Palm print: Latent palm print identification is of growing significance in forensic applications. The palms of the person include extraordinary pattern of major lines, wrinkles and minor lines. The palm print of a person is estimated more reliable than fingerprint as it covers larger area as compared to fingerprint.

Hand vein: The blood vessels or veins unseen underside of the skin is different in persons and also steady over long period of time. A vein is responsible for flow of blood from one body part to another body part. The vascular

pattern is spread throughout the body which functions to supply blood in our body parts. The veins that are there in hands are simple to acquire by using infrared lighting and then that can be used for the biometric recognition or verification process.

Figure 1: Multiple Hand Traits



Hand Geometry: This involves the comparisons between size of fingers, position of finger joints, contour and dimension of palm. Person identification using this hand statistics use hand images to extract a number of geometrical features such as length and broadness of fingers.

Fingerprint: Fingerprint based recognition system is more accepted and successful system for person identification. It has been used for many centuries. Fingerprint consists of a texture outline of ridges positioned on tip of each finger. Landmark point on ridges is called as minutiae. It is in the appearance of ridge endings and ridge bifurcations. These minutiae point is claimed to be exceptional for each fingerprint. In fingerprint matching process comparison of 2-D minutiae patterns obtained from an individual's finger with minutiae patterns saved in the database and used for further processing.

Palm vein: Palm vein verification uses the vascular patterns formed on human palm as a biometric data for personal identification. Compared with reverse side of hand palm has broad and complicated vascular pattern which is supportive to distinguish among individuals.

Finger Knuckle Print: Texture surface pattern formed by the finger knuckle winding (knuckle joint) is called as Finger Knuckle Print (FKP). FKP can be extracted from back side of finger surface as well as inside of finger surface. FKP is extremely exclusive and make the FKP as a unique biometric modality.

Literature Review: Related to the data utilized for human recognition, earlier hand based technologies classified into palm technology, hand vein, hand geometry and hand shape technology. Many of the researchers utilized palm print for individual identification. Guagming Lu, D Zhang, K Wang has been worked on palmprint recognition using mathematical based approach. By using K–L transform, they changed the original palmprint images into a small set of feature space. That are called ''eigenpalms''. The principal components i.e. significant information of the palmprints can be represented by the eigenpalms. Training set consists of eignpalms stored in the form of eigen vectors. By projecting a test palmprint image into the subspace spanned by the ''eigenpalms''.

Then palmprint recognition can be done using Euclidean distance classifier . Zhang D., W Kong presented an approach for online palmprint identification. A strong image coordinate system is defined by them to smooth the progress of image positioning for feature extraction. In addition to this they proposed a 2D Gabor phase encoding scheme for palmprint feature extraction and illustration. Connie et al developed Palmprint recognition using and ICA (Independent Component Analysis) and PCA (Principal Component Analysis) . By Anil K. Jain, Feng proposed similarity of Palmprint using minutiae features. Doublet, J., Lepetit O., Revenu employed touch less hand identification by texture and shape features by combining information from color and texture.

Michael Goh Kah Ong proposed touch less palmprint biometrics using local binary pattern(LBP) texture descriptor on the palm print directional gradient responses. A Morales, M Ferrer, F Díaz, J mAlonso, C. Travieso given a touch less biometric recognition system based on human hand geometrical featutres. R Kozik, M Chora collectively taken Shape and Texture Information for Palmprint Biometrics. Finger knuckle print is identified as a new hand based biometric identifier. A Kumar and Ravikanth (2009) proposed a novel approach for human verification using finger knuckle image. Author uses texture pattern formed by the finger knuckle bending for recognition as it is extremely distinct. They employ subspace methods such as Independent Component Analysis LDA. Finger geometry features are also extracted from the same image at the same time and integrated to improve the user-identification performance. Y Zhou (2009) examines a new method for efficient individual identification using KnuckleCodes.

After preprocessing knuckle images are used to generate KnuckleCodes using Localized Radon Transform. LRT can efficiently distinguish random curved lines and creases. The similarity between two KnuckleCodes is computed from the least matching distance. A Nigam and P Gupta (2011) offered a promising FKP based identification scheme by combining Scale Invariant Feature Transform and Speeded up Robust Features. Matching Scores are then generated using fusion. The subsequent features of the enrolled Finger Knuckle Print and the test Finger Knuckle Print are matched by means of nearest neighbor ratio method and then the resultant SIFT and SURF matching scores are combined using weighted sum rule method. Vishi K, Mavroeidis V employed a fusion of fingerprint and finger-vein for person recognition by combining score of min-max, z-score, and hyperbolic tangent.

Proposed Methodology: Proposed methodology is utilizing three different modalities that are finger print,

finger knuckle print and palm print to identify a person. In this paper Convolution Neural Network and Softmax classification technique is proposed. Three scores will be generated by three Softmax classifiers for three modalities: fingerprint, finger knuckle print and palm print. This fusion at decision level is proposed to generate final score. When final score is larger than threshold (theta) value then person will be accepted otherwise person will be rejected. All three biometric systems first will produce their score and then decision Level fusion will take place. The decision yes or no is converted into bit representation (1-match/0-not-match). The AND-OR fusion criteria then use for outputting the last result for this biometric system working with multiple modalities. As compared to feature level fusion, combining result at decision level is less complex. Here threshold will be determined by experiment.

Figure 2: Work Flow Diagram for Multimodal Hand Based Biometrics

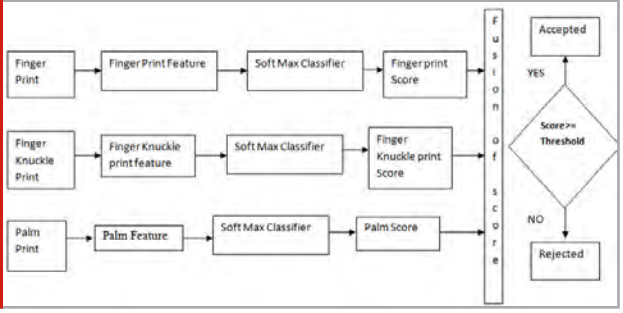
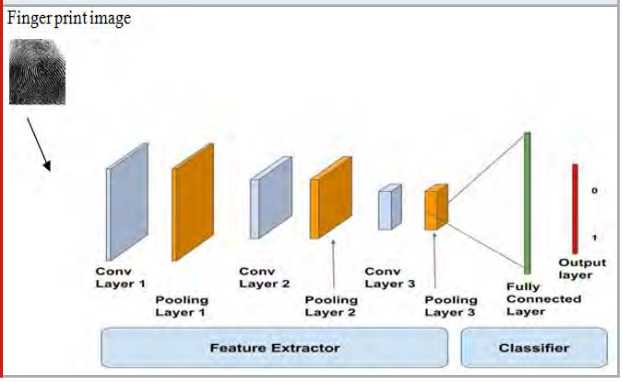


Figure 3: Working of CNN for finger print image



Convolution Neural Network: Every input image (finger print, finger knuckle and palm print) will go through a sequence of convolution layers. These layers consisting of filters called Kernals, Pooling layer and fully connected layers (FC). The function used is softmax function which categorize finger print, finger knuckle and palm print with probabilistic values in range zero to one. The figures 3 showing entire work flow of Convolution Neural Network to process an input finger print image and classifies the finger print based on values. The Softmax function which is a normalized exponential function is then used.

An input a vector z of K real numbers is input to softmax function. This function then normalized it into a probability distribution comprising of K probabilities. These are relatively proportional to the exponentials of the input numbers. Before giving input to softmax few vector elements could be negative or greater than one. But after applying softmax function the value will be normalized and every element in vector will within range (0 – 1) . The elements will add up to 1, so that they can be represented as probabilities. Here the greater input elements will associate with larger probabilities. Below is an expression for defining the typical (unit) softmax function:

$$\sigma(\mathbf{z})_i = \frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}} \text{ for } i = 1, \ldots, K \text{ and } \mathbf{z} = (z_1, \ldots, z_K) \in \mathbb{R}^K$$

Table 1

Modality with Fusion	Accuracy (%)	Method (score level fusion)
face and finger vein	95	Weighted Fuzzy method
speech and face	99.91	Finite Gaussian mixture model (GMM) based Expectation Maximization (EM) estimated algorithm
fingerprint and finger vein	98.7	Min-max normalization used for normalization.
Iris and finger print	94.1	The iGRVM classifier.
Finger print, FKP, Palm print [Proposed work]	97	CNN, softmax

RESULTS

As shown in Table I the performance analysis of various method using decision level fusion is recorded for multimodal biometric system. For combining results of two or more modalities, integration of scores is used at decision level by applying different fusion method. The accuracy of system is also improved using fusion technique of multiple modalities. Related work and their performance analysis using different type of fusion method are shown in Table1.

CONCLUSION

In this paper various hand based traits that may be used to identify a person is introduced. Proposed work flow is given for designing of multimodal system using finger print, FKP and palm print. A multimodal system for person identification using CNN models is proposed. Decision level fusion is proposed to integrate score of these three modalities to achieve high performance. In future fusion of features can be applied to improve the performance of this multimodal system.

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Effective E-Challan Generation and Management System for RTO

Praful R. Pardhi[1*], Pravinkumar M. Sonsare[2] and Aditya Jain[3]

[1,2]Department of Computer Science and Engineering, Shri Ramedobaba College of Engineering & Management, Nagpur, India

[3]PG Scholar, Computer Science, IIT, Bombay, India

ABSTRACT

With increasing incidents, the need for monitoring the roads to avoid mishaps is also increasing. Thus, today we see police officers keeping a strict vigilance and compelling the citizens to follow the rules by imposing a fine or challan. But in this system, there is a delay in the processing of challan due to which the citizens tend to continue with their recklessness. Thus, there is a need to make this challan system more effective and ease the job of the police officials. This can be achieved through an android application which aids instant payment of challan. Existing RTO Office work is very complex, time-consuming & having real-life problems such as if an individual needs to pay the challan, every time he/she needs to visit the RTO. This takes a lot of time. And nowadays each and every person is in hurry so by analyzing and considering these problems we developed a mobile application which overcomes this problem and gets a solution in an efficient way.

KEY WORDS: RTO, FIREBASE, E-CHALLAN, E-SEVA ETC.

INTRODUCTION

e-Challan is an electronic format of the challan, a term generally used in India and Pakistan as a receipt for payment or delivery. An e-Challan can also be defined as a specific format used for depositing or remitting the contribution or statutory payment at a bank or treasury. A challan is a way of crediting the money to one's bank account through a form. An example of a challan would be a spot traffic ticket issued by the traffic police for a violation of traffic rules. This challan would then have to be paid directly by cash, at an e-Seva center, or by any other payment mode as specified on the challan.

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This system is helpful for Traffic police also as it helps traffic police to be more effective in controlling repeat violators of traffic rules. Traffic Police have the database of registration numbers as well as the history of driving license holders. When a traffic policeman would enter the details of any vehicle caught violating traffic rules, it would give the complete details of that particular vehicle including the name and address of the owner and the make, model, and other details of the vehicle. Not only this, but the details of the driving license holder would also be available. Therefore enhanced penalties would be imposed for the repetition of violation of traffic rules. Fake registration plates, if any, would be detected immediately.

Objectives

The proposed application aims

- To take input as a picture or as the vehicle number for which the challan will be generated.
- To send a text message and a notification regarding the payment of challan.
- To aid the driver to pay the challan through online payment.
- To ease identification and notification in case of

accidents.
- To trace the missing vehicle.
- To create an enhanced web application to be used in place of old system.
- To Provide easiest and efficient way to handle the hassles work of RTO.
- To ensure transparency in the day-to-day management and administration of the officials in RTO department.

Systems/Technologies used
- Application development: Android Studio, Java & XML
- Database Management: SQL, SQLite & Firebase Real-time Database.
- Location based services: Google Maps API services.

Propose Approach: Proposed approach designed a mobile application with an interactive user interface, designed and setup the database connectivity using SQLite & Firebase real-time database, implement Location Based Services to get the location at real-time and testing of application with all aspects. Implementation requires:

- Connection with online database:
- Uploading important documents.
- Login Page Functionality.
- Dynamic fetching of location.
- Online payment of challan.

Methodologies: The complete work is divided into three categories of users which are Admin (RTO), Traffic police, and the general public. The various situations in which the app can be helpful are:
- Generating Challan
- Notifications in case of accidents

Generating Challan: In this situation, the police officer will have access to click the image of a person caught without the helmet and will have to enter the vehicle number. After entering the number, the police will get complete information of the user which includes his account of previously paid challan. The police can then generate a new challan which will get added to the RTO database. The RTO will then have to update the current profile of the user and will have to notify the user. After getting notified, the user will have two options to pay the challan:
1. Online payment using the app
2. Pay at RTO

Once the payment is successful, the user's profile will get updated by the RTO and will receive the confirmation message. In case, the user is not done with the payment, the user will constantly get notified in specified duration.

Notification in case of accidents: At the time of registration, the user will have to provide 3-5 contact numbers that he would like to get notified in case of emergency. If a person is met with an accident, the witness will be able to notify the person the victim has registered. The app will be provided with a feature using which, the witness will have to enter the victim's vehicle number. On entering the number, the list of the registered contacts will get displayed, which will then get notified about the incident along with the location of the mishap. The notified person can then contact the witness to get information about the incident and further updates.

Three main Modules of an application are:
1. User
2. Police
3. RTO (Database)

Figure 1: Use-case diagram for Challan management System

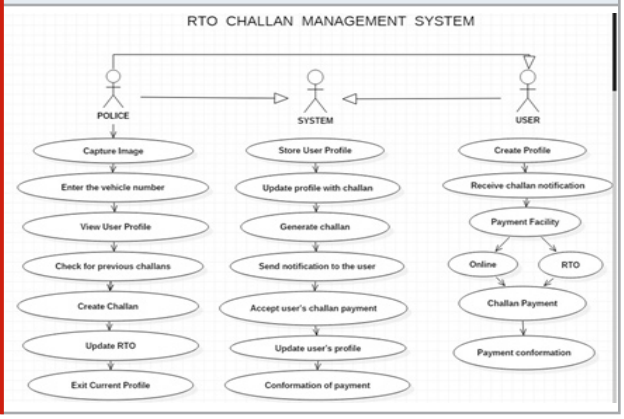
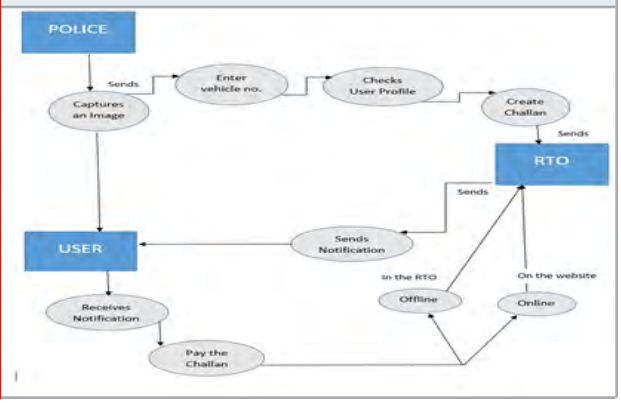


Figure 2: Dataflow Diagram of Online Challan Generartion & Mangement System.



User Domain: The User Domain is for the general public who will be given a unique password by the RTO while registering. Through this account, the user will be able to perform the following functions
- Online payment of challan
- Viewing challan details (paid or unpaid)
- Reporting accident
- Editing profile
- Uploading documents (such as Driving license, Aadhar card, PAN card etc.)

Functionalities available for user: The above mentioned are some important functions that the user (i.e. general

public) of the application can perform. Once the user logs in in his/her account, he will be directed to the home page which will display the username and his vehicle number. The user will also need to verify the OTP first time through the email ID. As you can see it has three main functions. Let's take a broader look at each functionality.

Challan Details: On pressing the Challan details button on the home screen the user will be able to view the history of challan payments till date and also the challan to be paid. The challan details for a paid challan will consist of the date of generation of challan, date of payment, amount, and the location where the rule-breaker was fined.

Online Challan Payment: Through this feature users are allowed to do the online payment for the challan through the e-payment services which minimize the physical as well as time-overhead of the user.

Report Accidents: In case an accident takes place in front of a user then he can report the accident by logging into his account and selecting the report accident button. On hitting the button, the user will be asked to enter the vehicle number of the victim. On hitting the search button, the profile of the victim will be displayed along with three contacts of his relatives. On hitting the send notification button, the message of the mishap will be sent to the three contacts along with the location of the accident.

In this manner the victim will get immediate medical aid through their relatives. In addition to these three major features there are some more features which include editing of the profile, adding emergency contacts, and uploading documents such as Aadhar card, driving license, and vehicle registration documents.

Police Domain: Police domain act as the intermediate between the User and the RTO. The main role of the police domain is to generate challan. Police will be able to generate the challan of the user in case if any user breaks the rule. The police application helps to generate instant challan which eases the work of the traffic police. Features included in this module are.

- View details of a rule breaker
- Generate challan instantly
- Verify the documents of the user
- Gets notified time to time from the RTO
- To inform the victim's relative in case of any accidental issues

How Police domain works: The traffic police will initially get an email id and password from the RTO. Through this mail id and password, the police will be able to login to his own application module. This is nothing but giving security to the application so that no one else other than traffic police will be allowed to login to the system. As soon as he logs in into the system he will be able to capture the image and generate the challan.

How Challan Is Generated By Traffic Police: As soon as the rule breaker is caught by the traffic police officer, he will need to enter the vehicle number into the application and capture a photograph of the number plate which will act as a proof that the vehicle was actually caught by the police. As soon as he proceeds further the challan gets generated for the respective vehicle number entered. The challan generated by the police gets updated to the RTO instantly. The user will also get notified about challan which is generated by the police.

Other Functionality of Police Domain: The police have additional functionality i.e. he can inform about any accidental issue occurred nearby. He just has to enter the victim's vehicle number in the required field and press enter. The registered mobile numbers of the victim will be displayed and the message will be sent to all the numbers. The other functionality of the police is that he can view the documents of the user. Through this, the police can warn the user about the pending challan (if any) while generating a new challan. This will generate awareness among the public that they have to pay the pending challan also (in case if the user forgets to pay any challan). The police will also, be able to check whether the user has valid documents or not. When any user is being caught by the police officer, he will be able to check that the user has the valid documentation of the vehicle or not.

RTO (Database): The RTO system is nothing but the database which is handled by the RTO office. The RTO office maintains a database that consists of all the information about the vehicles being purchased and being registered. The RTO maintains the database in a real-time manner so that instant challan's can be generated and notified. Various features included in this module are.

- Managing the database
- Save data in real time manner
- Provide details to the traffic police as and when needed
- Provide emergency contacts of the victim to the traffic police
- Provide necessary notification to the traffic police
- RTO keeps record of the registered vehicles
- Update the user domain as per the challan paid or not

How the RTO System Process: The RTO system simply maintains the database which consists of all the information of the registered vehicle. The RTO gets updated in a real-time environment and also provides the necessary information to the traffic police whenever required. As soon as the request comes from the police domain the RTO system processes it and provides the required information. The RTO system (database) consists of the emergency contacts feed into it. The emergency contacts are provided by the user while registration of the vehicle at the RTO. At the very early stage, the contacts

are stored in the database which is useful when any of the emergency cases occurs.

In emergency case (i.e. accident) when the police or any user enter the victim's vehicle number in their respective application then the request is directly sent to the RTO system to fetch the data and provide the contact number. The RTO verifies the vehicle number and provides the contact number to the police or user. If the number is not found in the database then no further information is provided by the RTO. The RTO helps in maintaining the record of the registered user.

Firebase Real-time Database: Store and sync information with our NoSQL cloud information base. Information is matched up over all customers in real-time and stays accessible when your application goes disconnected The Firebase Real-time Database is a cloud-facilitated information base. Information is put away as JSON and synchronized in real-time to each connected client. At the point when you assemble cross- platform applications with our iOS, Android, JavaScript, and SDKs, the entirety of your clients share one real-time Database occurrence and naturally get refreshes with the most current information. After each violation, the profile of the defaulter will be created. In case a person cannot pay the fine on the spot, he can pay it online by logging on to the website. The challan receipt issued will have a unique identification number. Entering this number will take the defaulter to his profile which will have a history of violations by him.

RESULTS

Proposed work has resulted in a working application that will help the Police Department, the citizens, and the RTO to conjointly contribute in making our city safe. It is a fully functional application that will allow the citizens to upload their documents such as Aadhar card, driving license, etc, approved by the RTO. The Challan payment will be strictly monitored through the app thereby making the system more meticulous. In case of an accident, the victim will be provided with immediate help by reaching their near and dear ones within minutes which could give him/her a new life.

CONCLUSION & SCOPE

RTO Challan Management System is a mobile-based application, which is very useful for RTO works completely online. Here we have developed the modules which help to reduce the RTO work manually and it helps to save the time of the user. Considerably reduce corruption in the transport department. Very useful for the completion of RTO work online. Our system helps R.T.O Officers to perform their functions electronically. It will also help the R.T.O officials to maintain records systematically and reduces a lot of paperwork and manual efforts. We also identified some general requirements of such a system and tried to meet those requirements as much as possible in the design and implementation of our system. Traffic policemen can easily generate challans and update it instantly in the RTO database system.

In the future, as per the user's requirement, the work can be extended and it provides a better way of document verification for R.T.O officials. Our system is an integration of several systems that in the present act as a separate system. It will also reduce a lot of clerical works and provides better accountability. We can also add a provision to track a stolen vehicle in the future systems either through verification or through GPS tracking. This system is also helpful for Traffic police also. The traffic police to be more effective in controlling repeat violators of traffic rules. Therefore enhanced penalties would be imposed for the repetition of violation of traffic rules. Fake registration plates, if any, would be detected immediately.

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Furniture Positioning Using Augmented Reality

Abhijeet R. Raipurkar[1], Manoj B. Chandak[2] and Anshit Raika[3]
[1,2] *Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur*
[3]*Amazon India, Chennai*

ABSTRACT

Buying furniture has been a daunting task for every family. Checklist associated with buying furniture is a long one and matching of the furniture item in their house is a very important aspect. The customers have a hard task in imagining the matching of the furniture item in their house. Here the concept of Augmented Reality comes to the aid of customers. With the help of augmented reality the customer can actually view how the furniture will be look at their house and based on that make intelligent purchase. This application will be beneficial to the furniture sellers as they will be able to market their products in a better and more efficient way. Thus the sellers will be able to provide better service to customers and grow their business. Intended to build a UNITY3d model based android application that will help customers visualize the furniture item set at their place. A sample booklet for the furniture will be provided to the customers by the seller. This booklet will have all the images of furniture item sets and customer can scan this and view the 3d model of the items at their home and can check which item suits them most. The use of Vuforia is very important along with the unity 3d as Vuforia stores the marker images which will be used as the marker for projecting the 3d model of the furniture item sets.

KEY WORDS: AUGMENTED REALITY, VUFORIA , UNITY 3D, MARKERS.

INTRODUCTION

Furniture industry is growing at a fast pace. But the main problem that customers faces is that they find difficult to imagine how the item will match & fit in their home. Also the sellers have a problem in making the customers understand which furniture item will be best for them. Thus our augmented reality based application solves this problem of customers about the furniture items and positioning of furniture items at there home. The main objective of the project is to develop user friendly mobile application which can project 3D model of furniture items.

Problem Definition: To design a prototype system that is intended to aid the people by providing an android application to see how the room will look with new furniture without actually buying or moving real furniture while simulating an arrangement of furniture.

Use of Application: This application has a wide area of implementation. Each seller can have his own application customized as per his needs and set of furniture items available with him. There is also scope for advertisement videos for the seller based on the marker. This application can be made available for Android as well as iOS users. It will replace the traditional ways of imagining the fit of the furniture item by the customer. It will help customer make better choices in selection of furniture items and help the sellers expand their business. It will also solve the issue of positioning of furniture at customers home

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or office in case of large number of furniture items and aid them in quick decision making which will save time as well as cost.

Literature Survey

Augmented Reality: Augmented reality (AR) can be seen as a technology where the objects in the real world are enhanced by computer-generated mathematical knowledge, sometimes in many emotional senses, including visual, tangible, abstract, visual and virtual reality. A key feature of augmented reality is the approach that integrates parts of the digital world into the real-world individual's perception. It is not only the general presentation of data, but also the consolidation of captivating sensations that appear to be natural components of the surroundings.

Challenges In Augmented Reality

Hardware Issues: Most of the increased reality headsets are huge and very expensive for the people. Adding to this, most of the available headsets that support AR need to be connected to a computer thus hampering the entire experience and making it confined and bounded. On the other hand, the end users can use their smartphone or tablet for AR related applications. However, one of the problems with smartphones is that the scenes are not displayed properly. Mobile sensors such as accelerometers can be interrupted by electrical interference, which is often seen in urban areas. Majority of the available smartphones or tablets are made to capture the two dimensional images and are not able to give three dimensional images. Making a note of the above mentioned problems, the hardware that is needed for technologies like AR needs some expansion before moving towards mass adoption.

Limited Content: Creating dynamic content and engaging it as per the requirements is one of the challenges for augmented reality. Strainers & some recreational games used in social networking sites such as "Snapchat" and "Instagram" are one of the major contents for AR devices. AR can also be used for promoting businesses but it can be extremely complicated and expensive. The developers of the technology like augmented reality should go for some high-functionality use cases so that AR can be a useful technology for end-users on diurnal

METHODOLOGY

Th methodology includes the procedure for implementation of the project and a brief explanation of why it will be useful for implementing the proposed system. This module will show the usage of Vuforia and Unity3d for linking the 3d models to their respective markers.

The system frame diagram displays the flow chart on the entire process that is required for implementing the augmented reality application.

- **Vuforia database creation:** Images of items that will act as marker for the 3D models of furniture items will be stored. A key is generated which is to be entered in unity3D in order to link it with Vuforia database.
- **3D Model creations:** In this step, the 3D model will be created for respective furniture items using Blender tool. The 3D models for the .fbx format will be stored under the projects folder in unity3D.
- **Assigning target image to the 3D Models:** A target image will be assigned to the 3D models. Application will scan the markers from the image and project the 3D model.
- **C# scripts for Rotation and scaling:** The user should be able to move scale and rotate the 3D model generated as per their requirements. C# scripts are written so that the user can scale rotate and move the 3D model by his fingers.
- **Building environment and deploying the APK:** Adding of the SDK and the JDK path of the system to the Unity 3D software. The Unity 3D software uses these paths in order to build the APK file of the application, since the entire android application is java based and thus it required the specifications of the path of SDK and JDK.

Figure 1: System Frame Diagram

System Implementation Methodology

Unity 3d: Unity is a multi-platform, integrated IDE for scripting games, and working with 3D virtual worlds including:

- Game Engine
- 3D terrain editor
- 3D object animation manager
- GUI System

Unity gives users the ability to create games and experiences in both 2D and 3D, and the engine offers a primary scripting API in C#. Prior to C# being the primary programming language used for the engine, it previously supported Boo, which was removed with the release of Unity 5 and a version of JavaScript called Unity-Script, which was deprecated in August 2017, after the release of Unity 2017.1, in favour of C#. Within 2D

applications, Unity allows importation of sprites and an advanced 2D world renderer. For 3D applications, Unity allows specification of texture compression and resolution settings for each platform that the game engine supports, and provides support for bump mapping, reflection mapping, parallax mapping, screen space ambient occlusion (SSAO), dynamic shadows using shadow maps, render-to-texture and full-screen post-processing effects.

Vuforia: Since augmented reality is used for developing many applications, thus there is a need of a software development kit for AR. This software development kit used for AR is called Vuforia. Vuforia enables the creation and development of applications by using computer vision technology to trace, track locate and identify three dimensional targets in real time. This allows the developers to potentially place the three dimensional object over the planer two dimensional objects which is being viewed by the camera of the smartphone or any other gadget used for the AR application. The three dimensional object that is been viewed on the gadget's screen is adjusted with the location and co-ordinates of the real time image which makes the observer feel that the three dimensional object is a part of the world outside the screen of the gadget. The Vuforia SDK supports the marker system. In the marker system it treats the corners of the two dimensional image as the markers and then uses this markers to place the three dimensional object. This marker system helps to improve the blending of the 3D model with the real world. These markers are often called as "VuMark". Some of the major uses of this SDK are listed as:

- Used for storing the images in Vuforia db. These images will be used as marker for 3d object visualization.
- Vuforia database is linked with Unity3d via a license key generated in Vuforia. This key is to be entered into the unity3d to link the database and its images with unity.
- Using Vuforia database to store the 2d images of the furniture.
- Create a new project on Vuforia and generate a license key that will be placed in the unity software.

Android SDK: The Android Software Development kit commonly referred as SDK consists of comprehensive development tools. These include a debugger, libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials. Currently supported development platforms include computers running Linux (any modern desktop Linux distribution), Mac OS X 10.5.8 or later, and Windows 7 or later. As of March 2015, the SDK is not available on Android itself, but software development is possible by using specialized Android applications. The Android Software Development Kit (Android SDK) contains the necessary tools to create, compile and package Android applications. Most of these tools are command line based. The primary way to develop Android applications is based on the Java programming language. The Android SDK Platform Tools are a separately downloadable subset of the full SDK, consisting of command-line tools such as adb and fast boot. The Android Debug Bridge (adb) is a tool to run commands on a connected Android device.

Steps to get an android SDK:-

- Obtain the Android SDK.
- Install the Android SDK.
- Open Android SDK Manager.
- Install Android Version and Extras for SDK.
- Obtain Eclipse IDE.
- Run Eclipse for First Time.
- Add ADT Plugin Repository.
- Install ADT Plugin.

Implementation: The marker was image of the sofa that was uploaded in the database of Vuforia which was kept aligned on the wall, when scanned with the application camera gave this 3D model. In the next step, table marker was added along with the sofa marker.

Figure 2: AR projection of the marker sofa

Figure 3: AR projection of table and sofa

Assumptions of the system

- Initially the application will be made available for limited set of furniture items.
- Each seller will have to provide list of available item set in his shop.
- 3D models for newly arrived furniture items could not be dynamically added.
- The new-users can face difficulty in adjusting the positions of projected 3d models
- The user will have to carry a booklet containing images of items.
- The user cannot get the measurements about the furniture item that fits at their place.

- Mobile camera should be good enough to identify the markers form the image.
- There is a problem with respect to rotation of the 3D object .
- The content is a real problem in Augmented Reality applications; the content is limited and needs to be updated very often.

CONCLUSION AND FUTURE SCOPE

The application was used to visualize the furniture as a marker and can be used to give the predictions about the real time world coordinates where the object should be placed. It will be possible for the sellers to provide a better service to the customers and grow up their business. The unity 3d can be used to know the product and visualize the product in a better and efficient way, thus helping to learn more about the product. It will solve the real life problems faced by the customers at the time of buying the furniture items by allowing the customer to visualize the 3d model of the furniture item set which will help customers to make better choice. The application can be used by the seller to advertise their products by playing the promotional video for their shop on scanning the logo of their shop. The application as of now supports android users only. But the Unity3d supports both Android and the iOS so the application can be built for the iOS users also, thus expanding the user base. The application can be expanded to other domains like the educational, medical fields, for other item sets for which it is not possible for customers to carry the items for visualizing.

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Change Detection and Extraction of Information in Remote Sensing Images Using Time Series Information

Aarti Karandikar[1*], Abhishek Sambhare[2], Niladri Sen[3], Aditya Kakde[4], Saket Gulhane[5], and Saurabh Thakre[6]

[*1,2,3,4,5,6]*Shri Ramdeobaba College of Engineering and Management Nagpur India*

ABSTRACT

Over the years, change detection(CD) has been garnering a lot of attention due to its applications in remote sensing to detect changes in multitemporal satellite imagery. High-resolution images are taken using satellites which provides multispectral as well as hyperspectral image data. Using change detection techniques, various changes occurring over time in these images in different scenarios can be detected, which in turn, help to track changes in vegetation cover, geology, urban development, etc. Various CD techniques have been discovered over the years. In this study, the authors present a novel idea to use Principal Component Analysis (PCA) and k-means clustering to detect and visualize changes occurring over a certain time period using multitemporal satellite images. Our methodology depicts how a satellite image with a really high resolution can be used in change detection by first reducing the dimensions using the PCA algorithm and then further using its features to segregate the points into various classes.

KEY WORDS: CHANGE DETECTION, PRINCIPAL COMPONENT ANALYSIS, REMOTE SENSING, MULTITEMPORAL AND BINARYMAP.

INTRODUCTION

One of the interesting application of image processing is to detect changes in images acquired over a period of time of a particular region. To detect changes in surface features of a region, the algorithm is feed with multiple images of the same target. These images can be single-phase or multi-band remote sensing images. Satellite imagery is prominently used to monitor urban expansion and land use land cover changes at a medium or large scale. This aids in better observation and understanding of the evolution of urbanization and helps in advancing the sustainable development process. The main objective of change detection is to identify the changes in the spatial representation of any point by observing it at different times.

Typically used change detection methods are either to utilize post-classification analysis or use difference image analysis. The post-classification method first classifies the contents of two temporally different images of the same scene and then compares them to identify the differences. One may get inaccurate results due to classification errors in either of the two images. To combat this, a high degree of accuracy is required of the classification. This study is using the concept of image segmentation. It basically divides a given input image into segments which simplifies the image analysis process. The segments comprise of sets of pixels or "super-pixels" and represent objects or parts of objects.

Segmentation simplifies / changes the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is normally used to locate objects and boundaries, i.elines, curves, etc.,

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in images. More specifically, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain distinct characteristics. It groups pixels into larger components and thus eliminate the need to consider individual pixel as units of observation. The two types of image segmentation are Semantic Segmentation and Image Segmentation. In this paper semantic segmentation is used. Semantic Segmentation is performed on remote sensing images using U-Net architecture. It is based upon semantic segmentation. It is symmetric and skips connection between upsamplingpath and downsamplingpathand applies concentrator operator instead of sum operator. It is divided into 3 parts - downsampling path, bottleneck, and the upsampling path.

MATERIAL AND METHODS

The workflow is distributed across 2 phases: in the first phase all the changes are detected and a binary map is created to better visualize the changes; and in the second phase highly trained models are used to classify the changes into different types of objects/classes. Using these features, it can be detected what places, objects, geometries, etc are either added or removed. The dataset was downloaded from Amazon Web Services (AWS) Public Dataset which is publicly available containing commercial satellite imagery. The satellite imagery is provided by Digital Globe, a vendor of space imagery and geospatial content. Raster data in the SpaceNet dataset is present in the form of .tif (GeoTiff) images. These GeoTiff images are made using multispectral image data. SpaceNet dataset provides:

- MS: Raw source GeoTIFF of 8 Band Multispectral raster data from WorldView-3.
- PS-MS: Raw source GeoTIFF and COGs of 8 Band Multispectral raster data pan-sharpened to 0.3 m.
- PAN: Raw source GeoTIFF of Panchromatic raster data from Worldview-3.
- PS-RGB: Raw source GeoTIFF of RGB raster data from Worldview-3 pan-sharpened to 0.3 m.
- Metadata (GeoJson files).
- The geotiff images for Vegas, Paris, Khartoum, etc locations were selected to experiment with.

Phase 1: In this Phase PCA algorithm is implemented for change detection on multitemporal remote sensing images. We have implemented principal component analysis (PCA) for dimension reduction. PCA takes less time to implement and provides better accuracy. Block structure is used of the correlation matrix so that the PCA is conducted on data of smaller dimensionality, which significantly reduces the computational load and gives a smaller set. This consists of features which are uncorrelated to each other. The multispectral images consists of multiple bands are are acquired in different parts of the electromagnetic spectrum. Using PCA data can be transformed into smaller sets, N number of correlated bands of the image data can be reduced to a few uncorrelated bands.

Following steps are performed to obtain the change map for two images:

Difference image and the Eigenvector space (EVS): The difference of the two images gives an image wherethe pixels linked with changes would have values that are considerably different from those of the pixels associated with unchanged areas. Non overlapping blocks are taken from the obtained difference image and are flattened into row vectors. To get the Eigenvector space(EVS), principal component algo is then applied on this vector set. Building the Feature Vector Space (FVS): We first create VS by taking blocks from the difference image, flatten them, only this time, the blocks are overlapping. FVS is then constructed by projecting VS onto the EVS which can be done by the following matrix multiplication:

$$FVS=VS.EVS$$

Clustering the FVS: The feature vector carries data about changed and unchanged pixels, which are clustered into two classes using K Means clustering. The cluster which belongs to the changed class is the one with the lowest number of pixels, and the highest mean. Using these, a change map is created representing the changes.

$$change\_map(i,j) = \begin{cases} 255, & if(i,j) \in pix_u \\ 0, & otherwise \end{cases}$$

Phase 2 - Feature Extraction: In this phase features from the remote sensing images were extracted to classify the change in different objects/classes. For the Extraction of features, Semantic Image Segmentation is done using U-NetArchitecture. The architecture of a U-net is similar to the encoder-decoder architecture, with additions of skip connections. The first half focuses on feature extraction(analysis) and the next half is used for localization and segmentation(synthesis).

Figure 1: U-Net Architecture [7]

As discussed, in order to better localize and learn representations, whileperformingupsampling and going deeper in the network, the higher resolution features are concatenated from downpart with the upsampled features, with following convolutions. Since upsampling is a sparse operation it needs a good priorknowlwdge from earlier stages for better representing the localization. Unlike in CNNs, where it only learns the feature mapping of images by converting them into vectors, here it is also needed to reconstruct an image from this vector

in segmentation. This is a very arduous task. So, while converting an image into a vector, the feature mappings of the image that were already learned in the first half are used to convert it again to an image. This is the idea behind U-Net. Use the same feature maps that are used for the contraction to expand a vector to a segmented image.

Figure 2: Sample satellite images from two different timestamps.

Figure 3: Change Map of above two satellite images

Figure 4: Change Map with sharpened edges

RESULTS AND DISCUSSION

Change detection was performed on the multitemporal remote sensing images. The Principal Component Analysis (PCA) calculation was applied to two sample satellite imagery of two different timestamps. As shown in Fig. 2 there are two sample satellite images of different timestamps on which change detection was carried out. The image shown in Fig. 3 was obtained from these two images, which shows the changed portion or pixels in white color and unchanged in black color. The image shown in Fig. 4 is cleaned by sharpening the edges to get a better view of change.

As shown in Fig 2. It provides the change map which detected the change in two images of Dubai of different timestamps. The change is shown in white color. For the feature extraction the model was trained using the spacenet dataset. The model is capable of detecting some objects/classes. It classifies or extracts the information using semantic segmentation which was carried out using U-Net Architecture. The input image of 640 x 640 x 3 was passed to the model which then using U-Net architecture gives the output image of 640 x 640 x 1 that is in binary map. As shown in figure 5 the output image obtained shows the building detected in white color.

Figure 5: Building classified from the remote sensing image

Input: 640 x 640 x 3

Output: 640 x 640 x 1

CONCLUSION

In this project changes are detected in remote sensing images of satellites using time series data. This project was done in 2 phases. First, was the change detection part and the second phase was all about feature extraction. In the first phase, change detection was done using the

Principal Component Analysis (PCA) Algorithm. PCA was efficient in terms of accuracy, as it provides better accuracy in remotely sensed image classification. The PCA based system provides high speed processing and comparatively better accuracy. PCA could also handle large numbers of image data due to its capability of reducing data dimensionality and complexity. In the second phase we extracted the features from satellite images using Semantic segmentation and U-Net architecture. Semantic segmentation identifies what is present and where, it also clusters the patches of images which have the same object of interest. The U-Net architecture is used with Semantic segmentation, it follows an autoencoder architecture as it has 2 structures. The U-Net joins the area data from the downsampling way with the relevant data in the upsampling way to at last acquire an overall data consolidating localisation and setting, which is important to foresee a decent division map. Hence, it provides the information of features extracted from images to classify the change in objects or classes in remote sensing images.

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Illegal Link Tracker

Vrushali Bongirwar[1*], Anjusha Pimpalshende[2], Shailendra Aote[3] and Archana Potnurwar[4]
[1,3]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*CMR College of Engineering & Technology, Hyderabad, India.*
[4]*Priyadarshini Institute of Engineering & &Technology, Nagpur, India*

ABSTRACT

Most of the times, we encounter at situations, where we simply click on some links. This is because those links looks similar as the original links. The confidential information is stealing by using cyber attacks. Fraud websites may come to us, where we fail to differentiate it with original websites as images and logos looks similar. In this paper, Data mining techniques is proposed to detect phishing websites. A model is designed, which is used to classify the data. This model is then used for predicting whether the website is legal or illegal.

KEY WORDS: PHISHING, DATA MINING, ILLEGAL LINK TRACKER.

INTRODUCTION

In the current cyber world, the practice of phishing increases. Phishing is a kind of fraud where the attacker steals the important information of users such as login credentials, bank passwords. This information is gathered by sending mail, messages or any other communication medium. Victim receives a message, which appears as an important message to the users. These messages contain malicious software targeting user's account, which contains link that actually reads all the information from the user's machine. This information may also be taken from users camera or browsers. Phishing is very popular amongst attacker, because it is very easy to fool the people those always look for popular EMI's, sale, offers etc. Awareness amongst people is the main reason behind increasing the phishing practises.

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Here, the aim is to design an application that will ensure safety from fake websites that is forwarded everyday at a huge scale. The application running in the background will alert user whenever the phone's web browser accesses any hoax link. The proposed system focuses on many factors such as: To control web browser from accessing fake websites; Before accessing any website, the app will ask permission to scan it so that user is safe; To ensure safety by securing personal information of user; Security is very important. Personal information will be secured so that his/her browsing experience is safe; To avoid leak of user data to phishing artists; User data information will be safe so that user does not become a victim of phishing attack.

Review of Literature: An illegitimate link tracker checks a link based on various parameters. This system revolves around checking these parameters and classifying on basis of them. The more are the parameters considered, more is the accuracy and efficiency of results. Alerting system should allow the user to request or cancel the emergency services in situation of false positives. https://www.psafe.com is website that helps to prevent phishing attacks and identifies a phishing link. Dfndr have 300+ million installations. "dfndr" security is a comprehensive tool goes beyond being simple antivirus software and helps protect your mobile privacy as well as enhancing your Android device's performance. New tools are constantly being added and upgraded to keep dfndr security cutting

edge in an ever-evolving world of cyber threats. We continue to expand our product portfolio with apps such as dfndr vault, dfndr performance, dfndr vpn, and dfndr battery that safeguard and enhance Android and iOS users' experience. Limitation in existing systems are

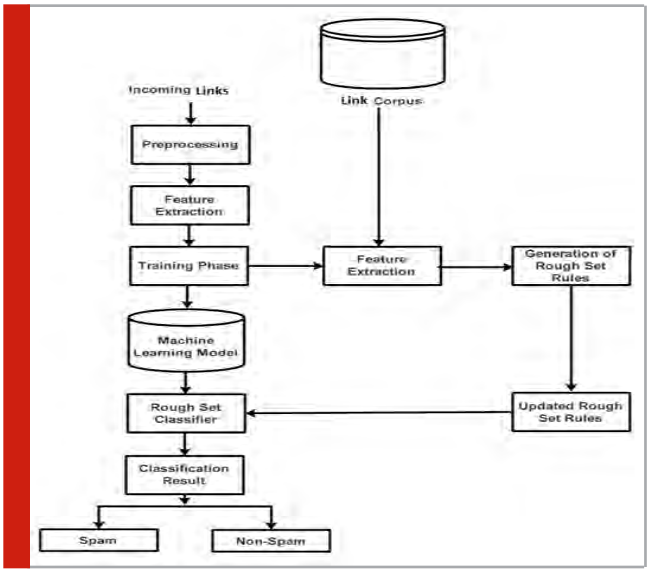
1. Upgrading and maintenance of this system is very expensive process.
2. The main issue with this systemis that the notifications are sent to a web server and responders needs to check the web server for notification.
3. The system is not handy for mobile users and is time consuming as one needs to open the site and then access it.

METHODOLOGY

The procedure for implementation and a brief explanation of why it will be useful for implementing the proposed system is included, and a brief description of the current system development approach is counted here. The figure is an activity flow diagram of given system. The system focuses on three modules as showing in above figure, i.e.

1. Feature Extraction
2. Training Phase
3. Classification as spam or non-spam

Apart from these, the first decision block acts like a filter for trigger, if the user clicks on 'Abort' emergency services won't be alerted then. Else the nearest responder is selected for the providing the emergency service. And side by side, the location path is shown to the user and responder, both.



The dataset has a 30 predictors and the label is saved in the feature named Result. A value of 1 in the Result column denotes that the corresponding website is a phishing website and a value of -1 denotes that the corresponding website is a normal one.

```
Index(['having_IP_Address', 'URL_Length', 'Shortining_Service',
       'having_At_Symbol', 'double_slash_redirecting', 'Prefix_Suffix',
       'having_Sub_Domain', 'SSLfinal_State', 'Domain_registeration_length',
       'Favicon', 'port', 'HTTPS_token', 'Request_URL', 'URL_of_Anchor',
       'Links_in_tags', 'SFH', 'Submitting_to_email', 'Abnormal_URL',
       'Redirect', 'on_mouseover', 'RightClick', 'popUpWidnow', 'Iframe',
       'age_of_domain', 'DNSRecord', 'web_traffic', 'Page_Rank',
       'Google_Index', 'Links_pointing_to_page', 'Statistical_report',
       'Result'],
```

RESULT AND DISCUSSION

Fake links and websites detection is implemented successfully. We have been able to identify whether a link is legitimate, illegitimate or suspicious based 15 different parameters. Random Forest Algorithm is used for classification as it has the best accuracy for our dataset over SVM or ID3. Android app is working in the front end and python codes run in the backend on Django server. This application is handy for all types of users and protects them from malicious sites which focus on phishing of data. Phishing of data is a scam worth millions of rupees per year. This application will prevent violation of privacy of user and safeguard their personal information and data from being mishandled.

The system accounts for improvisation of the accident alerting and benefits the user in many different ways. Moreover, the current system overpowers the existing system based on following crucial parameters:

1. **Hardware independent:** The current system is based on mobile based application and requires less or no dependency on external hardware, thus free from wear and tear.
2. **Cost effective:** The existing systems are costly and require quite maintenance as they are hardware based. Due to no such dependency in this system, accessibility to the application is quite cheap and easier.
3. **Multiple factor consideration:** The system takes various parameters as input. These parameters are calculated with the help of various existing and detected fake and trends observed in them. These parameters altogether make the detection and alerting mechanism effective and make less false predictions.

CONCLUSION AND FUTURE SCOPE

Now a days, number of evidences that the confidential information is stealing by using cyber attacks. Fraud websites may come to us, where we fail to differentiate it with original websites as images and logos looks similar. In this paper, a model based on data mining technique is proposed to classify the data. This model is then used for predicting whether the website is legal or Illegal. For future work, more progress is needed in research in order to detect the phishing links and aware the user about it. Adding additional feature such as, the application can be developed in such a way that will allow the user to report if the website if phishing which can be stored in database for future reference. More robust machine learning based models can be used to work up as classifier on the

multiple set of attributes, which are promising. This will help to improve the accuracy of system.

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Recognition of Letters and Letter Font in Images Using Deep Learning

Nilesh Korde*[1] and Abhijeet Ramesh Thakare[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

The reason for this article is to perceive letters and particularly textual style from pictures which are containing writings. To perform the acknowledgment process, fundamentally, the content in the picture is separated into letters. At that point, each letter is sent to the acknowledgment framework. Results are separated by vowels which are generally utilized in English writings. Accordingly, the textual style of the content is gotten. To isolate letters from content, a calculation utilized which created detachment. This calculation is made for English letters which have specks. To give acknowledgment of English characters, all conceivable outcomes were made for every one of these characters, and the calculation was framed in like manner. In the wake of perceiving every letter, separate portions were submitted for processing to CNN system. The informational index contains about 13 a huge number of letters with 227*227*3 size that have been made with various focuses, textual styles, and letters. Therefore, 100 percent of progress has been accomplished in the preparation. % 79.08 letters and %75 of text style achievement have been accomplished in the tests.

KEY WORDS: CONVOLUTION NEURAL SYSTEMS (CNN), LETTER ACKNOWLEDGMENT, PROFOUND LEARNING, TEXTUAL STYLE ACKNOWLEDGMENT.

INTRODUCTION

Lately, humankind is attempting to do all activities which are in everyday life, on advanced frameworks by diminishing and robotizing human force. This mechanization necessity empowered the formation of keen frameworks. Method of Profound learning used to re-enact the human mind 's structure. Used technique depicts progression of calculations for searching various leveled portrayal information via mimicking how that individual cerebrum faculties significant pieces of a lot of tangible information that it is presented to consistently. The thought originated with the premise of profound wisdom developed in the year 1950 based on the perception definition. Perception has the capacity to learn. The recognition to perception structure specially multilayer received during the period of 1980s. Be that as it may, the perception has constrained learning capacity. Hence, the proposition of neural systems with numerous layers developed during the 2000s.

The structure alongside this proposal has been exceptionally equipped for knowledge. The numerous levels of profound wisdom foundation. CNN systems, specially concentrates on the picture, demonstrating elite and accomplishments, also identified to be profound wisdom structure that conveys improved outcomes. This model helpful for finding designs in pictures to perceive items, appearances, and scenes. They gain legitimately from picture information, utilizing examples to arrange pictures and disposing of the requirement component removal physically. This model consisting of multilevel structure, every level containing a majority of two-dimensional planes and a majority of neurons each plane.

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Furthermore, within old-style AI, the appropriate response is just 1 or 0, and in the yield of the investigations utilizing this system structure, values somewhere in the range of 0 and 1, for example, 0.2 and 0.7 can be acquired. This makes it simpler to tackle the issue in a progressively itemized manner, it expands the accomplishment in learning and gives better outcomes. In the wake of learning highlights in numerous layers, the following piece of a convolutional neural system is grouping. The CNN system design utilizes a grouping levels for giving the characterization yield. This paper has been divided into five segments. The main segment of this paper gives concise information on profound learning. The subsequent area surveys the related works. The third area is worried about the system utilized for this investigation. The fourth segment shows the discoveries of the examination. At long last, we give the end.

Related Works: Lately, considerably more data has gotten accessible on profound learning. Thusly a lot of writing has been distributed on this subject. Regardless of whether convolutional neural systems have been enhanced during the long period of time, prevalence of it has picked from many years. The numerous levels of profound wisdom foundation. Expanding the information, some unsolved issues dependent on picture and film preparing, its deficiency of existing knowledge strategies expanded the notoriety of profound perception. Thus, a large portion of the investigations taking place considering the effectiveness of CNN systems. These days, with extremely thriving capacities, profound deep networks being utilized in support of order, recognition, conclusion. Letter acknowledgment in digitized records is significant for chronicling. Some digitized archives contain two pictures and content. So, a simple neural network processor designed and actualized for visual letter acknowledgment during 1991.

During examination, manually written letters with 20X20 size have been utilized. In one more examination, optical substance recognizable proof was acknowledged with the neural system. Chinese character acknowledgment was acknowledged by utilizing different convolutional neural systems. Textual style acknowledgment was considered by certain scientists. Character free textual style acknowledgment on a solitary Chinese character was examined. Since expressed in given article, acknowledgment exactness was expanded using quantity of the letters utilized for acknowledgment. An additional investigation done on Arabic text style acknowledgment. The anticipated framework was founded on manageable geometry and indicated the elite.

MATERIAL AND METHODS

In the vast majority of the investigations, written by hand letter acknowledgment has been executed for various dialects. An examination was discovered, that two measurements optical letter acknowledgment dependent on profound learning, underpins English letters. No text style acknowledgment study, for English, was found in the writing. In this examination, it is expected to perceive the textual style of the content in a picture and to separate the letter and text style data in the picture. To the extent we inquire about, this is the primary investigation on textual styles that help English letters in the applications up until this point. Fundamentally we perceived the characters along with the text styles of the characters. Thus system of character acknowledgment comprises English script. The third division is worried regarding the technique of picture handling prior to the picture is sent to organize. The fourth division clarifies the manner for utilizing the character partitioning. The last division illustrates the outcomes.

Data Set: As no readied informational collection was establish in the writing, another informational collection was made for this investigation. In the initial segment, the informational index was arranged by characters, and the later division information was sequenced using text styles. Within letter arrangement, pictures were made for every one of the 29 letters. Just letters were incorporated, digits were prohibited during investigation. Since pictures might include various sizes of letters which were chosen. Including these lines, three letter pictures were made as large, medium and little for every lower and capitalized letter. Focused on keeping 72 points as large, 20 points as medium and 8 points as little.

Once the arrangement of all the letter pictures were made, pictures were resized as 271*271 for a profound convolution neural system. Then, 228 letter pictures for single letter and 6612 letter pictures for the entire letters in order were made. Another informational index has been made by choosing 38 text styles that help English letters and utilizing these textual styles in every one of the 29 letters in the English letters in order. All shapes and size cases were incorporated and a sum of 38 textual styles were utilized for single letter and 174 letter pictures for single text style, and 6612 letter pictures for the sum total of what text styles were made altogether. Subsequently, the arrangement part has been finished. Some of the models from the database are given below.

Figure 1: Models from Dataset

Creation of Profound Learning System: During examination, Alex net was utilized to make neural system which generally remembered for the profound learning tool compartment of Mat lab ©. Alex net was prepared to classify thousand of various types of pictures and it was prepared on various other million pictures. Consisting about 25 layers, the greater part among

layers were doing helpful picture prepartion that would work for our framework. Firstly, the preparation pictures were appeared in the system. Furthermore, information would split into preparing and test pictures. overall 80 percent pictures were decided for preparing pictures by randomizing. later on, the pre-prepared system, Alex Net, would be changed. The 23rd layer of Alex Net consisting a thousand neurons as Alex Net characterizes a thousand diverse images. It was adjusted to 29 for the primary system along with 38 for the second. In the wake of setting up all system parameters, the preparation procedure was figured out. In the wake of preparation done, the system was tried. Since the exactness was acceptable, the system was spared.

Pre-processing of Picture

The picture was prepared before it was sent to the system. These activities were recorded beneath.

- In the initial step, the picture was changed over to the power picture group.
- In the second step, the picture was changed over to a twofold organization.
- In the third step, the picture was changed over to supplement itself, as a result of morphological picture preparing.
- In the last advance, morphologic picture preparation was utilized for finding every one of letter areas. We have utilized a capacity that profits the name network that contains marks for the 8-associated (even, vertical and corner to corner) questions in picture

Figure 2: Preparing Process Plot

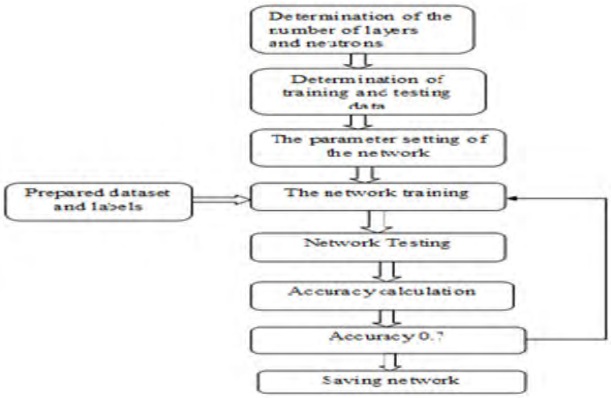
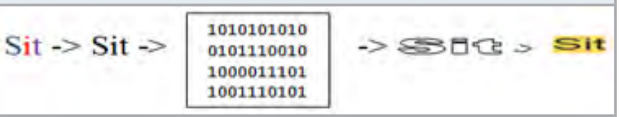


Figure 3: Pre-processing Plan



Separation of Letter: In the wake of pre-processing steps that were done, letters were isolated and found by marking the picture. The total of what steps were recorded underneath.

- Corner directions of every single marked field was established.
- It was concluded that this marked field was a letter or part of a letter by making relative estimations.
- If the letter would be a complemented letter, for example, "g" or dabbed letter, for example, "i, j, ü or ö", the directions of the marked field were refreshed by these pieces of letters.
- As per calculation, there were three conceivable outcomes. Within the principal cycle if the calculation was demonstrated when first field was a piece of a letter and the subsequent field was a letter then this was the "I" letter. Else If the first field was a letter and the subsequent field was a part of the letter then this would be "j or g" letters. Else if the primary field was a letter and the second and third fields were portions of a letter then this would be the "ü or ö" letter. If one of the conceivable outcomes becomes genuine, at that point update the directions. Once the directions of the entire letters including English letters were characterized, the picture was changed over to a simulated rub position once more, just for the system necessity.
- Size was scaled to 271*271.
- Each letter was sent to the prepared letter arrange. As indicated by the system yield mark, the related letter was added to the content.
- Once every letter acknowledgment, every letter was sent to the textual style organized. As indicated by the system yield name, related text style name was spared.
- After every letter textual style was accomplished separately, it was seen that the system result for every letter can some of the time be extraordinary. Even though the content of the test picture was novel textual style, every one of the letter textual styles can be various because of the trouble of textual style acknowledgment. So we conquer this trouble with a likelihood count. The outcome text style was achieved with likelihood.

Printout the Outcomes: The outcomes have appeared in two sections. The initial segment is preparing results with subsequent division is acknowledgment outcomes. The accompanying tables demonstrate the preparation outcomes. To expand the exactness of the textual style acknowledgment, the outcomes have been approved by most utilized English characters. For approving the outcomes, after being discovered every character and every text styles of the letters, its being tallied to each character textual style recurrence. The outcome textual style of the picture is concluded by most elevated recurrence. Specified system being prepared for 38 distinct textual styles. The system has been tried with 12 test pictures in which their properties given in Table III. Lorem Ipsum pictures made for testing. Table I and Table II depict training results. Test outcomes have been given in Table IV.

RESULTS AND CONCLUSION

The investigation expecting for building up a profound system, perceiving the two text styles and characters in English. Nearly 13 thousand images have been prepared for the pre-prepared system. The character

acknowledgment preparing precision was %100, and text style acknowledgment preparing exactness was %73.44, in light of the closeness of the textual styles. In any case, to build the textual style acknowledgment rate, a probability estimation has been utilized, after the system yield has been found. Regardless of whether the main test picture text style exactness is 14/26, on account of the probability is greater than 0.5, its being acknowledged as Arial. So with along these lines, the acknowledgment execution expanded more. The system tried with 12 pictures. Pictures contain only characters. As indicated by the outcomes, character acknowledgment in this system expected about %100 rate, however, precision about textual style acknowledgment is low, as it can clearly seen from Table IV. Be that as it may, utilizing the likelihood, textual style acknowledgment rate being expanded.

Figure 4: Stream Graph of Acknowledgment

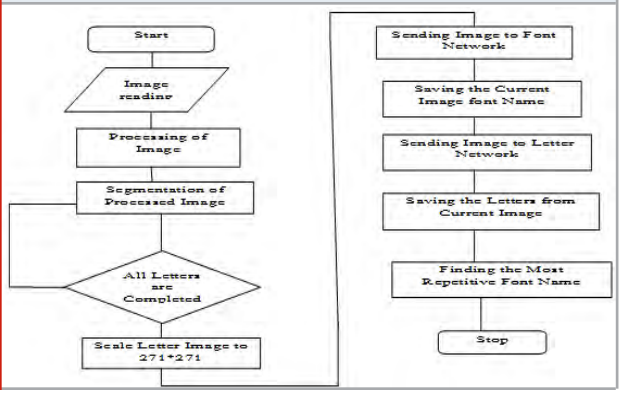


Table- I: Training Textual Style System Results

Epoch	Iteration	Time Elapsed	Mini-batch Accuracy	Mini-batch Loss	Base Learning Rate
1	1	00:00:01	1.58%	4.3096	0.0010
2	150	00:06:34	18.20%	2.4671	0.0010
3	200	00:08:13	30.15%	2.3336	0.0010
4	250	00:14:48	36.55%	1.8929	0.0010
5	500	00:19:45	40.08%	1.7260	0.0010
6	650	00:23:02	51.03%	1.5559	0.0010
7	800	00:27:58	44.78%	1.4569	0.0010
8	1050	00:32:55	61.93%	1.2811	0.0010
9	1300	00:44:26	64.61%	0.8712	0.0010
10	1600	00:56:41	72.45%	0.8155	0.0010

Table- II: Training Letter System Results

Epoch	Iteration	Time Elapsed	Mini-batch Accuracy	Mini-batch Loss	Base Learning Rate
1	1	00:00:01	3.13%	3.4619	0.0010
2	150	00:05:58	91.63%	0.1500	0.0010
3	300	00:11:55	94.31%	0.4740	0.0010
4	550	00:17:52	100.00%	0.1866	0.0010
5	700	00:23:49	98.44%	0.0094	0.0010
6	850	00:29:46	100.00%	0.0151	0.0010
7	1000	00:35:43	97.44%	0.0217	0.0010
8	1250	00:41:40	100.00%	0.02165	0.0010
9	1600	00:47:43	98.44%	0.0034	0.0010
10	1900	00:57:53	100.00%	0.0078	0.0010

Table- III: Properties of Test Pictures

Fonts	Points
Arial	7, 30,81
Bahnschrift	7, 30,81
Century Gothic	7, 30,81
Juice ITC	7, 30,81

Table- IV: Results of Testing

Fonts	Point			Result
	8	20	72	
Arial	14/27: True	23/48: True	11/23: True	%100
Bahnschrift	3/35: False Franklin Gothic	9/45: False Arial	7/28:Bahnschrift	%33
Century Gothic	17/31: True	24/45: True	13/22: True	%100
Juice ITC	3/8: False Courrier New	34/44: True	20/22: True	%66
	Total Average Success			%75

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Agribot: Iot Based Farmbot for Smart Farming

Jignyasa Sanghavi[1*], Rina Damdoo[2], and Kanak Kalyani[3]
[1, 2, 3]Assistant Professor, Shri Ramdeobaba College of Engineering and Managment, Nagpur, M.S. India

ABSTRACT

Agriculture has been always the important occupation of the country like India where two-third of the population is dependent on it for their livelihood. The traditional system of agriculture is mostly dependent on the natural resources which sometimes yield good production and sometimes in losses. Moreover, proliferative population, decrease in farming land, natural calamities like drought, unwanted heavy rainfall and storms worsen the situation. However from the past few decades, various scientific innovations have changed the agricultural and farming techniques with time. IoT, AI and Machine learning techniques are used for smart farming to get the good crop yield. In this paper, an IOT based technology platform is proposed for farming. The farming bot "Agribot" proposed in this paper is equipped with the significant sensor for keeping track of environmental parameters on which farming is dependent. The android application with this bot provides view of data extracted from all the sensors and pictures of the crop/veggies grown in farm at regular basis so that one can monitor it at their finger-tip from any place. It also performs data analytics on the sensor data for calculating watering time intervals for the specific crop which can be viewed in android Application.

KEY WORDS: SMART FARMING, IOT, FARMING BOT, SENSORS, DATA ANALYSIS, WATERING PLANT INTERVAL PREDICTION.

INTRODUCTION

The current world population of the world is 7.8 billion according to the most recent United Nations estimates elaborated by Worldometer. The United Nations projects world population to reach 10 billion in the year 2057. This global population blast will become world scale problem resulting in food shortage, urbanization which will decrease the farming land and increase in demand for all the resources. Food is the basic requirement and production with good crop yield becomes the basic necessity for any country for their national stability.

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The main factors affecting this occupation are rainfall, soil quality, temperature, and other climatic conditions. The soil testing is done manually for checking the fertility of land. The water quantity required for various crops/ veggies is different. Sometimes water is wasted in the fields; however drop irrigation techniques are used in some places. The sudden changes in climatic conditions can adversely affect the production. All such problems can be solved up to certain extend using innovative automated solutions. With the boom of smart cities all over the world, agriculture is also equipped with smart farming. IoT based sensors can be used for monitoring atmospheric pressure, atmospheric moisture, amount of sunlight, rainfall, pest infestation, soil moisture and nutrition.

The data extracted from these sensors can be used for data analysis and decision making. If sensors are attached with Bots, the data extracted can be used for taking appropriate actions like watering the crops/plants with specific amount of water on proper time, spraying fertilizers in proper amount, taking pictures of the plant for monitoring and disease detection, etc. Furthermore,

this smart Bots can be connected with smartphones, which will help to access the data from anywhere in the world. The smartphones can be used as dashboards giving all the brief of particular land. This combination of devices will prove to be beneficial in smart farming. IoT proves to be beneficial to agricultural supply chain and provide a critical technology for establishing a smooth flow of agricultural logistics. The Key advantages of Smart farming are:

1. Proper water management preventing the wastage of water.
2. Soil Management for checking pH level and moisture in the soil.
3. Crop Monitoring using cameras to detect infections and diseases in crop.
4. Weather monitoring for live monitoring and crop sowing time.

Related work: With advancement in technologies IoT frameworks and platforms has been used in many domains like smart healthcare, smart cities, etc. but still in agriculture domain large scale use of IoT solutions is not seen in many countries. In this section we tried to describe some of the IoT based solutions proposed by some of the researchers. Anand Nayyar et.al proposed a Smart IoT based gadget "Agriculture Stick" which assists farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring. This stick was developed with the combination of Arduino, Cloud computing and Solar Technology using Breadboard mixed with various sensors. Thingsspeak.com was used to get the live data feed. The author claimed the accuracy of 98% in the data feeds extracted from the sensors . Andreas Kamilaris et.al developed Agri-IoT, a semantic framework for IoT based smart farming applications, which supports reasoning over various heterogeneous sensor data streams in real-time.

Framework also supports large-scale data analytics and event detection, ensuring seamless interoperability among sensors, services, processes, operations, farmers and other relevant actors, including online information sources and linked open datasets and streams available on the Web. For the experimentation of this project they deployed 100-300 sensors in the field. The comparative analysis of two RDF Stream Processing (RSP) engines CSPARQL and CQELS is illustrated with the results. Amandeep et.al proposed the GPS based remote controlled vehicle which can operate on both automatic and manual modes, for various agriculture operations like spraying, cutting, weeding etc. It can also monitor the temperature, humidity, soil condition and water supply. The researchers came with the concept of connected farm, which can provide suitable environment for growing crops. In this project all sensors and actuators used for monitoring and growing crops were connected with a gateway installed with a device software platform for IoT systems, called &tCube.

The IoT service server "Mobius" was used to monitor the environmental condition of the connected farm, to communicate with expert farming knowledge systems and controls actuators according to it. The experiment suggested that different crops can be cultivated on a single field by dividing the land in the grid format and installing the automatic plant irrigation system which consists of soil sensors, water level indicators and chemical sprinkler. Information about the field can be extracted from GSM+ARDUINO system. For data analysis they used Things for visualization. They also used Speak, an open source platform for future records or if the GSM fails due to some technical errors. Some of the researchers tried to use IoT based solutions with Precision Agriculture. Precision Agriculture mainly includes data collection, processing and variable rate applications of inputs. Precision agriculture is one of the paradigms which can use the IoT advantages to optimize the production efficiency across the agriculture fields, optimize the quality of the crops, and minimize the negative environmental impact.

They proposed internet of things can be used to collect local information data like water level, temperature, humidity, soil moisture, and light from the various crop on precision agriculture. Li Hong-ying et.al proposed the maximum yield of the crop can be reached in the given environment using the time series techniques with past yield data for employing on a forecasting model. The crop yield forecasted model was tested in Liaoning Province in China from 1949 to 2005. Some researchers tried to implement Decision Tree Classifier on the environmental parameters for the prediction of crop to get the good yield. The following sections will introduce the proposed system in detail.

The Proposed System: This paper briefs the working and methodology of the proposed system. The hardware system used in this project is based Computerized Numerical Control (CNC) machine which provides free arm for movement in a confined area. This arm is fitted with a soil moisture sensor, humidity sensor, light detecting sensor, temperature sensor, small camera and water outlet pipe for watering the plants. These sensors help in monitoring the environment and its effect on the crops. This device is connected to internet so that it can provide real-time data of all above sensors on the smartphone. This data can be used for analytics purpose and for applying any machine learning algorithm for good crop yield. This project is majorly divided into the following parts:

1. Agribot Structure
2. Hardware Devices
3. Software Component
4. Android Application Development
5. Data-Analytics

Agribot Structure

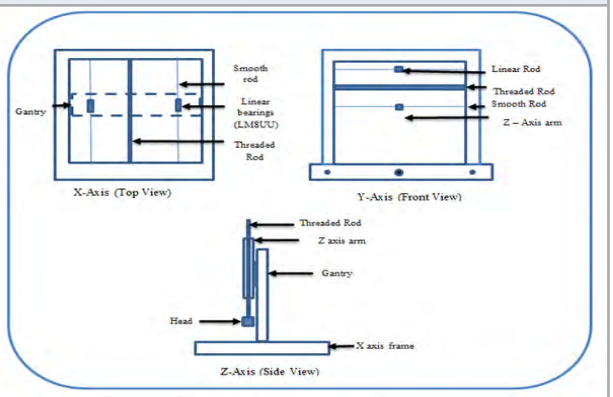
X-Axis: The structure is made from a wooden block. In figure 1, the diagramatic representation of the hardware structure is shown. In this block, 2 smooth rods are running parallel to each other and fitted with the linear bearing for the smooth motion of the gantry (the structure that supports y and z-axis). The forward

and backward motion is achieved by converting rotation motion into linear motion. For this, the threaded rod is placed in between the block. The motion to this rod is provided by a stepper motor.

Y-Axis: The y-axis structure is similar to the x-axis as shown in figure 1. The only difference is that the structure stands on the x-axis (as Gantry) and not lay down. The motion is again provided by rotation of the threaded rod. This axis performs the left and right motion.

Z-Axis: The Z-axis performs upward and downward motion and based on the same principles as x and y axis works. The z-axis is connected with a head, which has the connection for soil moisture sensor and water outlet pipe. Combining all 3 axis X, Y and Z we get a 3-D axis motion, where the head can be moved to any point in the confined space and the plants are planted in a grid format (for ex. 4 x 4 grid planting). In this architecture the benefit of multi-cropping by planting different plants in the different grid can also be taken. Every grid is associated with its column and row number as in a matrix.

Figure 1: Diagrammatic structure of Agribot Model



Hardware Devices

1. **Raspberry pi-3:** It acts as a CPU for the system and manages all the internet related Activity. It gives command to Arduino for performing tasks like moving the head to a particular location, watering the soil, check sensor readings, taking pictures of the plant and uploading pictures in the database.
2. **Arduino Uno:** All the sensors are connected to Arduino. It controls the revolution of stepper motor using A4988 stepper motor driver. It is directly connected to the raspberry pi through the USB interface and it follows the commands given by Raspberry pi.
3. **Stepper Motor and Stepper Motor Driver (A4988):** This Stepper motor can be controlled precisely with different steps. The set of 3 stepper motors is used in X, Y and Z axis attached with the threaded rod to provide a 3D motion to the head. This motor is controlled by Arduino using motor driver A4988, this motor is powered by a 12v DC.
4. **Temperature and humidity sensor, LDR, Soil Moisture sensor, Camera, Water pump, Relay:** These sensors are attached to Arduino and share the real-time data with it. The relay is used to ON power pump from an external power source. The relay is turned ON and plants are watered as per requirement only, when the soil moisture sensor detects low moisture in soil.

Software Components: The preliminary software of this project manages the movement of the arm in the confined region. The soil moisture sensor attached with the arm is pressed under soil for checking an accurate moisture level. Taking into account values of all sensors, threshold value is fixed and depending on it decision is taken whether to water the plant or not. The pictures are captured of the plant from above with a camera attached to the arm top. These pictures are sent to the Firebase database. Collaterally it also uploads the sensor's values, so a user can get additional information about the day. This collected data can be further used for Data-Analytics process.

Android Application Development: An android application is developed for tracking details of all the sensors. This android app can act as live surveillance of the plant. The information extracted from sensors, stored in the raspberry-pi is send to the firebase database. The database can be accessed by the mobile application. The graphical representation of the sensor data for each day, navigation bar with different functionalities such as pictures of the plants, etc. can be viewed from this application. This data can be further used for data analysis using machine learning algorithms or forecasting algorithms.

Data-Analytics: One of the significant parts of the project is applying a Data-Analytics on the collected data of temperature, the moisture of environment, amount of sunlight and soil moisture for different plants. The weather data of that region is collected from different websites. This data can help in analysing the specific and precise need of the water for the different plants. This can result in efficiency in the watering of the plants and thus can increase the overall performance of the device.

The input for the analytics is the data extracted from sensors for temperature, environmental moisture, sunlight intensity and soil moisture. The system analyses the data and gives output of the duration or the interval of the time the device will wait to water the plant next time. Here, the water requirements for the plants are predicted through data-analytics and Machine Learning algorithms. For example after analysing 2 days data of a medium grown Tulsi plant, it depicts the variation of soil moisture according to the surrounding temperature, sunlight, and humidity. The data visualization shows the amount of sunlight increases as the day starts, reaching a peak point and falling again at the time of sunset.

The temperature follows the same pattern as of sunlight; Humidity has little variation but has a drastic effect on soil moisture. The pattern of soil moisture is inverse, low level of moisture when other data are increasing and retain less water in the soil and also seen vice versa. This

pattern is due to the two reasons: (1) High evaporation rate: Evaporation rate during hot day is much higher than the rate during the cool night. (2) Transpiration pull: It is the pull created by the plant on the underground water to evaporate from leaves so the plant can get water and minerals through it. This data can be further used, when collected in abundant for different plants, for generating an accurate Machine Learning model for prediction of the time gap for watering various plants.

CONCLUSION

In this paper we tried to describe Agribot which is IoT based farmbot and will assist farmers for smart farming. It provides automated arm for watering the plants time to time and preventing from wastage of water. It also provides user all the details of environment and plant condition on finger tips using android application. It will reduce human intervention. The data is extracted from all the sensors and is used for the analysis. Machine learning algorithms or time series forecasting algorithms can be the future scope of this project which can determine the water needs of the plant, crop to be sown and other forecasting.

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Design of Time Aware Traffic Control Cache Algorithm for Efficient Performance of Web Caching

Kavita Kalambe
Shri Ramdeobaba College of Engineering and Management, Nagpur, India

ABSTRACT

Web caching plays a vital role to provide better web services and solve the problem of network access delays and network traffic congestion. This paper designed Time Aware Traffic Control Cache replacement algorithm (TATCCA) that saves the network access time by holding those object inside the cache whose access time is more. This considers the access time, object size, frequency, and timespan for choosing the object to be replaced to avoid the cache pollution. Access time is the most prominent factor. The example shows that compared with the traditional cache replacement schemes, the proposed TATCCA strategy has a higher hit rate and provide fastest services to user..

KEY WORDS: WWW, WEB CACHING, TATCCA, PROXY SERVER, CACHE MANAGER BLOCK (CMB).

INTRODUCTION

In recent years, World Wide Web services are highly disseminated among a millions of world population, with heterogeneous interests like marketing, banking, education sector, entertainment, business, personal communication etc. (James Huang and Chao, 2001). Due to this, there has been increase in the network traffic congestion (Kim and Park, 2006) also increase the server load, client latency and bandwidth utilization (Barish and Obraczka, 2000). As every client aspires to get fast network service, the internet must be able to handle an aggressively increasing amount of traffic (N, 2015). Some mechanism should be provide to overcome the network traffic problem. The effective solution is web caching. Web caching is the technique of prefetching and buffered repository of the web objects closer to clients so that if client request frequently and in the near future is satisfied from the repository located at the client side without interrupting the server (Teng, Chang and Chen, 2005; Ali, Shamsuddin and Ismail, 2011).

The typical structure of the WWW is shown in Fig 1. It includes three elements: cache on the client side, cache on the server side and cache on the proxy server. Proxy server acts as an intermediary between the client and server (Ali, Shamsuddin and Ismail, 2011). Whenever client sends request for the web object, it first arrives at the proxy server instead of the origin server. Proxy server serves these requirements by using either previously stored responses or gain the required document by requesting the original server on behalf of the client. This will reduce network access latency for a web object also reduces network traffic (Arlitt et al., 2000; Barish and Obraczka, 2000).

The overall performance of the system depends on the web cache eviction policies (Bilal and Kang, 2017). Several web cache replacement algorithms have been designed for improving the performance of the system. This paper presents a new approach for Web cache eviction policy by

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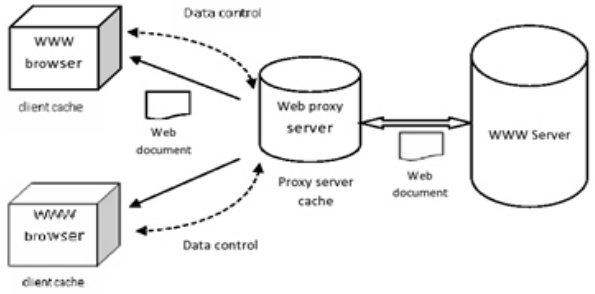
preferentially caching the objects whose cost of retrieval is the largest to improve the network performance as well as provide better service to user.

Figure 1: Architecture of World Wide Web



Related Work: Several web cache replacement policies have been proposed for upgrading the network performance. In this, we give an overview of conventional Web Proxy Cache replacement techniques that analyse their performance based on different key parameters used for the eviction and in addition to specify it's limitations.

The Original Greedy Dual Algorithm: The original Greedy dual algorithm developed by Young. In this algorithm, every object of equal size corresponds with cost needed to fetch the objects from secondary storage which is defined by H value. When cache needs to be replace, then objects with the minimum standard cost Hmin is considered for eviction and decrease the cost values H of all other objects in the cache by Hmin (Cherkasova, 1998). So object having largest cost value may be next object for the replacement. But it does not consider the non-uniform object size.

1. Greedy Dual Size Algorithm: The Greedy Dual Size algorithm (GDS) (Curcio, Leonardi and Vitaletti, 2002) was introduced by Rizzo and Vicisano. which is the modified version of the Greedy Dual algorithm. This algorithm considers the parameter object size S(i), object cost C(i) and inflation value L(offset value) to calculate the standard key value H of object(i) and use the priority queue to store H(i) value. The standard key value for object (i) is calculated in the following way:

$$H(i)=L+C(i)/S(i)$$

In this algorithm, the object having minimum standard key value Hmin is consider for eviction. The limitation of this algorithm is that it does not consider the frequency value of the object.

2.Greedy Dual Size Frequency Algorithm: To overcome the limitation of GDS algorithm, the Greedy Dual Size Frequency algorithm (GDSF) (Li and Shen, 2004) was proposed that considers the frequency of object i for compute standard key value of objects in the priority queue. GDSF adds the frequency of object F(i) with the GDS algorithm to calculate the value H(i). The performance of GDSF algorithm is better than GD and GDS algorithm. This algorithm also uses the priority queue. The standard key value for object (i) is calculated in the following way (Li and Shen, 2004):

$$H(i)=L+F(i)*C(i)/S(i)$$

3. Greedy Dual Size Frequency Access Interest Algorithm: The GDSF-AI (Sarhan, Elmogy and Ali, 2014) algorithm is considered user's access choice, document types and access trait of the web for efficient web cache replacement policies. In GDSF-AI algorithm, the access choice model for ith web user is represented in the form of vector qi = { <Ci1,wi1>, <Ci2,wi2>, ... , <Cin,win>}. Where the set{ Ci1,Ci2,..,Cin } represents the web user's access choice and the set {wi1,wi2,..,win }represents the corresponding weights to the user's access choice. The objects in cache can be specified as the array Obj={obj1,obj2,..,objm} . The interest vector qi of web user i and the vector dj of the jth document, they obtain the two term approximation degree of the documents by using the cosine formula as follows:

$$SIM(qi, dj) = \frac{\sum_{k=1}^{n}(Wdk * Wqk)}{\sqrt{\sum_{k=1}^{n}(Wdk^2)} * \sqrt{\sum_{k=1}^{n}(Wqk^2)}}$$

Proposed Algorithm: While providing fastest CPU request, cache prefetching the requested object from the remote memory. As the cache memory is fastest and limited in capacity, its space must be utilized efficiently so that it will satisfy maximum CPU request. In this paper, we designed a new algorithm called as Time Aware Traffic Control Cache Algorithm (TATCCA). This algorithm selects the object for eviction by considering three parameters i. e. size of object, object fetch time, frequency of object. It maintain a database called Cache Manager Block (CMB) as illustrated with the help of dummy dataset shown in Table 1. Our proposed algorithm computes the Least Effective Object (LEO) (whose size is largest and cost of retrieval is less) large size can be consider either one or summation of size of two object that is largest among the cache database and having less fetch time for eviction based on the Cache Manager Block information.

Table 1. Cache Manager Block (CMB)

Object Size(Largest to smallest)	
Obj_id	OBJ_Size (in KB)
OBJA4	32
OBJB2	28
OBJB3	22
OBJA1	16
OBJB1	12
OBJA2	10
OBJA3	8

Descriptions of all the fields of CMB is as Follows:

- Obj_id: Obj_id is the object identification number which is used to identify object referred in the cache.
- **Size:** Size is the size of object.
- **Fetch_time:** It is the time required to bring the object into the cache from the remote memory.
- **Frequency:** Frequency of object is the number of times the object is requested by the user.

Table1.2. Database_2(DB_2)

Fetching Time (minimum to maximum)		Freque-ncy of object in cache	Time_Gain
Obj_id	Fetch_Time (in ms)	Freq	TG=(Fetch_Time* Freq) -Fetch_Time
OBJA1	25	4	75
OBJA2	41	3	82
OBJB1	52	2	52
OBJA3	71	5	284
OBJB3	95	6	475
OBJA4	101	3	202
OBJB2	122	6	610

Table1.3. Database_3 (DB_3)

Most recently Evicted Objects and its address in next level memory	
Evicted Obj_id	OBJ_ADDR
OBJD1	0xED12A367
OBJC2	0xABFF1256
OBJB4	0x78237698
OBJA5	0xDFE98706
OBJC3	0x3456AC8B
OBJD4	0x7865FABC
OBJC1	0xCCAD7865

I. Design of TATCCA Algorithm

Algorithm1: BROWSER PROCESS NEW REQUEST

// DB_1 is the Database_1 which stores the information about object and its size in a sorted manner (From Largest to Smallest) as shown in table 1.1
// Fetch Time is the time required to fetch the object from the remote location into cache.

CHECK if (NEW_OBJ ∈ DB_1)
  SEND to CPU for EXECUTE
  CACHE_HIT++
  Call **UPDATE Cache Control Block** (Obj_id, OBJ_ADDR, OBJ_{SIZE}, Fetch_Time)
Otherwise **CHECK if** (IS CACHE EMPTY **OR** NEW_OBJ_{SIZE} ≤ $CACHE_{FREESPACE}$)
  $CACHE_{FREESPACE}$ = $CACHE_{FREESPACE}$ - NEW_OBJ_{SIZE}
  Call **INSERT INTO LOCAL CACHE(NEW_OBJ)**
  Call **UPDATE Cache Control Block** (Obj_id, OBJ_ADDR, OBJ_{SIZE}, Fetch_Time)
 Otherwise Call **TATCCA** //select objects for evict
 End if
End if

Algorithm2: TATCCA // select objects for evict

// DB_4 is the database used to store Time_Gain for the objects which satisfy the given condition
// DB_3 is used to keep track of evicted objects
// k is the number of objects in the cache
// OBJ_{SIZE}(Obj_id[k]) is the sorted array of object size from largest to smallest
// Cache Object identification Vector is Obj_id[i]= {OBJ_{A1}, OBJ_{A2}, OBJ_{A3}, OBJ_{A4}, OBJ_{B1}, OBJ_{B2}, OBJ_{B3} . . . .}

1. i←1, j←1
2. **REPEAT** while i ≤ k
   a. **CHECK if** (OBJ_{SIZE} [Obj_id[i]] ≥ NEW_OBJ_{SIZE})
      i. DB_4[j] ← TG[Obj_id[i]]
      ii. j←j+1
   b. Otherwise **CHECK if** (**SUM**(OBJ_{SIZE} [Obj_id[i]], OBJ_{SIZE} [Obj_id[i+1]]) ≥ NEW_OBJ_{SIZE})
      DB_4[j] ← **SUM**(TG[Obj_id[i]], TG[Obj_id[i+1]])
      j←j+1
      Otherwise **BREAK LOOP**
      End if
   End if
3. i←i+1
4. **End while**
5. **SELECT and REPLACE**(Obj_id(s)(**MIN**(TG(DB_4)))
6. **INSERT INTO DB_3**(Evicted Obj_id, Address at next level)
7. **INSERT INTO DB_1**(NEW_OBJ)
8. **UPDATE** Catch Control Block Database

II. lustration of TATCCA Algorithm: Whenever the web user sends the new request onto the network, browser will first search it into DB_1 of CMB. If it is there, then cache hit occurs and it will directly provide to user but if it is not there then cache miss and search it in the DB_3 of CMB to check if it is either evicted recently or not. If requested object is not found in DB_3 also then TATCCA algorithm works when either the Cache is full or have no sufficient space to store the new object. TATCCA works on the basis of information given in the CMB. In Database_2 contains the information about the time required to bring the object from the source into the cache and number of times the object is referred and also the third most important is calculate the time gain factor by using following formula:

Object , TG(Obj_id) = [(Fetch_Time(Obj_id) × Freq(Obj_id))] - Fetch_Time(Obj_id) ...(1)

This time gain factor helps to choose the least effective object, if the object require maximum time to fetch and if it referred more time then it is very beneficial to keep into the cache for a long time until its comparable object comes into the cache. Our algorithm selects the least effective object whose time gain factor is minimum so that the minimum time spend to fetch object if it is requested again. This will also consider the new object is better to fit into the free space of the cache. This algorithm selects the object in a sequence of largest size to smallest size to see the best fit space for the new object size with reference to select minimum corresponding time gain, this algorithm provides two choices for creating space for new object by selecting either one object having largest size and minimum time_gain or summation of two object's time_gain is minimum and the sum of their size is sufficient to fit the new object.

Let us consider example if new request arrives OBJC1 which is of size 24KB, and not found in cache and cache is full, so replacement takes place on the basis of TATCCA algorithm: According to this algorithm and Cache Manager Block information computes least effective object, following Database_4 is created and the object ids OBJA1, OBJB1 is treated as the least effective objects which creates best fit space and their time_gain is also minimum. So if this object is required again then it will take less time to fetch than other objects within the cache.

Table 1.4: Database_4 (DB_4)

SUM(TG(Obj_id(s)))	Obj_id(s)
202	OBJA4
610	OBJB2
550	OBJB3 , OBJA1
127	OBJA1 , OBJB1

Table 1.1: Database_1 (DB_1)

Object Size (Largest to smallest)

Obj_id	OBJ_Size (in KB)
OBJ_{A4}	32
OBJ_{B2}	28
OBJ_{C1}	24
OBJ_{B3}	22
OBJA2	10
OBJ_{A3}	8

Table 1.3: Database_3(DB_1)

Most recently Evicted Objects and its address in next level memory

Evicted Obj_id	OBJ_ADDR
OBJ_{A1}	0xEDCEA667
OBJ_{B1}	0xCBFD125B
OBJ_{D1}	0xED12A367
OBJ_{C2}	0xABFF1256
OBJ_{B4}	0x78237698
OBJ_{A5}	0xDFE98706
OBJ_{C3}	0x3456AC8B

According to the table 1.4 the objects OBJA1, OBJB1 have lowest time gain and summation of its size create best space for the newly requested object OBJC1 having size 24KB. If largest size object OBJA4 is replaced then it will take 101 time to fetch if it is requested again. Though OBJA4 has less frequency than OBJA1 still it is better to replace OBJA1, OBJB1 who require only 25 and 52 time to fetch respectively. Due to this process we will save time to access object from remote memory and one or more object can be replaced to create large space in the cache. After replacement new status of CMB database_1 is shown in table 1.1 and reference of replaced object is also save in database_3 shown in table 1.3. This algorithm will save reference of recently replaced object so that after some time if OBJA1 or OBJB1 is requested again then it will be fetched from referenced location directly so that this will save searching time and accessing quickly.

CONCLUSION

Web caching is one of the most promising techniques to reduce network access delay, network traffic congestion, bandwidth utilization. Nonetheless, most of the related work in the literature is about improvements of Web cache replacement algorithm, when the Internet was very different from todays. Starting from this observation, this paper aim to provide new viewpoints on the web cache replacement algorithm i. e. designed Time Aware Traffic Control Cache algorithm (TATCCA) in order to make caching i) efficient in enhancing the metrics that are the most relevant for the fastest network, in particular satisfying users demands quickly, ii) suitable for the type of different file that largely dominates the traffic today, e.g. video, audio and iii) provide quick response to user demands and save access time. In this algorithm, the objects whose has highest frequency and access time, it is affordable to keep those objects inside the cache so that whenever it is requested again then due to this algorithm cache hit occur and save its access time also. This algorithm is better to provide fastest network services.

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Object Detection in Real Time Video

Shailendra Aote[1*], Pankhudi Tiwari[2], Manjiri Butolia[3], Aaishwarya Suradkar[4] and Shrasti Gupta[5]

[1,2,3,4,]*Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

ABSTRACT

In this modern era, it is essential for various brands and businesses to have a technology that will be helpful for them with respect to the promotion of their business. Existing logo detection research focuses on closed set scenarios. The logo domain is too large for these strategies and requires an open set approach. In this paper, a logo detection and recognition system is proposed which detects the logos in the video. The issue of speed and size is addressed by proposing a compressed convolution neural network model VGG16 in Machine Learning. The proposed model improves on size, speed, and solves degradation issues. VGG16 trains the model and further classifies the images in order to detect the images. In comparison to VGG16 the proposed model is 88.4% smaller in size and 23.86% faster in training time. Thus, this model helps recognizing the images from the video with higher accuracy.

KEY WORDS: CONVOLUTION NEURAL NETWORK (CNN),MACHINE LEARNING, LOGO DETECTION, VGG-16.

INTRODUCTION

Nowadays visual content is considered to be the most powerful and informative among all the communication means that multinational and national brands all over the globe are using to showcase and advertise their brands. As the world is leaning towards digital platforms for almost anything and everything it becomes a beneficial and powerful means of advertising ones brand and catching eyes of millions of people in one short as well as to gain an edge over the competitors. For this very purpose owners invests money in online advertisement or even the digital events but the problem arises when the money invested for advertisement through online or digital means become worthless due to the issue of difficulty in coming up with the right amount of money to be sponsored in any digital event, this issue occurs as there is uncertainty and dissatisfaction of whether the amount invested is worth the time for which brand logo is appearing on the screen throughout the event.

Logos are considered to be the mean of identification for the company, organization or institution throughout the globe. Logo is crucial for identity purpose and logo matching is one of the challenge in the recent era. There are some difficulties in logo matching such as different images and videos contains logo with different shapes and size also the location of logo is not fixed in each image. For the detection of logos in such a situation, traditional methods which includes the manual calculation fails. To overcome the problem associated with traditional method Logo Detection System comes up with an automated method which would count the total time period for which the logo appears in the video which will help brand owners decide the suitable amount to invest. For the deployment of this application in real-life scenario we would need to create an effective GUI so that even a lay man can interact with the application with almost no efforts. Along with this we will also be required to train our model on huge dataset as there are immense amount of brands around the world.

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System Model

a. We have designed a CNN model by using Python as a programming language.

b. We used open source library in python called as TensorFlow which is widely used in today's world for machine learning applications such as neural network.

c. Google Colab is used as a development environment.

In this paper we are working on the dataset of approximately 1000 images containing logos of different companies around the globe and using this dataset to develop an image classification tool which will characterize images in accordance with the company specific logo present in the frame of video by mapping each frame aspect to each image is the dataset provided.

METHODOLOGY

Initially we divided the process into three main categories which are: 1. Convolution Neural Network that is used to classify images by passing each image through the layers of CNN , 2. Implementing VGG-16 as a pretrained model to categorize frame of the input video and check accuracy for the same, 3. Calculating screen time for the respective company logo in the video.

A.Convolutional Neural Network: The convolutional neural network (CNN) is a part of deep learning neural networks that uses multiple preceptron that analyze image inputs and have learnable weights and bases to several parts of images and able to segregate each other. The advantage of CNN compared to other similar classes available is that it is self capable of detecting important features with any human intervention. CNN is also computationally efficient. It uses special convolution and pooling operations and performs parameter sharing.

a.Convolution Layer: The main purpose of the convolution step is to extract features from the input image. The convolutional layer is always the primary step during a CNN. We've an input image, a feature detector, and a feature map. The task is to take the filer and apply it pixel block by pixel block on the input image. We have to do this through the multiplication of the matrices. If we have a 2-Dimensional image input I, and a 2-Dimensional kernel filter K, the image convoluted is calculated as

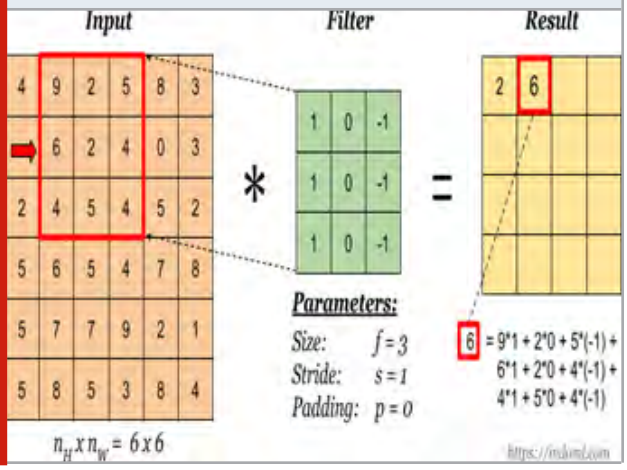
$$(i,j)= \Sigma\Sigma(m,n)k(i-m,j-n)$$

b. Non-linear activation function(ReLU): ReLU applies an activation function onto the feature maps to extend the nonlinearity within the network. Because the images are highly non-linear. ReLU activation function performs a major task of discarding negative values from activation map by changing them to zero.

c. Pooling Layer: The disadvantage of the feature map output of convolutional layer is that it stores the exact position of features in the input which in result means that during the process of cropping, rotation or any other minor changes to the input image will completely results in a different feature map. To beat this problem we use Pooling which is defined as to progressively reduce the spatial size of the representation to scale back the parameters and computation within the network. Pooling layer operates on each feature map independently. It makes it possible to detect objects in an image regardless of where they're located.

d. Fully Connected Layer: The main purpose of the artificial neural network is to combine our features with more attributes. This is done to make sure that the prediction of the classes are done with greater accuracy. This combines features and attributes which can predict classes more efficiently.

Figure 1: Element wise matrix multiplication and summation of the results onto feature map in convolutional layer.



B. VGG-16 Model: VGG -16 is the name of a pre-trained convolutional neural network invented by Simonyan and Zisserman from Visual Geometry Group (VGG) at University of Oxford in 2014 and it was able to be the 1st runner-up of the ILSVRC (ImageNet Large Scale Visual Recognition Competition) 2014 in the classification task. VGG Net has been trained on ImageNet ILSVRC data set which include images of 1000 classes split into three sets of 1.3 million training images, 100,000 testing images and 50,000 validation images. 16 is employed with VGG because it uses 16 layers for filtering. The model obtained 92.7% test accuracy in ImageNet. Following are the 16 layers of VGG-16:

1. Convolution with 64 filters
2. Convolution with 64 filters along with Max pooling
3. Convolution with 128 filters
4. Convolution with 128 filters along with Max pooling
5. Convolution with 256 filters
6. Convolution with 256 filters
7. Convolution with 256 filters along with Max pooling
8. Convolution with 512 filters
9. Convolution with 512 filters

10. Convolution with 512 filters along with Max pooling
11. Convolution with 512 filters
12. Convolution with 512 filters
13. Convolution with 512 filters along with Max pooling
14. Fully connected with 4096 nodes
15. Fully connected with 4096 nodes
16. Output layer with Softmax activation with 1000 nodes.

C. Screen Time Calculation: We are giving 1000 images of different logos of the companies around the globe for training and validation which will be processed by CNN and trained by VGG-16. For the result and actual implementation of Logo Detection we are giving input in the form of mp4 video which includes logos of different brands. The video can be of any products advertisement or any online streaming event which is sponsored by some product companies along with the csv file for the respective video. As the final result we will iterate through the whole video and calculate the screen time of every brand in seconds.

IV. Dataset: The training archive contains cumulatively 1000 images of logos. Our objective is to build a robust image classification model with restrictions of consisting of few training samples of logos (multi-classification problem). We need to downscale the number of images to add a constraint on the input images. We trained our model for validation of approximately 1000 logo images. We have given labels to a few images and train the model on them. After learning patterns by the model, we can use it to predict an unseen set of images. We have mapped the csv file into two attributes, Image Id which consists of the name of each image along with the extension (.jpg) , and class which consists of the corresponding class for each image or each logo type.

Figure 2: Dataset

We leverage the pre-trained VGG-16 model as a feature extractor and transfer low-level features, such as edges, corners, rotation and learn new level features specific to the target problem which is to classify the images. The model takes an input image of shape (224 X 224 X 3). After resizing and preprocessing the images we divide

Figure 3: Output

```
The screen time of Coke is 16 seconds
The screen time of BMW is 0 seconds
The screen time of Yahoo is 0 seconds
The screen time of Google is 0 seconds
```

the dataset into training and validation set. Getting the features of the training and validation set we then use those features to retrain the model. Then we build the model followed by compiling and training the model.

CONCLUSION

This paper proposes a complete logo detection/ recognition from a video. This software can calculate the total time of the advertisement displayed in the video. It makes the invested money in the advertisement worth the sponsorer and avoids dissatisfaction among them. It will help any company to decide the amount to pay for advertising, based on the number of times its logo is displayed in the advertisement. The results fetched for logo detection in a real-time video is an evidence to show that the overall performance of the system is suitable for practical use. The main objective of this paper is to give an in depth information about the Logo Detection System, the technology and algorithms running in the backend of the system and how the system as a whole can be proved beneficial for digital event sponsoring.

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Z-source DC- DC Converter for Low Power Application in Micro Grid Operation

Sangita H Deshmukh[1], P V Kapoor[2] and D. R. Tutakne[3]
[1,2]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management,Nagpur*
[3]*Professor, Wainganga College of Engineering and Managment, Nagpur, India*

ABSTRACT

Nowadays DC- DC converters are widely used in Microgrids for synchronization of distributed generators with AC and DC power lines and for low power applications. Therefore it becomes very necessary to improve the performance of AC–DC convertor The main emphasis is given on power factor improvement on supply side. To achieve this Z-source AC-DC power convertor is proposed in this project. By using Z-source at the input side transient response of convertor gets improved and power factor is obtained nearly equal to unity. Proposed scheme uses ferrite core high density , high frequency transformer . For the proposed scheme results are obtained by simulation and simulation results are validated with the hardware results.

KEY WORDS: HIGH FREQUENCY(HF), DC-DC PUSH-PULL CONVERTOR, HIGH DENSITY, MICRO GRIDS , DC TRANSFORMER.

INTRODUCTION

Nowadays Power electronic converters are widely used in many applications including renewable energy generation, microgrids synchronization ,Initially AC gains more advantage over DC . But now a days DC come back and is replacing AC. For the advantages of DC over AC the main focus is on it's technical advantages from microgrid point of view and it's cost. For proper analysis of DC versus AC two classical transformers i.e. AC transformer and DC transformers are compared. In case of DC fast switching power electronics provides improved performance and controllability which is very poor in case of AC transformers. Again the most serious issue regarding materials required for AC and DC transformers.

AC transformer requires 2.5 kg of copper or steel per kW capacity of grid whereas DC transformer requires 0.25 kg per kW capacity of grid. There are two types of DC transformers depending on single phase high frequency transformer which is applicable for low power applications at low voltage distribution level such as for battery charging applications, industrial equipment/motor drives, electric vehicle/train, aircraft, household appliances, computer power supplies, power for telecommunication equipment, etc The scheme is proposed for single phase high frequency ,high density push-pull AC-DC convertor. Designers of DC-DC power converters are under relentless pressure to increase power density, efficiency, reliability, improves transient response, and reduce cost, preferably achieving all these goals simultaneously, therefore the most important requirement is that the introduction of DC –DC convertor should not introduce harmonics in the system. DC-DC and AC-DC convertors are used mostly to connect solar power to DC and AC microgrids.

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*Corresponding Author: deshmukhsh@rknec.edu
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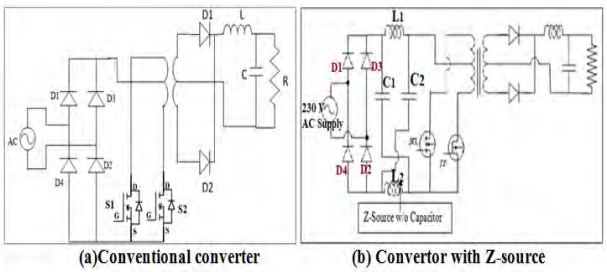
The most commonly used DC-DC convertors are push-pull amplifier, Buck-boost convertors , half bridge , full bridge convertors. In the scheme high frequency push-pull amplifier with z-source at supply side is proposed. With this power factor on input side gets improved and thus power quality gets improved which in turn will reduce the harmonics in microgrids.. This improves the power factor of the source, i.e. of input voltage and input current. Also by using variable duty ratio, variable output voltage is obtained to meet the load requirement. The simulation results for the proposed topology is found using MATLAB and PSIM software. The simulation results are validated with the results of the hardware model of the proposed HF push–pull DC transformer with z-source.

The hardware model for control circuit and power circuit is presented. In the near future the electrical grids based on DC will become more and more attractive and cost-effective than AC. To design a universal interface between DC sources and higher voltage systems and synchronism with microgrids is one of the challenging tasks. In proposed DC transformer with z-source both switching and conduction losses, can be reduced and consequently the overall efficiency can be improved. Another advantage of the proposed converter is its extremely low output current ripple which requires an additional small inductor. All these benefits are obtained without applying additional stress on active components or using transformers.

Research Methodology: HF DC transformer using Push-Pull Topology: Push-Pull topology is used because of its high power handling capability than a buck, boost and buck-boost converter. The control may be introduced at any stage, the actual stage depends on the load requirements and the overall cost structure. In order to improve the performance of conventional DC-DC push pull transformer it is designed with Z-source with soft switching [3] in the input side Figure 1(a) represents the circuit diagram of conventional push-pull DC-DC converter/transformer and figure (b) represents push-pull DC-DC converter with z-source. Figure 1 represents the conventional converter and proposed converter with z-source.

Figure 1: (a)Circuit Diagram of conventional Push-Pull DC-DC Converter (b) circuit diagram of push-pull converter with z-source



(a)Conventional converter (b) Convertor with Z-source

Performance Improvement of DC-DC Converter using z-source: A z-source converter is a unique x-shaped impedance network called Z-source impedance network [1] Work in this thesis represents the study on its superiority compared to conventional converter. The operation principle of the proposed topology and comparison with the conventional topology is analyzed in detail with the help of simulation and then Simulation results are validated with the hardware experimental results to demonstrate the new features of the improved topology and it successfully worked. Figure2 represents simulation circuit of z-source push-pull DC transformer/ converter. Second diagram represents z-source output voltage without filter capacitor. Figure 3 represents complete hardware circuit which includes z-source push-pull convertor , high density and high frequency ferrite core transformer , driver circuit using IR2110 to boost the voltage from 3.92 volt to 8 volts and control circuit for generation 50kHz control pulses using microcontroller dsPIC33EP256MC202. Since proposed DC-DC transformer is a step down transformer, current on input side is very low and therefore z-source inductance required is very small and it is in milli henrys.

Figure 2: simulation circuit of z-source push-pull converter with expected voltage waveforms

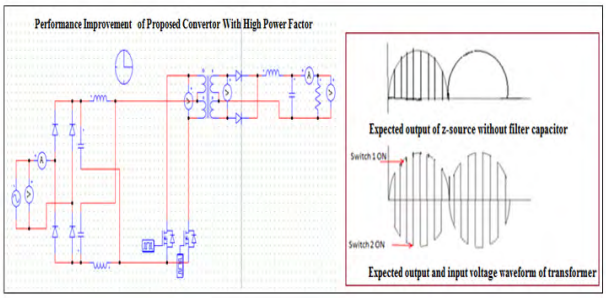
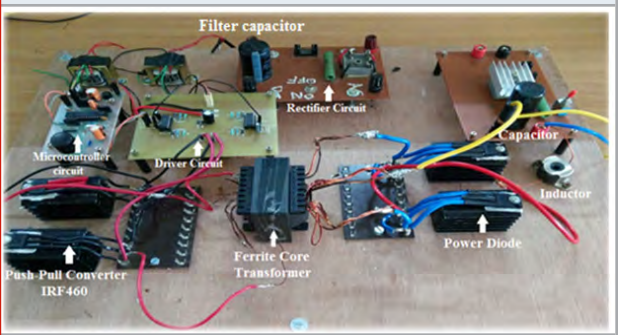


Figure 3: complete hardware set up of z-source push-pull DC-DC Convertor

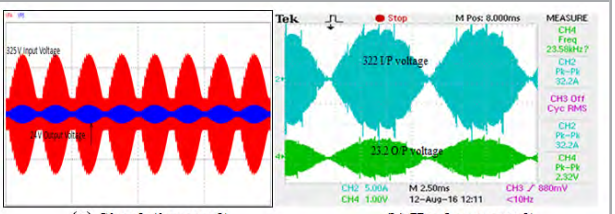


Validation of Simulation results with hardware: Figure 4 (a) represents hardware results of 3.92 volt, 50kHz switching frequency obtained from microconroller dsPIC33EP256MC202 and figure 4 (b)represents 50 kHz pulses from simulation circuit. Figure 5(a) represents simulation results of line voltage and line current and figure 5(b) represents hardware results of line voltage

and line current. It is seen that in both the cases line current is nearly in phase with the line voltage getting nearly unity power factor. Figure 6 represents Improved performance of the proposed converter using z-source showing high power factor on the supply side at 50 kHz. Figure 6 represents high density transformer input and output voltage envelope with z-source. Red color is input voltage and blue color represents output voltage envelope. This result is obtained due to shifting of capacitor from input side of rectifier to the output side of converter.

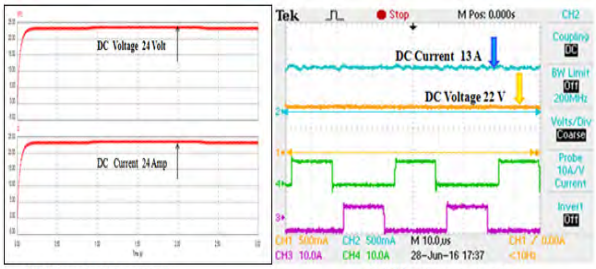
Figure 7 represents DC voltage and DC current across load of proposed converter with z-source at 50 kHz switching frequency. Figure 7 (a) is simulation result which is obtained for 1 ohm load resistor which gives 24 A. and figure 7 (b) represents hardware result which shows 13 A load current and 22 V across DC load. Figure 8(a) represents transient response of DC voltage and current across load without z-source and figure 8(b) represents transient response with z-source both at 50 kHz. Figure 9(a) represents improved performance of the proposed con verter using z-source showing high power factor on the supply side at 50 kHz and figure 9(b)represents performance without z-source resulting in spikes in supply current which results in harmonics.

Figure 6: High density transformer input and output voltage with z-source



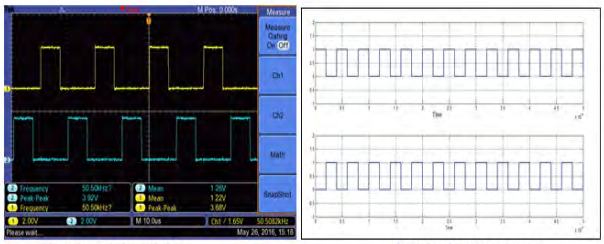
(a) Simulation result (b) Hardware result

Figure 7: Output voltage and current of DC transformer with z-sourse



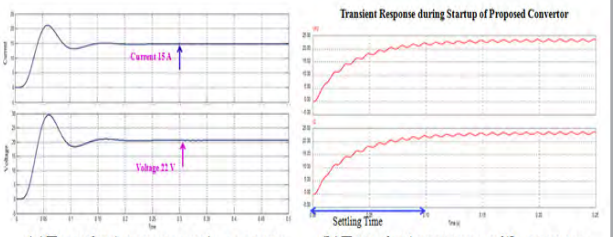
(a)Simulation result (b) Hardware result

Figure 4: 3.92 volt, 50 kHz switching frequency PWM pulses From microcontroller dsPIC33EP256MC202.



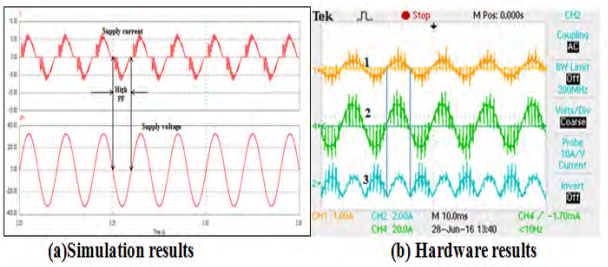
(a) hardware result (b) simulation result

Figure 8: DC current and DC voltage waveform across load indicating transient response at start



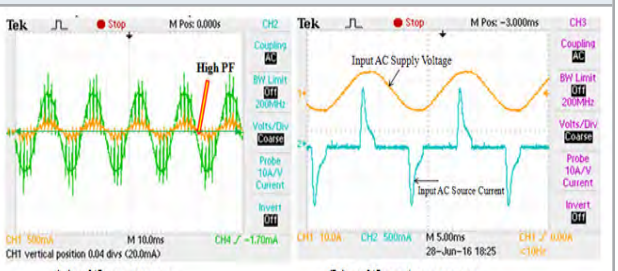
(a)Transient response w/o z-source (b)Transient response with z-source

Figure 5 : (a) Line voltage and line current with high power factor at 50 KHz frequency.



(a)Simulation results (b) Hardware results

Figure 9: Performance of the converter on the supply side at 50 kHz



(a)with z-sourse (b) without z-source

RESULT AND CONCLUSION

Thus it is prooved from the simulation and experimental results that newely developed high frequency high density 50kHz DC-DC push–pull transformer results in high power factor almost unity and also the improved transient response and thus can improve the performance in microgdid for low power applications. Improvement in power factor is the most important feature achieved of this DC transformer which will help in reducing the the harmonics in microgrids. For 50% duty ratio at 50kHz switching frequency shoot through of the switches is taken care by z-source. In this push-pull DC transformer start up current transient response time has reduced considerably.

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Data Mining for Adivasi Vikas Vibhag Mobile App Usage Predictions and Recommendations

Madhavi Khode-Chaware[1] and Aarti Karandikar[2*]
[1]*Ex. Additional Commissioner, Tribal Development, Nagpur, India*
[*2]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management Nagpur, India*

ABSTRACT

The main purpose of digital technology is to connect every strata of the society. The utilization of technology by means of 'mobile government' or 'm-government'can be used to bridge the gap between public needs and services that the government provides. One form of the 'm-government' is the usage of mobile application (mobile app) as a medium of communication.Tribals or Adivasis as they are referred in India are one of the less connected and cut off communities from mainstream. Due to many geographical and technical reasons, both sides – the adivasis and the administration - find it difficult to mingle with each other. At the same time taking every policy to their door step is financially and practically a daunting task as they live in far remote places and hence the communication gap. This paper is a study of the "Adivasi Vikas Vibhag" Mobile App which is one such step towards bridging the communication gap between tribal and administration on digital platform. The data collected through this app has tremendous potential for application of data science tools. Mobile data science is a fast emerging field that involves collecting the mobile phone data from various sources and building data-driven models using machine learning techniques, which in turn will help in making dynamic decisions intelligently in various day-to-day situations of the users.In this paper we discuss how mobile data science can be applied to data collected through Adivasi Vikas Vibhag Mobile App to make intelligent decisions and to enhance user experience.

KEY WORDS: ADIVASI VIKAS, TRIBAL DEVELOPMENT, GOVERNMENT SCHEMES FOR ADIVASIS, DATA SCIENCE.

INTRODUCTION

Adivasis are anintegral part of India and account for 8.2% of India's population. These communities are found all over the states and union territories of India. Due to their different lifestyle and different ideology, culture, tradition and social values they are cut off from mainstream society. The solution to most of the problems lie in keeping tribals informed about various schemes of their benefit.If we can reach out to these people and help them to grow at their traditional habitat, we will be able to preserve the culture and values of these communities at the same time it will help to preserve cultural and social heritage of India.In Maharashtra,there are 10.33 million tribals like Kolam, Katkari, Bhil, Gond/Rajgond, Warli, Kokana, Thakur, etc. There are many schemes and policiesby government for these tribals. But the ground reality is that government does not have machinery or a system where person to person contact with each Adivasi is technically possible.

A practical case of Adivasis from far remote place called as Timeli which is some 50 km from Bhamragarh will make thing more clear. Astonishingly, even Google map fails to show the road map and distance of this place. If any person from a small village from above example, like Timeli or similar remote small village wants to know

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some information about Government schemes, he has to spend a day's time and almost one day's wage of his monthly income just to get the information about the scheme of his interest in first visit. Then he goes back to his place, collects all documents and again spends another 3 to 4 days wages of his income in multiple visits to offices for submission of documents, verification and follow-ups. If the problem is not solved or the need is not fulfilled at Bhamragarh, he has to come to Gadchiroli or to Nagpur where he spends much of his monthly income to get the right information about particular scheme. Overall situation is such that he spends almost 20 to 25 % of monthly income along with loss of almost 4 to 5 man days and a loss of equal amount of energy in successful filing of an application to get the benefits of Government schemes.

In such scenario, digital connect is the best possible way to reach out to every Adivasi in the shortest span. This is economically viable for both parties, administration as well as Adivasis.Developed under guidance of Additional Tribal Commissioner (ATC) Nagpur Dr. Madhavi Khode-Chaware, and endorsed by Maharashtra Government, the Adivasi Vikar Vibhag mobile app is on its way to success. The app is getting good response from the tribals with over 23000 download in 1.5 years. This paper focuses on possible applicationsof mobile data science tools on the data collected through the existing app. A quantitative analysis of the data will revealwhat type of schemes are popular in a particular district or area, what type of problems tribals of a particular areaare commonly facing, what type of documents are frequently needed to apply for a given scheme, how manypeople benefited, which schemes are garnering good response, and factors influencing availing of various schemes. An analysis of the app surfing patterns of the adivasi can disclose future demands or needs of the tribals. Thiscan be used to create a predictive tool to study problems faced by tribals regarding various government schemesand policies and use it to evaluate different schemes and policies.

MATERIAL AND METHODS

This research uses an 'exploratory research' approach to explain how the mobile app is used in the context of providing vital information, about various schemes and policiesof the government, to the Adivasis.Exploratory research is the process of investigating a problem that has not been studied or thoroughly investigated in the past.
The information in app is classified in 5 different heads on the home page:

1. Gallery
2. Different Schemes of Government
3. Important Addresses and Contact Numbers
4. Suggestions/Requests/Enquiries/Queries.
5. Important Services for citizens

The most important Tab is Tab Number 2 which showcases different schemes of government. This Tab is further sub classified as:

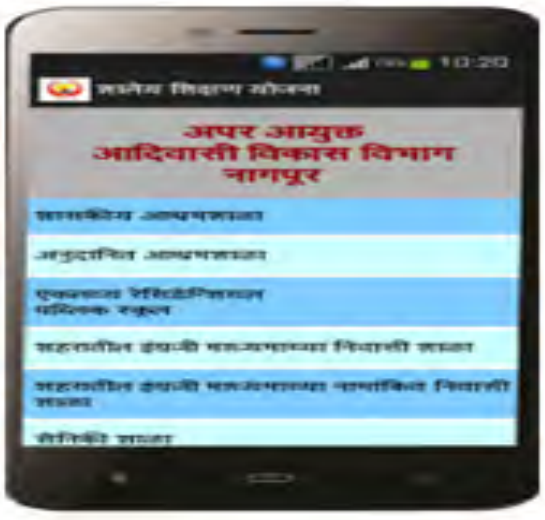
1. Schemes of Educational Importance
2. Schemes for Individual Benefit
3. Schemes for regional development
4. Schemes for community development
5. Other Important Events.

Figure 1: App interface of Tab Number 2 showing different schemes of government.

Every sub-tab is further divided into categories which are easy to understand. For example under Educational Schemes, the app provides 4 important categories:

1. Primary Education
2. Hostels for tribal students
3. Scholarships / and fee structures
4. Other educational schemes

Figure 2: Page showing different schemes under a category.



Once we select a category of our interest, the app provides full listing of all schemes of selected categories. The user can select any scheme of his/her interest and search all detail information of the scheme. The following important information is provided in Marathi language for the user that is Adivasi.

1. The outline of scheme.
2. Eligibility criteria
3. Necessary documents required for the scheme.
4. Sample form.
5. All important addresses and contact numbers of concern departments and officers.

DISCUSSION

This research uses sample data set for illustration purpose. To implement the algorithms of data science and to improve the throughput of the digital application from perspective of planning and implementation, it is very much necessary to collect the data in a scientific way. The scientific data collection is a first step towards implementation of effective data science algorithms. Consider the following descriptive statistics of the app are : there are around 23000 downloads of the app till September 2020 and the app is opened for 76000 times. This means on an average after downloading every user is visiting the app three or four times.Currently, the app does not support user registration. If this feature is included in the app, it will facilitate maintaining user related information. The users can be classified as 'traveller' or 'explorer' where traveller is a user who browses the app at a glance and explorer is a user who is interested in gathering information provided in the app. Number of hits for a traveller will be very less, hardly one or two, as compared to a explorer who may visit the app multiple time, usually three and more. If explorers are identified, the app can be reconfigured to cater to their specific needs.

Table 1. Number of hits on Tab Number 2 (Representative data only for illustration purpose)

Name of the scheme	Number of hits
Schemes related to education	23001
Schemes related to individual benefits	65780
Schemes for regional development	52311
Schemes for community development	38967
Other miscellaneousschemes	16554
Total hits	196613

Table 1 shows representative data about the number of hits on Tab Number 2 which showcases different schemes of government. The figures suggest popularity of schemes of individual benefits by the Adivasis. Table 2 gives representative data about number of hits under various schemes of individual benefits.

Table 2. Number of hits for Individual Beneficiary schemes (Representative data only for illustration purpose)

Name of the scheme	Number of hits
Schemes for youths	34988
Schemes for farmers	26655
Schemes for women	11970
Schemes for household	22008
Other schemes for individual benefit	15607
Total hits	111228

Using statistical analysis methods like Linear Regression we can predict a dependent variable by fitting a best linear relationship. Classification techniques of data mining can be used to categorize the users. In this app, the databasecan beredesigned to record the details of browsing pattern. Every page hit, event hit, session hit could be properly logged and stored in the database. Patterns like which types of schemes get maximum hits in which months, preference of specific section of users for specific schemes can be generated. Association mining can be applied to find which schemes are searched together.

If search patterns for a user are stored, layout of the screen can be dynamically generated based on his preferences. Natural language processing can be applied on the queries asked by the users and a Frequently Asked Questionnaire can be automatically generated. The automatic discovery of user navigation pattern can be done by tracking button/tab clicks. The button/tab click logs are created on daily basis at the time a user clicks a particular button/tab. The paper suggests restructuring of app contents according to the user preference and pattern. An optimal path for every type of user can be generated by considering the click pattern.

CONCLUSION

The data of app downloads for informative government apps show that the Adivasis and job seekers are more inclined towards digital platform for information collection than other class of people. Those who are struggling and those who want to explore future prospects use informative government apps more than those who are economically stable. This proves that the app is a best media to reach out to Adivasis. Hence we should develop more digital material for Tribals of India to provide equal opportunities of growth. Right from date of launching there is a steady and consistent download for the app. Almost 500 downloads per month is a rate of download. Considering the illiterate class with minimal connects and exposure to cyber world, we consider this rate as amazing response. This shows the thrust of every Indian to acquire the information of his/her importance.

Authors felt that the app is an important milestone on the path of Digital India and will be instrumental in bridging the gap between urban and developed society on one side and Tribals or Adivasis on other side. Platforms like this provide an excellent opportunity for industry-institute collaborations. In future, user registration facility can be added in the app. The data can be stored on a cloud based platform for online registration, scrutiny and approval. Mobile data science tools and analysis methods can be applied on the data collected through this app to gain meaningful insights into the requirements of the Adivasis which will help the administration in making decisions and introducing new schemes.

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Adaptive Hand Gesture Recognition System Using Machine Learning Approach

Rina Damdoo[1*], Kanak Kalyani[2] and Jignyasa Sanghavi[3]
[1, 2, 3]*Department of Computer Science & Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

One of the most important problem faced by our society is that deaf and hearing-impaired people are finding it hard to come up with the advanced moving technology. The sign language plays a vital role for these people as only through the sign language they can communicate with each other. But for other people it is very challenging to understand the sign language. But as we know, it is not feasible for everyone to learn sign language, need of a smart gesture recognition system for sign language is evolved. Sign language basically includes the various movements of palms, hands and other body parts. Gesture depicts an image of a specific body part. Gesture recognition is an advanced technology which is used to recognize the posture of body parts. Objective of this type of software is to provide medium between the human body movements with computer system. In gesture recognition system particularly hand gesture recognition provides a much effective and natural way for non-verbal data exchange when working with HCI system. This paper presents a real time vision approach for recognizing hand gesture based on machine learning using MATALB. Information gathering is a first step in our proposed approach where we will develop dynamic hand gesture dataset of sign language. In next step we will represent our original proposed framework to depict hand gesture recognition with the help of hand shape and its various motions descriptors. This second step will recognize the sign once it has been captured and is much challenging trade, especially in a continuous stream which a main focus of our work. In this paper we have presented an adaptive hand gesture recognition system using machine learning approach which is adaptable to multiple applications, thus making the gesture recognition systems to be application adaptive.

KEY WORDS: ADAPTIVE HAND GESTURE RECOGNITION, MACHINE LEARNING, HUMAN COMPUTER INTERACTION, COMPUTER VISION.

INTRODUCTION

Recent study revealed that various hand gesture recognition is a trendiest area of research that attract lots of researchers in the field of machine learning and computer vision-based system. In this gesture recognition system specifically adaptive hand gesture recognition approach is a most common way for interacting with HCI system where researchers are working mostly to develop application that can be operated with the help of only human being's gestures that include various parts of human body like hand, legs, facial expression, various musical facial expression etc. without taking help of any extra communication devices. HCI systems has been developed by combining various types of sub-domains like 3D/2D graphical interfaces systems, different types of multimedia based supported interactive systems or any virtual Advanced Environment based interactive system.

Including various advanced complex worldview to human being correspondence, cooperation, training & learning, Virtual environment frameworks additionally

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give different complexities as it has more advanced ways of data-presentation techniques and data exchange. For accomplishing common HCI collaboration for the virtual environment-based Systems, generally various hand gestures can work as a data input for system. Nevertheless, the excellent representation of different hand motions is still uncovered in every field of HCI based system-application. Basically, the various methods applied for solving the hand gesture-based system consist of determining the specific number of pixels in the captured image which covers the image of hand gesture, extracting the various features of captured picture for determining the pose and the occurrences of specific pose sequential data of the real time movements of the same. Various gesture analyses the deep interpretation of different human being behavior from different visual input device and is one of the latest research areas for researchers.

It is not just because of its ongoing and excited scientific challenges but also motivated by the increase of social requirement in terms of various software applications, for example modifications in real and virtual environments, monitoring system like CCTV security systems, medical support system, entertainment system etc. In real time application the accurate data should be fed so that the working of system should be evaluated very precisely. Hence accurate and complete gesture data should be obtained for any gesture recognition system. This paper proposes an approach for adaptive hand gesture recognition based on machine learning algorithm namely Artificial Neural Network (ANN). Here we have tried to represent the basic steps that should be carried out for extracting hand gestures from a sequential image frame of real time hand gesture. The rest of this paper is designed as follows: First we will review literature in this area. Next, we present the brief description of proposed methodology followed by the result obtained with two different light conditions and conclusion.

Literature Review: Recent study shows that many varieties of technology has been applied in gesture recognition system. Now a day's advanced machine learning algorithm has been applied successfully to various areas of research such as automatic face recognition system, automatic musical gesture recognition system, gesture recognition system, classification of various human's activity recognition system of automatic robotic road-detection system etc. Table 1 Compares various Gestures based techniques.

Hand Gesture Techniques: For accomplishing any type of work, initial step is to collect proper and complete information. For hand gestures recognition system, many techniques are available that can be used to determine input information for the system. Few prominent methods are listed below:

1. Vision based approach
2. Glove/Sensor Based approach

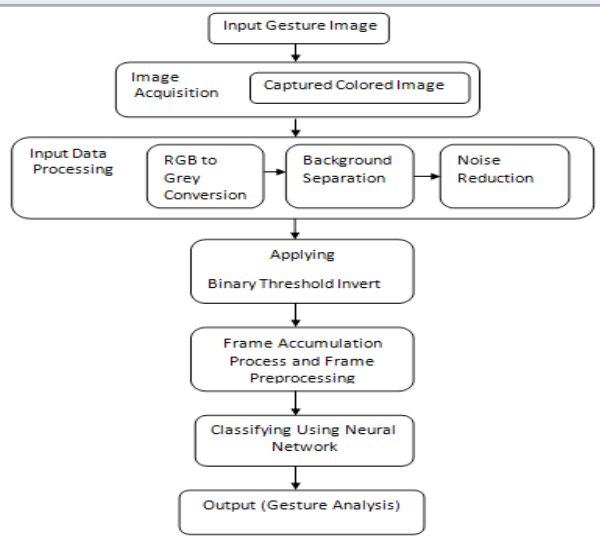
Vision Based Approach: In this type of approach [10], the web camera of computer system is used as an input device to take input from the user for providing data as input to system. Here web camera is working like a vision system for the approach. This approach just needs a good quality of camera thus analyzing a natural vision of interaction between human and computers system.

Glove-based Approach: In this approach artificial hand gloves are generally used to provide the accurate position of hand gesture as an input to the system. These hand gloves basically consist of various sensor devices of digitizing hand and various finger positions accurately into non-parametric information. The add-on extra sensor device provides help to get more accurate hand configuration and various hand movements. This type of artificial hand glove is little expensive device and should be handled with lots of care, especially if a user is a non-technical person. This approach needs lot of set-up with the devices as the artificial hand gloves is connected externally with the system using different type of connecting cables and sensor devices.

Proposed Methodology: Now a days touch-free technology is developed everywhere. Now we don't need any device to connect with the computer system. We have wireless mouse to connect with system, just like keyboard, display device etc. For various technological applications gestures recognition plays a very important part. Specially in non-verbal communication which include hand movement, are considered as hand gesture recognition system. Non-verbal communications which include hand movement are considered as Gesture. Hand gesture recognition system are categorized into two types of gesture recognition as:

1. Static Hand gesture Recognition
2. Dynamic Hand gesture Recognition System.

Figure 1: Block Schematic of Proposed System



Our research work mainly focuses on dynamic hand gesture recognition system. Here in adaptive hand gesture recognition, real time movements of hands are included and analyzed by the system. Our proposed approach is based on convolutional neural network machine learning

algorithm. These types of network are mainly developed to recognize different visual patterns. Basically, set of image frames of hand position in every second is required for processing of our proposed approach. Fig 1 shows the block schematic of our proposed approach.

Our proposed approach will work in following three steps:

1. Capturing the Hand Gesture
2. Extracting the features
3. Recognizing the Hand Gesture.

Processing Steps: Step-1] Initially real time hand gesture is first fed to the system as an input as shown in Fig 2 a, b, c, d. Here the web camera or any image capturing device can be used as input device to the system. At a time at max 30 frames can be processed.

Figure 2: (a) Frame-1, (b) Frame –2, (c) Frame-3, (d) Frame-4

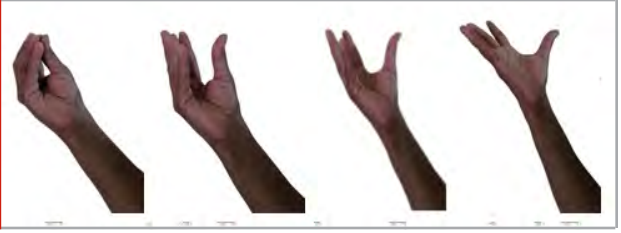
Step-2] Color Conversion Process: After the captured image is stored and processed by image capturing system it will do conversion of RGB colors in grey scale colors. This color conversion is called as RGB color presentation to HSV (Hue, Saturation, Value) image presentation. HSV color system has a color combination of Hue in "Radial Slice" manner with a center of point of each radial is a neutral color which comes mainly in color range of white to black in every top. The specific values are then used to find particular area of frames region:

F=max (G, R, B)
RGB color function uses following formula to determine min and max range of different color of an image.
RGBmax=MAX (R, G, B)
RGBmin=MIN (R, G, B)
Following is the algorithm used for converting image from RGB color into HSV color model.
Step-1] Y=(0.299*R) + (0.587*G) + (0.1115*B)
Step-2] U=(B-Y) * 0.0565
Step-3] V=(R-Y) * 0.713
Step-4] UV=U + V
Step-5] R1=R*0.299, R2=R*0.0569, R3=R*0.114
Step-6] G1=G*0.299, G2=G*0.589, G3=G*0.115
Step-7] B1=B*0.288, B2=B*0.537, B3=B*0.114
Step-8] R4=R1+R2+R3/3, G4=G1+G2+G3/3, B4 =B1+b2+b3/3
Step-9] End

Step-3] Background Separation Processing: In this step the identification of the moving object is done from the current scenario. As shown in Fig. 2 a, b, c, d the

If abs(Similarity_Prev_Similarity) > T1;
Progress += c;
Prev_similarity=similarity;

Figure 3: (a) Frame 1, (b) Frame b, (c) Frame 3, (d) Frame 4



background of image was having blue color which has been removed here in this step and the output is shown in Fig.3 a, b, c, d.

For removing the background from the captured image various methods are available which is elaborated by author Z. Vkovic [7] which is based on Gaussian calculative method for image segmentation in which every pixel is analyzed and used to subtract background form the moving hand in the captured image.

Step-4] Noise Reduction: In real time image capturing process, lot of noise is also captured with the input hence the noise must be removed from the input image. Here in this step captured noise is removed by applying median blur method with a particular kernel capacity of 12 to each frame for smoothing the image.

Step-5] Applying Bit/Binary Threshold Value: For obtaining the uniform binary image frameset binary thresholding process is applied where the inversion process of black and white color is done in the image. Typically, thresholding is needed to generate global threshold value. It should be noted that its value is varied in different light conditions is an image captured.

Step-6] Frame Accumulation & Processing: Here all the pre-processed frames will be accumulated for recognizing the gesture. The last frame will be in light color and more deviation time. The value of color intensity will completely depend on the movement of the hand motion occurred. Hence the brightness of the upcoming frame will depend on the deviation between the current and previous merged image and the time of the frame captured with image capturing device. The deviation calculation method is elaborated in [8] by author Zhou.

Step-7] Processing of Frames: For processing of frames following algorithm is used;
Step-1] Start
Step-2] Replace all 0's in "frames" having value of "PROGRESS"
Step-3] After_Mod= mod(frame, 255);
Step-4] Merged_Frame = ADD(After_Mod, Merged_ Frame)
Step-5] Similarity = Struct_sim(init_Frame, Merged_ Frame)

If Similarity < T2;
Classify (Merged Frame)
Step-6] End

Step-8] Classification Process: Here in this step frames are continuously fed to Recursive Neural Network (RNN) for classification process & the gesture is analysed. Here RNN is used which consist of basic thee layers. Every layer in this network contains 200 neurons. Gradient-Based optimization technique as described in paper has been selected as solver which is best suitable for large dataset and capable of handling too much noisy gradient data, needs very less memory for processing and proven excellent network for real-time application. As we had captured 2-D images and for giving them as an input to neural network, particularly 1-D array is generated using "FLATTEN" method. For training the RNN, hand movement details of every frame are generated and stored in memory. Afterwards these stored images will be transferred from memory with their details and given as input to RNN.

After the completion of training with selected dataset, this network is combined with the storage memory further for accomplishing classification processing and this has been done by us using python library functionalities. Gesture analysis is done by measuring structural value which is mentioned in Step-7. Similarity of frames value is calculated using algorithm given in Step-7. Initially the measure value of T1=1, as soon as the system user will start moving his/her hand in any direction, it will start reducing and will continue till the deviate value from blank white image. If this measure value will get reduced lower than our decided threshold value T2, immediately the final frame is sent to recursive neural network to further classification process.

RESULTS AND DISCUSSION

For execution purpose Intel corei7 (2.8 GHz) Mac OSX with 8GB DDR3 system configuration is used. We have considered real time hand gesture & the frames have been captured and classified in real time style with the help of inbuilt web–camera of system. For execution process we have considered light condition to see the effect of the variation of light in performance of our system.

Table 2 depicts the adaptive real time hand gesture analysis in two different light conditions of two different system users. Roman numbers describe the hand gestures. As depicted in Table 2 with good light situation, our proposed system is having 89% success where as in poor light condition the success rate of our proposed system is 79%. Hence, we can conclude that in our proposed system light has a significant effect gesture recognition ability.

Table 2. Success Rate with two different User Hand Gesture Analysis

Gesture	Good light Condition (% Success rate)					Poor light Condition (% Success rate)				
User	i	Ii	iii	iv	%	i	ii	iii	iv	%
1	99	82	90	89	88.9	89	79	88	67	72
2	89	90	89	80	92	68	61	70	67	66.9
Total	94	86	89	85	90	78	70	79	67	69

CONCLUSION

From past years we analysed that dynamic hand gesture recognition has been proven a complex challenging issue, in so many areas and hence our research work is a bit ahead solution for these issue towards gaining the desired result in ongoing research field. We had tried to propose a vision based and RNN-based adaptive hand gesture recognition system. Result shows that light condition will have much effect in the performance of our recognition system. Good Light will provide better result than a poor light condition. In future this effect can be reduced by applying filtering method. Neural network classification provides excellent way for classification process and identifies a correct gesture with good probability. Real–time execution with RNN will gives considerably good results.

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Performance Evaluation of Content-Based Image Retrieval Using Block Truncation Coding and CNN

A. P. Nilawar[1] and C. G. Dethe[2]

[1]*Assistant Professor, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

[2]*Director, UGC HRDC, R.T.M.N.U., Nagpur, Maharashtra, India*

ABSTRACT

Retrieving similar images from a large image database is a critical task. The solution to this problem is the use of a Content-Based Image Retrieval System. The images are described through their content, there is three predominant content existing in an image like color, shape, and texture. In this paper, we are evaluating the performance of the CBIR system using two methods. The first method consists of Block Truncation coding (BTC) with Grey level co-occurrence matrix (GLCM). The second method consists of Use of CNN. The feature extraction technique is achieved based on an input query image from the database and features are saved in a feature dataset. A proposed strategy retrieves similar images from a database that fulfills the user's desire. The similarity measurement can be done using the Euclidean distance and hashing technique. The overall performance of the retrieval system has been analyzed through the parameters Precision and Mean Average Precision. The experimental result shows encouraging results using CNN which leads to improving accuracy.

KEY WORDS: CBIR, BTC, GLCM, FOM, CNN.

INTRODUCTION

CBIR incorporates the extraction of features from an image essentially based on its content, estimating likeness between the query image and image in the database, and positioning from generally tantamount to the assorted image. CBIR system has two essential stages in the main stage the pre-handling for image database alluded to as image highlight extraction based on the sort of features like color, shape, and surface. What's more, in the second stage estimation of likeness from database image alluding query image gave using the user.

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*****Corresponding Author: aa.nilawar@gmail.com

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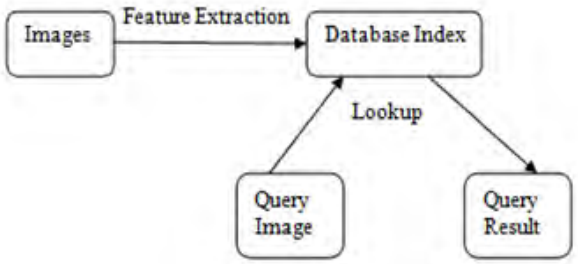
The above figure explains the basic operation of the CBIR System. In the retrieval system, there are essentially three most important fields text-based image retrieval, retrieval based on visual feature, and semantic features. In a text-based image retrieval system images are provided through labels and for retrieval cause similarity of these labels are used. A predominant disadvantage of these types of structures is that a lot of human work evolved for image labeling and if the database of images in a massive quantity then it is pretty difficult. And labeling of images is no longer user friendly it relies upon database creators labeling strategies (Song, H., Li, X. and Wang, P). Then the visual-based photo retrieval systems used for image retrieval purposes and low-level features are considered for feature extraction (Ganar, A.N et.al.). Presently CBIR is based on visual features along with semantic features in use. There are three most important features are existing in an image specifically color, texture, and shape.

Figure 1: Basic CBIR System



Color Features: Images are largely categorized into grayscale images and color images. In a grayscale image color pixel having a solely grayscale area while in a color image three color intensity ranges are used. In the color image red, green and blue intensities are used. Color histogram, color coherence, and color moments are important methods used for image retrieval

Texture Features: It measures the homogeneity of a pixel over repeated patterns in the image. We can format a retrieval system the use of two tactics particularly structural and frequency-based approaches

Shape Features: It gives edges or outlines of an object existing in an image. Region and boundary-based techniques are used in the retrieval systems based totally on shape features

Neural Network: A neural network consists of the input layer, hidden layer, and output layer. Convolution Neural Network is used for feature extraction from images.

Lituratture Survey

Block Truncation Coding: As explained in (Gahroudi, M.R. and Sarshar, M.R.), BTC has proven its use in the compression area and additionally, we can efficaciously use it in the CBIR application. BTC is an image ciphering technique, various advanced ciphering methods developed the usage of BTC (Qiu, G.).BTC can be used in image compression, ciphering, and retrieval applications. It consists of two tactics encoding and decoding. In the encoding process, it will divide the entire image into several image blocks having two quantizers particularly high and low. In this technique mean value and standard deviation are calculated for every block. Then the mean value is compared with every pixel in the image if the mean value is greater than the pixel value changed by using 1 in any other case pixel value replaced via 0. First, we will convert the image into a grayscale image, then the grayscale image is divided into several blocks of different sizes like 2 by 2, 4 by 4, 16 by 16, and so on. In the next stage, we will compute the mean value and standard deviation. After computing, the mean value bit map pattern of an image is generated.

Table 1. Gray Scale Image

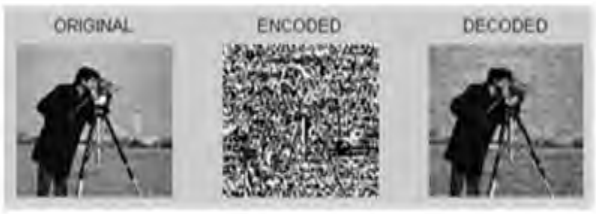
140	142	144	145
146	141	146	142
145	141	144	142
142	138	141	144

Table 2. Binary bitmap pattern

0	0	1	1
1	0	1	0
1	0	1	0
0	0	0	1

In Table, I grayscale image of block size 4 by 4 considered. The mean value for this block is 142.5 and the standard deviation is 2.199. If the mean value greater than the pixel value, then the pixel value is replaced by 1 otherwise pixel value is replaced by 0. By using this method table II was generated. In decoding two quantization levels as high and low are used to reconstruct value from the encoded block. Figure II shows the encoding and decoding process using BTC.

Figure 2: Illustration of BTC



2.1.1 Similarity Measurement: Euclidean distance is the most frequently used technique to discover the similarity between images (Wang, L., Zhang, Y. and Feng, J.). Euclidean distance measures the similarity between the query image and images existing in the database. Assume X is a set of query images and Y is a set of images in the database. The measuring technique can be carried out on X=[X1, X2....Xm] to every component in Y= [Y1, Y2... Yn] the usage of the following equation

$$d = \sqrt{\sum_{i=1}^{k}(Xi - Yi)} \text{ ^2} \quad (1)$$

Where,

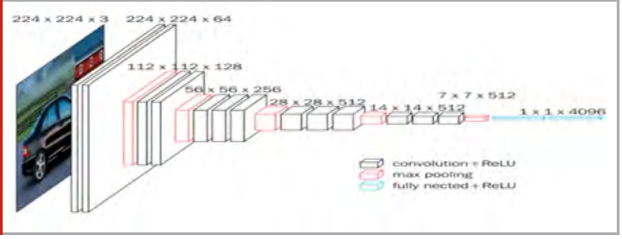
Xi and Yi represents the feature vector of the query image and image in the database at component i respectively

K represents the complete number of the component in individual feature vectors

d represents the similarity rating between query and image database

Convolutional Neural Network: The Convolutional Neural Network is a neural network having four steps. The first step is applying convolution to input. Convolution is a mathematical operation in which two functions are used. The values of the functions are changed due to convolution. For the application of CNN in image processing, the feature detector is needed. Generally, the Feature detector is a matrix of size 3x3.In convolution operation, this feature detector is applied to an image, and after convolution operation, we get a matrix with some values, which are different from the original (Wang, L., Zhang, Y. and Feng, J).In this step, a feature detector is applied to the input image which results in the generation of the feature map. After feature map generation for removing unwanted information, the ReLU rectifier function is used. In the second stage, the pooling operation is performed. There are three types of pooling are used namely max pooling, mean pooling, and sum pooling (Li, J. and Wang, J.Z).Stage three consists of flattening which generates a feature map. And in the last stage full connection is done. The softmax and cross-entropy are two functions used for improving CNN (Kuo, C.).

Figure 3: CNN Used for Feature Extraction



The above figure III shows Convolutional Neural Network which is used for feature extraction. In this network, CNN along with ReLU is used along with max pooling. The input for this network is an image. The output provides a feature vector of 4096 elements. This network is also known as the VGG16 network (Simonyan, K. and Zisserman, A).

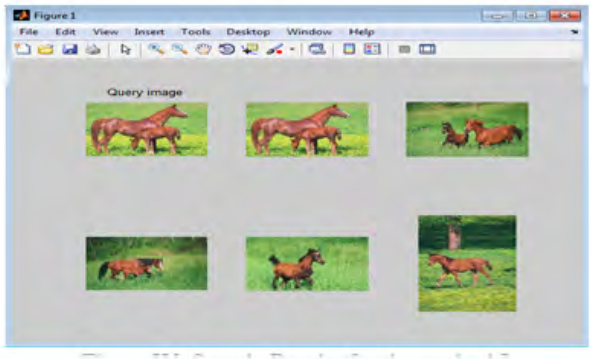
Similarity Measurement: The similarity between the query image and images in the database is measured by various methods. Euclidean distance, cosine distance, and Hamming distance is a popular algorithm for measuring similarity. In this paper, we will use the Approximate Nearest Neighbor method (ANN).ANN also is known as Locality Sensitive Hashing (LSH). Let us consider the database of images having various categories like bus, bird, planes, etc. After applying CNN feature vectors are generated for each image. Each vector represents the feature of an image. In ANN each Feature vector is provided to the hashing function. The hashing function is nothing but thresholding. It will convert feature vector value in either 0 or 1. After applying the hashing function the vectors having closer values are put into one common basis vector. In this way, various basis vectors were created. During the retrieval basis vector of the query, the image is compared with the basis vector of the image database and provides results. In this process since the basis vector consist of various vectors hence retrieval takes less time as compared to other functions.

Proposed Methods

Method I: Block Truncation coding with GLCM: In this method first, we apply BTC to all images in the database. For each image, GLM is calculated. And these feature vectors are indexed in the database. This system is implemented on the Wang database which consists of 1000 images spread across 10 categories (Wang Image Database). The algorithm for the proposed system is given by,

Step 1: User has to select rectangular block of size 2 x 2, 4 x 4 or 16 x 16.
Step 2: Then depending on the selection of block size image divided into non overlapped blocks.
Step 3: the Preprocessing process starts where each image in the database applied by BTC.
Step 4: After application of BTC, GLCM applied to an image.
Step 5: For every image, feature extracted and indexed in the database with the feature vector.
Step 6: After preprocessing done user has to provide a query image.
Step 7: Using Euclidean distance similar images are displayed

Figure 4: Sample Results for the method I

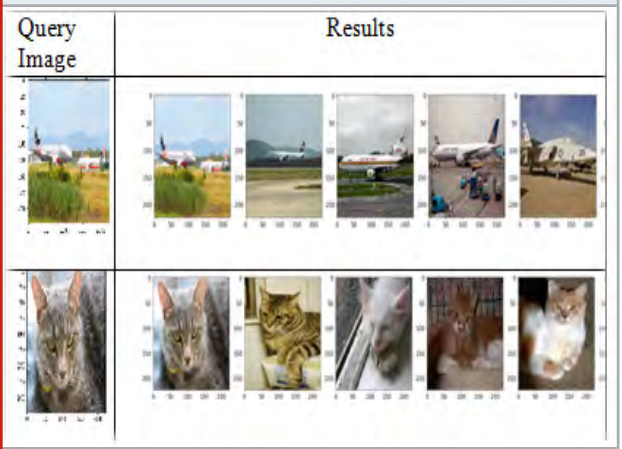


Method II: Convolutional Neural Network: In this method pre-trained CNN network is used. VGG16 is a pre-trained CNN network. The last layer of the VGG16 network was removed. Each image in the database generates 4096 elements as features. This proposed system is applied to the image database which consists of 1000 images spread across 20 categories (Rashtchian, C et.al.). The algorithm for the proposed system is given by,

Step 1: In an image database several images with different categories are present.

Step 2: These images are fed to CNN for feature extraction.
Step 3: For each image feature vector generated. Each vector consists of 4096 elements.
Step 4: Features are indexed in the database.
Step 6: The user has to provide an input image considered as a query image.
Step 7: Features of a query image extracted using CNN.
Step 8: Using ANN similarity between features of query image matched with index.
Step 9: Finally top 10 similar images are displayed.
Step 10: Repeat from step 6 for another input.

Figure 5: Sample Results for method II



RESULTS AND DISCUSSION

The performance of the system was evaluated using two parameters Precision and Mean Average Precision (MAP). Precision is the ratio of the number of relevant images retrieved to the total number of images retrieved.

Table 3. Results for Precision

Category	Method I
Airplane	87.75
Beach	83.38
Building	86.75
Cat	84.25
Dinosaurs	90.75
Elephants	82.75
Flowers	86.25
Horses	82.25
Mountains	80.25
Food	85.75
MAP	85.01

$$MAP = \sum_{k}^{K} \frac{Avg\ P(k)}{K} \quad (2)$$

Where k = value of precision for query and K is the number of query images.

Table 4. Results for Precision

Category	Method II	Category	Method II
Airplane	96.18	Dining Table	96.28
Bicycle	96.28	Dog	98.40
Bird	96.28	Horse	97.40
Boat	96.70	Motor Bike	96.18
Bottle	95.70	Person	96.50
Bus	97.24	Plant	95.40
Car	98.20	Sheep	96.28
Cat	96.25	Sofa	95.20
Chair	96.90	Train	96.24
Cow	96.85	TV	98.36
MAP		96.64	

Table 5. Comparison with existing methods

Methods	Images in	MAP
Color in YCBCR, Color Moment (Dandotiya, Y. and Atre, A)	Database 1000 Images	82.70
HSV Color Histogram and Hu moment invariant (Rajkumar, R. and Sudhamani, D.M)	1000 Images	84.20
BTC with GLCM (Proposed)	1000 Images	85.01
CBIR Using CNN (Proposed)	1000 Images	96.65

The above tabular data is conclusive for providing a comparison between two alternating methods BTC and CNN which provides better results on comparison with previously reported methods. For the requirements of providing better results of color features one needs to look up to BTC with GLCM providing 85% MAP. Whereas when one requires greater precision one should utilize CNN where one gets precision above 95% MAP as highlighted in table V. Also as categories increase one should opt for CNN for evolving precision as shown in table III and IV.

CONCLUSION

Analysis of color features is done using BTC and analysis of texture utilizes GLCM. The main contribution

of merging the two methods provides us handcraft features that help in increasing the precision for image retrieval. To provide a better solution towards feature extraction as well as the training time of the database we personalized CNN with the view of the generic image database. This helped in our research findings with an enormous improvement in the precision of image retrial and classification. Research of this decade shows the advantages of CNN in image classification but our current contribution provides us a breakthrough in utilizing CNN for image retrieval as well.

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Detection of Plant Leaf by Image Processing Using MATLAB

Kanchan Dhote[1] and Kartik Ingole[2]
[1]*Assistant Professor,Dept. of Electronics Engineering, Shri Ramdeobaba College of Engineering & Management Nagpur, India*
[2]*Assistant Professor,Dept.of Electronics Engineering, KDK College of Engineering Nagpur, India*

ABSTRACT

Agriculture is the most vital area in Indian economy. Therefore, inside the agriculture subject, detection of flowers disorder plays a first-rate function. If proper care of plants isn't taken then it reasons extreme results on flora and due to which respective product excellent, quantity or productivity is affected. In a few countries farmers don't have proper facilities or even concept that they could contact to professionals. Due to this consulting experts costs high. Manual monitoring the plant leaf sickness is very critical undertaking and also time eating too .The effects acquired also are no longer exceptional. Automatic disorder detection technique is beneficial at preliminary stage for detecting disease. If computerized disorder detection approach is used then it will take much less effort, less time and additionally offers more correct outcomes. Disease detection machine includes the steps like photo acquisition, photo pre-processing, image segmentation, feature extraction and category.

KEY WORDS: IMAGE PROCESSING, IMAGE SEGMENTATION, FEATURE EXTRACTION, SUPPORT VECTOR MACHINE ETC.

INTRODUCTION

The Indian economy relies upon heavily on the productivity of agriculture. Therefore, the detection of plant ailment performs a primary position within the agricultural area. If ok plant care is not taken, it creates extreme plant affects and influences the first-class, amount or productivity of the corresponding object. Unhealthy area of plant leaves is the place on leaf which is stricken by sickness, so that it will reduces the great of plant. Automatic ailment detection technique is beneficial at preliminary stage for detecting sickness. The existing approach of detecting ailment in plant life is really expert naked eye statement. This calls for a huge team of professionals and continuous tracking of the plant, which for massive farms fees very high. Farmers in some international locations do not have good enough gadget or even the concept of contacting specialists.

Due to which consulting experts even value excessive and it's time eating too. In such situations the cautioned method is useful for monitoring large fields of crops. Detecting sicknesses in an automated way via just searching at the signs and symptoms on leaves makes it less complicated and cost powerful. This affords support for gadget imaginative and prescient to give photo primarily based computerized procedure manipulates, inspection and robot guidance. Detection of plant sickness by means of visible way is hard as well as less correct

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Whereas If Automatic disease detection is used then it'll deliver greater correct outcomes, within a less time and less efforts. Image segmentation may be completed in numerous manners starting from simple threshold method to advanced coloration picture segmentation approach. This corresponds to something that human eye can effortlessly separate and view as man or woman item. Computers are not capable of apprehend the objects, numerous strategies are advanced for image segmentation.

Literature Survey: Mrunalini R et.al[1] introduces the method for classifying and identifying the various diseases affecting crops. A identification scheme based on machine learning will prove very useful.It also saves human effort, money and time. The Color Co-occurrence technique is used to extract the feature. Neural networks are used to automatically detect diseases. The suggested strategy can considerably promote precise leaf detection and, in the case of steam and root illnesses, appears to be an significant strategy that puts less effort into computing.

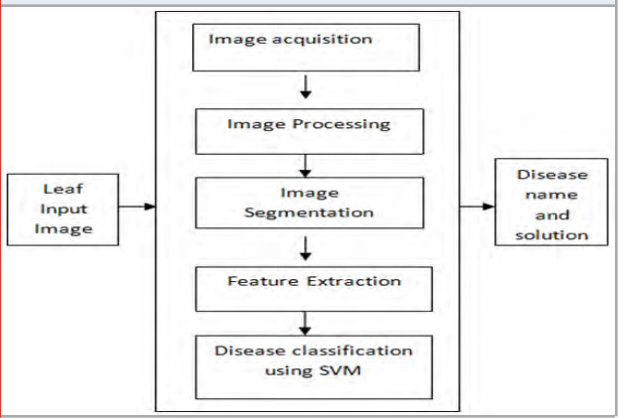
Prof. Sanjay, B. Dhaygude The implementation of texture statistics to detect plant leaf disease was clarified Firstly by converting RGB's color conversion structure into HSV room as HSV is a useful color descriptor. Masking and removing pre-computed threshold amount of green pixels. Then segmentation is carried out using 32X32 patch size in the next step and helpful sections have been acquired. These sections are used by color co-occurrence matrix for texture analysis. The texture parameters are finally likened to ordinary leaf texture parameters.

Sachin D. Khirade Plant disease identification is the key to stopping losses in agricultural product output and amount. It needs tremendous job ,plant disease knowledge, and excessive processing time as well. As a result, image processing is used for plant disease detection. Detection of diseases includes measures such as image acquisition, pre- processing of images, image pre-processing, image segmentation, feature extraction and classification. This paper used images of their leaves to discuss the techniques used to detect plant diseases. This paper addressed different methods for segmenting the plant's disease portion. This article also addressed some methods for extracting the characteristics of infected leaf and classifying plant illnesses. For effective crop cultivation, accurate plant disease detection and classification is very essential and this can be achieved using image processing. This article addressed different methods for segmenting the plant's disease portion.

This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self- organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, we can accurately identify and classify various plant diseases using image processing technique. Vijai Singh, A.K. Mishra proposed plant leaf disease detection using genetic algorithm Genetic Algorithm(GA) is optimization algorithm. The algorithm starts with population that is set of solutions. From one population solutions are selected and new population is created. This is done with expectation that the new population will be enhanced than the old one. According to the fitness off springs are selected. The fit solution has more probability to reproduce. The classifier used in this is Support Vector Machine (SVM).SVM is a very potential method to solve classification problems.

Proposed Work: Fig no.1 suggests device architecture of proposed plant leaf ailment detection machine. Image acquisition is the first actual step that's depends on hardware tool. Digital digicam or similar gadgets are used to seize images of leaf, also the images from datasets are used as input to the gadget to discover inflamed area of leaf.

Figure 1: System Architecture



Modules
1. Image acquisition
2. Image Preprocessing
3. Image Segmentation
4. Feature extraction
5. Disease type

Image acquisition: Image acquisition approach obtaining an photo with the aid of camera from any real life scene. In these days's global, commonly used approach is shooting picture with the aid of using virtual camera. But different strategies can also be used. In this undertaking, pix are taken from plant village dataset via which the photos might be fetched and the set of rules will be educated and tested

Image preprocessing: Image pre-processing is used to boom the first-rate of photograph necessary for similarly processing and analysis. It consists of shade space conversion, photo smoothing and image enhancement. The exceptional of enter photograph is carried out by removing undesired distortion from the image. Image enhancement is achieved to increase the contrast of image. Image clipping is done to get involved place .Smoothing clear out is used for photograph smoothing.

Image Segmentation: Image segmentation is the process of separating or grouping an photograph into one of a kind parts. Image segmentation are divided in to 3 classes

1. Edge primarily based
2. Region based totally

Clustering primarily based: In this paper image segmentation is finished based totally on clustering. Clustering divide the records in to precise quantity of agencies that are homogeneous. The segmentation system in based on diverse capabilities located within the photo. This might be coloration information, barriers or segment of an photograph. The most famous approach for picture segmentation is K- means clustering method. It is used to segment interested area from historical past. In this paper K-manner algorithm is used for photograph segmentation. Genetic algorithm is optimization algorithm, that is used after the ok-manner segmentation to attain optimized result. GA was proven to be the most powerful optimization approach in a massive answer area. Genetic algorithm is heuristic search method works in following steps:

1. Initialization of population
2. Fitness function

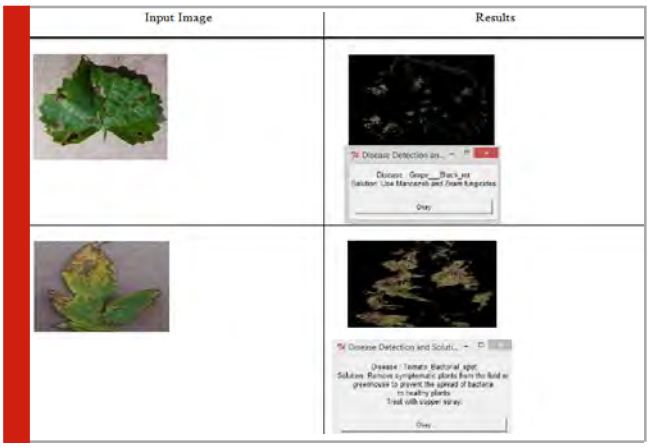
Selection crossover and mutation Operations Genetic set of rules gives optimized results.

Feature extraction: Extraction of features is the massive element of predicting the infected location graciously. Extraction of feature involves decreasing the amount of resource had to describe huge dataset. It is a method of identifying picture traits and set of characteristics in an effort to meaningfully constitute good sized classification and analysis information. It is expected that the extracted capabilities will include suitable statistics from the enter data, the usage of this decreased illustration instead of the full authentic information that the desired task can do. Texture content counting is in primary method for region description. In the texture analysis Gray Level Co-incidence Matrix (GLCM) of the leaf are calculated. Texture orientated function extraction like evaluation, strength, homogeneity are calculated.

Disease classification: In the category phase extraction and assessment of the co-occurrence capabilities for the leaves with feature values are saved in characteristic dataset. Image classification is executed with the aid of using Support Vector Machine. Support vector machines (SVMs) are a set of related supervised gaining knowledge of strategies used for type and regression. The information is split into teach and take a look at parts from the teach 80% of pix are taken for schooling the SVM and 20% photos are testing cause that is unknown to SVM.Based at the skilled pictures SVM evaluate the capabilities of input picture and perform type. The output produced by means of SVM is ailment call and the answer for that ailment.

RESULTS AND DISCUSSION

In this paper K-method algorithm is used for photograph segmentation and SVM for classification. The end result obtained is sickness call with answer for ailment.The following table shows the output of the machine. The machine accepts the input pictures from check folder, these snap shots are unknown to SVM the classifier evaluate the images functions based on formerly educated image capabilities and produces the output. The enter leaf pix for the device taken are Corn cercospora-leaf-spot, corn not unusual rust, grape black rot, grape leaf blight, peach bacterial spot, pepper-bell bacterial spot, tomato bacterial spot and tomato past due blight. The result for those above plant life is produced by way of machine with sixty three% accuracy.



CONCLUSION

The plant leaf disease detection the use of photograph processing allows to locate ailment at early degree. Automatic sickness detection reduces the work of monitoring and identifies the ailment at early stage. Infected leaf image dataset is identified for tomato, corn, grape, peach, pepper bell.The proposed set of rules is examined on these above five instructions of plant leaf pix. With very less computations surest consequences are obtained.

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An Advanced Trust-Based Routing Protocol for Mobile AdHoc Network under Black-hole Attack

Manish Devendra Chawhan[1], Kishor Damodhar Kulat[2], Sanjay Babanroa Pokle[3] and Ausaf Umar Khan[4*]

[1]*Associate Professor, Department of Electronics and Telecommunication Engineering, Yeshwantrao Chavan College of Engineering, India*
[2]*Professor, Department of Electronics and Communication Engineering, Visvesvaraya National Institute of Technology, India*
[3]*Professor, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, India*
[4*]*Research Scholar, Department of Electronics and Telecommunication Engineering, Yeshwantrao Chavan College of Engineering, India*

ABSTRACT

Mobile Adhoc Network (Manet) is a group of independent mobile nodes without fix topology and centralized administration. Because of absence of centralized administration, Manet is highly exposed to active as well as passive attacks. The existing routing protocols don't have security provision to protect the Manet against any type of attack. The Black hole attack is an active attack and effectively affects the performance of Manet by pretending itself as the safest and shortest path to the destination. So, there is a need of security provision in the routing protocol to protect the network against such attacks to avoid performance degradation. In this paper, An Advanced Trust-Based Routing Protocol (ATBRP) is proposed and implemented in NS2. The simulation results show that the proposed protocol defend the network from Black hole attacks and achieves better performance in terms of Packet Delivery Ratio (PDR), delay and throughput as compared to Dynamic Source Routing (DSR) protocol.

KEY WORDS: DSR, MANET, PDR, SECURITY MECHANISM AND THROUGHPUT.

INTRODUCTION

The wireless ad hoc technology has become a worldwide phenomenon in recent times due to tremendous and fast advancement. Recent wireless ad hoc technologies like MANET, VANET, SPAN etc. have a great contribution to the development of infrastructure independent wireless technology. A Manet becomes popular because of no administration cost and fast deployment. In Manet, each mobile node can store, transmit and receive binary data to establish communication within its transmission range. Because of decentralized infrastructure, the mobile nodes can participate or leave the communication network as per their convenience. In Manet, nodes are free to exchange their resources within their transmission range, creating separate spontaneous ad hoc networks.

In large Manet, it is important for each node to recognize its neighboring nodes for secure communication during route discovery process. During route discovery process, the source node broadcasts the route request packet (RREQ) to neighbouring nodes within transmission

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range in search of the shortest route to the destination node. During this process, neighbour node (if it is Black Hole) doesn't further broadcast the RREQ and reply the source node with the route reply (RREP) packet. Once the communication is established, that neighbour node acts as Black hole attack and drops all the data packets generated for destination node. This degrades the performance of network and disrupt the communication. To prevent the Manet from such type of attacks, a security mechanism must be provided in the routing protocol.

Literature Survey: An Evolutionary Self-Cooperative Trust Scheme (ESCT) is proposed to tackle different types of attacks in MANET. The proposed method is intellectually handle the internal attacks and lower the effect of them. This trust based mechanism able to defend a Manet against black hole as well as gray hole attacks. A trust-based DSR protocol is presented in which determines the fast and safe route in cooperation with neighbour node. This method able to protect the Manet without monitoring the neighbouring nodes. The proposed method able to yield better results in the presence of cooperative black hole attack. The new request forwarding mechanism is presented called EM-DSR. This method decreases the communication overhead and delay in the presence of attack. The techniques presented for packet classification used in intrusion detection system and firewall may be effective for Manet. because of dynamic characteristics of Manet, implementing security mechanism is bottleneck.

3. Network Model and Proposed Work

a. Network Model: In the proposed protocol, a neighboring node is assigned a trust rating depending on its behavior. First, the activity of the node is examined to adjust the trust level. It is not always that the node drops packets due to its malicious behavior, or it's a black hole attack. Sometimes a node may be a benign node or drops packets due to congestion. Therefore, it is crucial to ensure that the node is dropping the packets intentionally. In this process of judgment, the protocol need to maintain following five types of records:

1. Sent Packet Count.
2. Received packet Count by the neighboring node.
3. Self-assessment rating
4. Mutual-assessment rating.
5. Neighbor judgment.

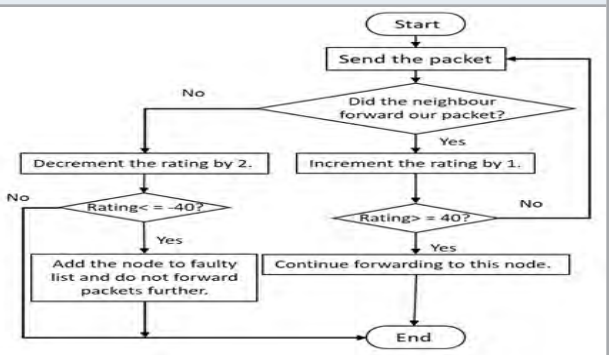
Before the final assignment of trust rating, it is initialized to zero for all nodes. It will increase or decrease depending upon the sent packet and received packet count. In this work, the final positive trust rating is 40 with the negative trust rating -40. The sent_count is the count of forwarded packets to a neighbor node, and each node updated this value at a one-hop distance. The received_count is the value of packets received from the source node, and this value has to maintain updated by each neighbor node. To monitor the packet forwarding activity, every node has to further forward the packets within timestamp, otherwise it is assumed that the packet has dropped and a negative event is recorded for that particular node.

b. Advanced Trust-Based Routing Protocol (ATBRP): The proposed method includes self assessment and mutual assessment of trust rating to the node. Both assessment helps to find the malicious node or attacks present in the Manet. This proposed mechanism is very effective and achieves better results for the Manet under multiple attacks. In this section, proposed method is illustrated with flowchart.

i.Self-assessment: Each node maintains a record of packets forwarded to neighbor nodes and monitors their activity. If the neighbor drops one packet a negative event is recorded and the trust rating decreases by 2. This is done by comparing the sent_count and received_count. When the neighbor node forwards the packet, then the positive event is recorded and the trust rating increases by 1. So, if a node drops packets due to traffic, that instance, it drops the packet and at other instance, it forwards the packets. This process doesn't affect the trust rating of node due to both event. On the other hand, if a node is malicious, then it drops the packets continuously, and repetitive negative events are recorded. If the value of drop packets reaches 20, then the trust rating will reach -40. At this point, the neighbor node is recognized as malicious and it is added to the black list and the routes containing this node are deleted. The neighbor id with its rating is broadcasted using the HELLO message so that the other nodes must also be aware of that malicious node in their vicinity. A node of rating -40 is abandoned, whereas a node of rating 40 is considered as the most trusted node.

ii. Mutual-assessment: In this type of assessment, each node keeps a record of the trust ratings provided by other nodes to their neighboring node for comparasion. Nodes retrieve their ratings from the broadcast messages.

Figure 1: Pie chart showing the reason for the first dental



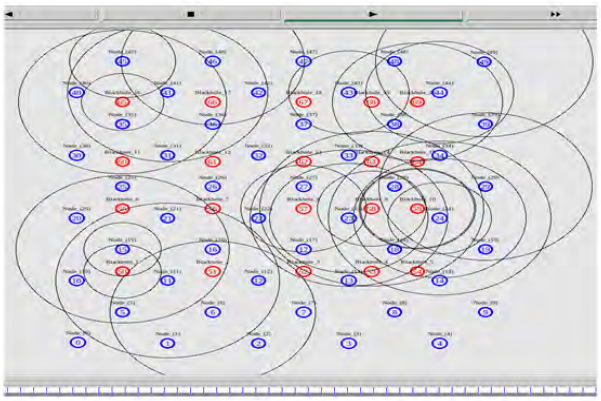
iii. Flowchart: A flowchart of the proposed method is depicted in Figure 1. The proposed method is efficient to protect the manet from multiple black hole attacks. To initialize a communication, route discovery process is carried. In the proposed work, after the success of route discovery, the source node will send packets to its neighbors. The activity of the neighbor is then examined whether it forwards or drops the packet. If the node forwards the packet, then the rating is incremented

by 1and if the packet is dropped then the rating is decremented by 2. If the rating drops below -40 then that node is blacklisted and no data is further transmitted to it and if the rating reaches 40 then data is forwarded to it as usual.

4. Simulation setup and Results

a. Network Scenario: A mobile ad hoc network of 70 nodes having a two-ray model is shown in Figure 2. Out of 70 nodes, 50 nodes are moving freely in random motion in an area of 1000x1000 m, whereas 20 nodes have no mobility. Out of 20 fixed nodes, 10 are employed as black hole attacks. In 50 mobile nodes, first 25 nodes are transmitting the data while other nodes are receiving the data. Speed of nodes vary from 1 m/s to 20 m/s. Each node travels at a different speed in a different direction. Each node has a transmission range of 250 metre with a packet size of 512 bytes. The Simulation time is 500 second and the traffic type is UDP.

Figure 2: Network Scenario



b. Results and Performance Evaluation: In this section, evaluation of a various parameter of proposed mechanism is carried and illustrated the comparison of proposed mechanism with DSR. For different number of attacks, the performance parameter like packet delivery ratio (PDR), throughput and delay are calculated. In this work, number of attacks are vary from 5 to 7 to 10 for evaluation of each parameter. From the comparison table and figure, proposed mechanism gives a significant improvement in the performance of Manet under black hole attacks can be noticed. From Figure 3 and Table 1, it is analyzed that using DSR, the value of PDR is decreased from 51.76% to 50.17% to 46.34% if the number of attack vary from 5 to 7 to 10, respectively. Whereas using proposed ATBRP, the value of PDR is 70.33% to 67.4% to 56.35% if the number of attack vary from 5 to 7 to 10, respectively. The significant improvement in PDR using proposed mechanism is depicted in Table 1 as compare to DSR.

Figure 3: No. of Attackers vs. PDR

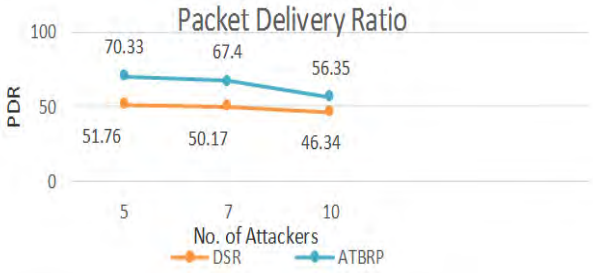


Table 1. Comparative analysis of number of attackers vs. PDR between DSR and ATBRP

No. of Attackers	5	Change (%)	7	Change (%)	10	Change (%)
DSR (%)	51.76	18.57	50.17	17.23	46.34	10.01
ATBRP (%)	70.33		67.4		56.35	

Figure 4: No. of Packets vs. Throughput

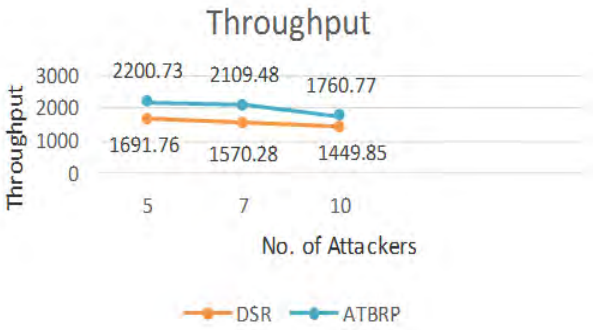


Table 2. Comparative Analysis Of Number Of Attackers Vs. Throughput Between DSR And ATBRP

No. of Attackers	5	Change (Kbps)	7	Change (Kbps)	10	Change (Kbps)
DSR (Kbps)	1691.76	508.97	1570.28	539.2	1449.85	310.92
ATBRP (Kbps)	2200.73		2109.48		1760.77	

From Figure 4 and Table 2, it is clearly analyzed that throughput of the network using DSR is decreasing from 1691.76 Kbps to 1570.28 Kbps to 1449.85 Kbps progressively with an increase in number of attacks 5 to 7 to 10, respectively. In proposed ATBRP, the throughput goes from 2200.73 Kbps to 2109.48Kbps to 1760.77 Kbps

for 5 to 7 to 10 attacks, respectively. The significant improvement in Throughput using proposed mechanism is depicted in Table 1 as compare to DSR.

Figure 5 and Table 3 give the relation of average delay with number of attacks.It is clear that the average end-to-end delay increases in DSR with an increase in number of attacks as compare to proposed ATBRP. For less number of attack DSR has less delay than ATBRP but with increase in attack, proposed ATBRP performs better than DSR in terms of dealy. The significant improvement in average delay using proposed mechanism for different number of attacks is depicted in Table 3 as compare to DSR.

Figure 5: Average Delay Vs. No. of Attackers

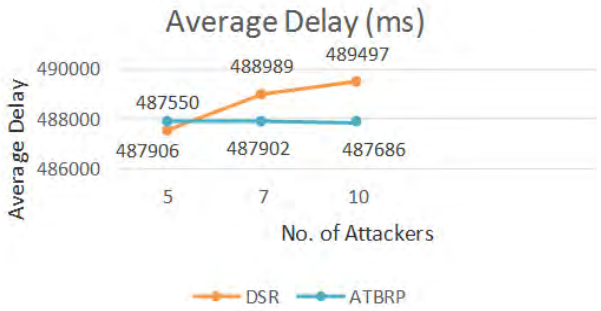


Table 3. Comparative analysis of number of attackers vsvs. Average Delay between DSR and ATBRP

No. of Attackers	5	Change (ms)	7	Change (ms)	10	Change (ms)
DSR (ms)	487550	-356	488989	1087	489497	1811
ATBRP (ms)	487906		487902		487686	

CONCLUSION

Security mechanism in routing protocol is very crucial to maintain quality of services and to achieve distortion less communication in ad hoc network. The well established routing protocol like DSR, AODV etc. don't have security provision to protect a Manet from active and passive attacks. The proposed trust based method yields better results in terms of throughput, packet delivery ratio and average delay for the network under multiple attacks as compare to DSR. It has been concluded that the proposed protocol using self-assessment and mutual assessment operation can improve the data transmission in the network and use trust information to protect the network. This quality of the protocol in addition to the other functions of DSR makes it more reliable and eligible than DSR in the sensitive fields where high security is required.

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An Approach to Detect Sentence Level Sarcasm Using Deep Learning Techniques

Amruta K. Chimote[1], S.R. Tandan[2] and Rohit Miri[3]
[1]*Research Scholar, Department of Computer Science & Engineering, Dr. C.V. Raman University, Bilaspur (CG), India*
[2,3]*Associate Professor, Department of computer science & Engineering, Dr. C.V. Raman University, Bilaspur (CG), India*

ABSTRACT

Today is the era of customer self-service, where people use conversation agents (chatbots) to get their query solved in minimum time and cost. Use of conversation Agent gives real time experience to user/customer to get answers very fast. To make this experience more genuine it needs understanding of human emotions and which is the most complex task to perform as facial expression and verbal details are unavailable. Most of data over the internet is in textual format which needs to process to get required answers that is why one of the most popular area in natural language processing is Sentiment analysis which focuses on solving this issue. Sarcasm is critical sentiment which is very difficult to recognize by machines. User express sarcasm to show their anger, disagreement using positive words over internet forums, social media and over shopping sites for reviews about product, services, situation, workplace etc. This paper gives a combined approach by extracting pragmatic features like emoticons, use of hyperbole, punctuations and special words used in sentence to detect sentence level sarcasm using deep learning techniques such as LSTM which will help machine for better understanding of natural language.

KEY WORDS: SARCASM, SENTIMENT ANALYSIS, CONVERSATION AGENT, LSTM, NATURAL LANGUAGE UNDERSTANDING.

INTRODUCTION

Sarcasm is one of the sentiments belongs to anger or disagreement representing something positive with negative intent. Sarcasm is defined by so many people with different approach. Some of definitions are:
a. (Mondher etl.,2016) elaborated Sarcasm as form of irony, majorly used on internet platform such as social media and blogging sites.

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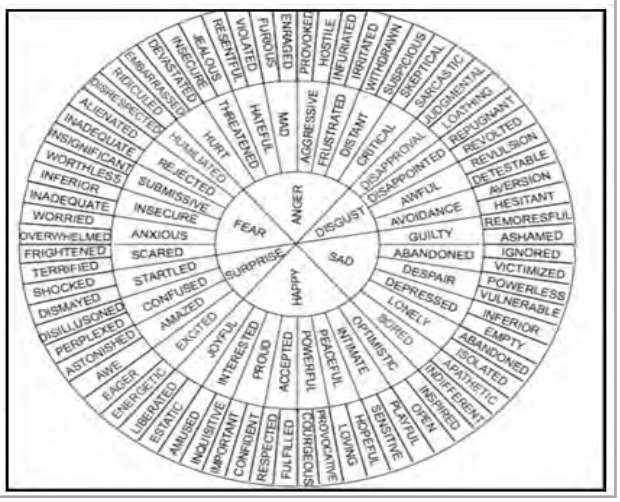
b. Cambridge Dictionary explains sarcasm as remark used to state opposite of what is said, this is to hurt or to criticize in humorous manner. (Cambridge Dictionary, n.d.)
c. Sarcasm is the lowest form of wit, but the highest form of intelligence stated by Oscar Wilde.
d. According to wheel of sentiment Sarcasm is critical expression of anger.

Sentiment analysis specially inclined towards opinion mining is one of the most favoured topics in natural language processing which leads to understand sentiment behind textual data provided by user such as reviews about place, product, person and even situation. Detection of sentiment from text/speech data leads to correct decision making for company. Available methodologies for sentiment analysis find it difficult to process complex sentiments such as sarcasm, rhetorical questions which can affect ability to reach correct decision.

Identification of sarcasm in any text/speech data which may include instructions, blogs, views, or reviews is known as sarcasm detection. Sarcasm detection is emerging area under sentiment analysis and text mining. It is primary need of all conversation Agent to detect sarcasm and generate response based on natural language understanding. Sarcasm detection will be most useful while instructing robots and get efficient work done through it. It further leads to identify the mood, psychology and sometimes even the health condition of people which make human machine interaction more efficient. It is observed that person going through stress or extreme emotion phase starts behaving sarcastic over social media or at workplace, he/she starts giving sarcastic reviews which cannot be identified on textual data by automated system so sarcasm detection can help to identify mental health of person. (Urmila Shrawankar, 2019)

Figure 1: Wheel of Emotions



Literature Review: Ample numbers of applications are using sentiment analysis to give user better experience for using chatbots, automated answering machines, etc. Conversation agents are used globally and impacting to reduce overall business cost (Benlian1, march 2020). To make human machine interaction more realistic so many researchers are attracted toward the area of opinion mining and contributed to detection of sarcasm using various approaches. Majorly researchers used social media domain like tweeter and reddit where one can express in minimum number of words so makes it easy for pre-processing. Many researchers used classification, neural network, and deep learning approaches to detect sarcasm.

Initially researchers went with rule-based approach to detect sarcasm, but it is found that use of machine learning and deep learning techniques are more efficient. Rule based approach depends on occurrences. These occurrences are identified, and rules are applied to detect sarcasm. (Kumar, (2017)) Higher accuracy can be achieved by using machine learning techniques. It is observed that extraction of features plays very important role in detecting sarcasm. Research Papers such as Dr. Kalpesh H. Wandra1, 2017 used n-gram (uni,bi,tri) for feature extraction which mainly focuses on pragmatic occurrences in given text used Logistic regression and SVM for classification. In Research work published by (Lakshya Kumar, 2017), steps further for detecting sarcasm and in this author used two approaches where first approach is to get exact noun phrase matching and second approach uses pragmatic feature extraction along with number of tweets embeddings. Here researches got success to get 90% accuracy by using deep learning methodology.

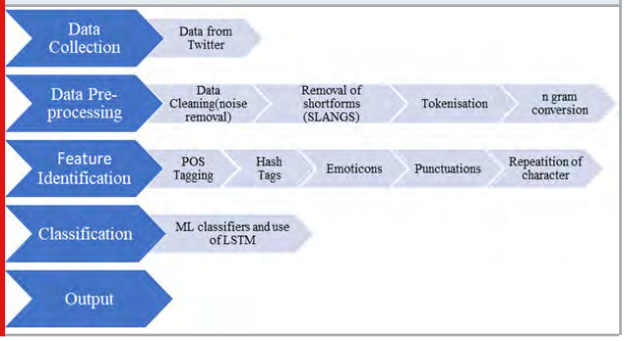
In scholarly article Encoding Sentiment Information into Word Vectors for Sentiment Analysis (Zhe Ye, August 20-26, 2018),primary focus is on following points: (1) The lexicons of sentiment were formed and encoded them into word vectors by FF neural network (2) Fine tuning of Lexicons were done during training of CNN sentiment classifier, (Garg, 2019), in their research paper focused on context of text for that researcher used data from twitter and reddit to detect sarcasm, they used two approaches first one used tf-idf and another one is deep learning approach by using bi directional LSTM and GLoVE. They achieved accuracy of 86% and 82% on twitter and reddit datasets, respectively. Sarcasm Detection Using Machine Learning Techniques (P, april 2018), In this paper author used twitter dataset and used multinomial Naïve Bayes to detect sarcasm and used support Vector Machine (SVM) classifier to classify types of sarcasm from tweets.

In paper Sarcasm Detection Building a contextual hierarchy, novel approach is given which is conversation based here author convince about the subjective nature of sarcasm. Author used social platform like twitter and focuses on relation between speaker and listener. Here methodologies used are lexical and pragmatic analyses. (Taradheesh Bali, December 12 2016). Recent research trying to explore sarcasm with new intent like number incongruity in sarcasm detection, rhetorical questions in detecting sarcasm (Aditya Joshi1, 2015) (Abhijeet Dubey, 2019). Some of medical science research papers showcased on detection of brain injuries based on language spoken, detection of sarcasm can help medical science to detect any brain injuries at early stage and autistic nature of person. This may also help in linguistic development. (Autism as well) by (Rambam, 2005) (Channon S) (Katherine P. Rankin, 2009 Oct 1).

MATERIAL AND METHODS

With the increase in use of online platforms it is mandatory to have human machine interaction in more natural way. Now maximum portal uses automated answering systems, chatbots to answer frequently asked questions by user so require robust methodology to understand human nature and generate response accordingly. In this proposed methodology we use data collection, data pre-processing, feature identification, classification and finally classified text as sarcastic or non-sarcastic.

Figure 2: Methodology for sarcasm detectio



Long Short-Term Memory is dedicated form of artificial recurrent neural network commonly known as RNN. It has capacity to learn order dependence where prediction is needed. This made it eligible to solve complex domain problem like machine translation, speech recognition etc. Its main focus is to remove problem like vanishing gradient which was present in other versions. LSTM is able to deal with issues like noise, distributed representations and time lags. In LSTM, it's not mandatory to have finite states beforehand. Without fine adjustments LSTM can work with more parameters like rate of learning, handling biases of input and output. LSTM success is reduced complexity up to O(1). (aditianu, n.d.)

```
embed_dim = 128
lstm_out = 196

model = Sequential()
model.add(Embedding(max_fatures, embed_dim,input_length = X.shape
[1]))
model.add(SpatialDropout1D(0.4))
model.add(LSTM(lstm_out, dropout=0.2, recurrent_dropout=0.2))
model.add(Dense(2,activation='softmax'))
model.compile(loss = 'categorical_crossentropy', optimizer='adam',m
etrics = ['accuracy'])

    if np.argmax(Y_validate[x]) == 0:
        neg_cnt += 1
    else:
        pos_cnt += 1


print("Sarcasm_acc", pos_correct/pos_cnt*100, "%")
print("Non-Sarcasm_acc", neg_correct/neg_cnt*100, "%")
```

```
Sarcasm_acc 80.8446455505279 %
Non-Sarcasm_acc 83.75149342891278 %
```

RESULTS

Partial prototyping model after applying LSTM over political headlines and tweets generated following output. Proposed model correctly classified sarcastic and non-sarcastic sentences with accuracy 80.84% and 83.75 % respectively.

CONCLUSION

With the reviewed papers, articles, and applications it is observed that detection of sarcasm is complex. As sarcasm is critical expression of anger one needs to identify the context of sentence before classification. Pragmatic features help to detect sarcasm correctly and use of LSTM increase the accuracy when used with n grams. Scope of this can be extended to identify the incongruity of numbers and autosuggestions before entering sarcastic sentence which will ease the work of machine to respond.

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Development of an Approach for Discourse Analysis of Natural Language

Animesh R. Tayal[1], S.R. Tandan[2], Rohit Miri[3] and Madhuri A. Tayal[4]

[1]*Research Scholar, Department of Computer Science & Engineering, Dr. C.V. Raman University, Bilaspur (CG), India*

[2,3]*Associate professor, Department of computer science & Engineering, Dr. C.V. Raman University, Bilaspur (CG),, India*

[4]*Assistant Professor, Department of Information Technology, Shri Ramdeobaba College of Engineering and Management, Nagpur (MH), India*

ABSTRACT

We are alive in the age of brainy machineries where the whole thing is substituting by machinery, understanding of concealed meaning of text/speech turn into essential to comprehend by machine. Natural Language Understanding (NLU) is an emerging area of Computational Linguistics under the subarea of Natural language processing that is used to analyse and distinguish text or speech sentences written in human understandable language into machine understandable presentation. The purpose of NLU system is to interpret a text. The NLU expects that human languages must be interpreted statistically by the system. Understanding natural language is biggest challenge in Artificial intelligence field as well as Discourse processing. Discourse is "Language above the Sentence or above the Clause". This paper presents a method which designs and builds computer system that are able to analyse and understands human language and to generate output in same human understandable language. The system which is designed for discourse implementation is tested on IMDb movie review dataset. IMDb Stands for Internet Movies Database. The results are quiet promising. We have used Convolution Neural network concept for the same. The efficiency of this model is around 87%.

KEY WORDS: DISCOURSE, DISCOURSE ANALYSIS, TOKENIZATION, TAGGING, NAME ENTITY RECOGNITION (NER), SYNTACTICAL/ SEMANTICAL ANALYSIS.

INTRODUCTION

The Technology is making a great impact on us in every facet of our life whether it is through making our life relaxed by making better decision with the help of Artificial Intelligence or understanding the human and understanding the language. In the hierarchy of artificial intelligence, Natural language understanding (NLU) plays important role, which empowers human computer interaction. NLU practices the system programs which must be understood either sentence text or speech. NLU forces computer to understand the instructions and then system joins back to humans in their particular dialects.

The NLU in our system will help to understand the conversation and provide the analytical thought to the conversation. The subdomain of it, is Discourse processing. Discourse processing is identifying the unseen sense from the portion of data. In this application, the system will analysis the reviews and check for the semantic and syntactic analysis, then based on these

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**Corresponding Author: animesh9777@gmail.com*

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analysis and training of these movie review datasets it will interpret how good or bad the movie is. Currently, our application can predict the movie review with that much accuracy as expected. The designed system is to be expected as:

Conversation-1: How was the movie U saw?
Conversation-2: Movie was fabulous and meanwhile story was good and after interval story makes sense.

The designed system should give Machine Interpretation as :> Movie was good and can be watch.
This way we want to analyse actual discourse from the text data.
This paper is arranged as follows: first section gives the idea of the concept Discourse processing along with Natural language Understanding. Second Section gives the existing methods and third section defines the method used for this system to be developed. Paper ends with results and conclusion.

Literature Review: There were many efforts made in this area of Discourse processing for identifying hidden meaning from given sentence/Text, listing here some of them. The concept of Neural Discourse Segmentation (Yizhong Wang et.al, 2018) which recommends an effective neural segmenter which is constructed on the basis of BiLSTMCRF framework. This concept is very fast and effective. They have used a word representation model which was trained on an enormous corpus. Altogether this is done for improving efficiency of system and solved the problem of data insufficiency. Overall the results for this investigation are good.

A comprehensive review based on Statistical learning for semantic parsing is specified by which has reviewed the current mechanism for semantic parsing with predictable deep learning techniques, machine learning techniques. For the received input order our system must give correct response, then we can say that machine understood well. The responses will be of various forms: a desired movement of robot, or a desired response for a given query. This can be accustomed through semantic parsing. The logical form, i.e semantic illustrations are used for machines so that it will be understood by it. In this work the system of parsing is given and further converted into learning statistically. (Xiyao Ma et.al).

The analysis of Named Entity Recognition (NER) is also required for this task, a complete survey of named entity recognition and classification given by David Nadeau et al. It focuses on Relation Extraction (RE), Co-reference Resolution (CO), Named Entity Recognition (NER), and Event Extraction (EE). All these concepts are utilised to categorize and extract the important entities like some expressions, proper names, organizations species etc. The various NER techniques have been presented in this paper. These NER techniques are in a position to classify Personnel to organization information as well as rare species, cells and proteins in various applications. (David Nadeau et.al)). Interpretation of the discourse and conversation prearrangement of SMS communication is discovered in (Nianwen Xue, Qishen Su, 2016) similarly on chat dialog (Forsythand et.al, 2007). One of the algorithms considers information related to discourse for creation of categories clustering outcomes based on better syntactic parse trees. (Tatyana Makhalova et.al, 2015) (Ashraf Ullah et.al, 2014).

In one of the paper media contents were analysed from the newspapers "The Nation", of discourse from media. The different kinds of text were used in media discourse (close and open text) were analysed (Farah Benamara et.al, 2018) (M. Ayoub et.al, 2016). The various properties related to discourse of text have been explained along with development as present past and future in (Bonnie Webber et.al, 2012) (F.Cornish et.al, 2006). The method for detection of sarcasm which is based on various levels of analysing the text like, lexical, syntactic and semantic level is described in (Devamanyu Hazarika et.al, 2018). The pen tree bank is also been developed as wide-ranging corpus which uses discourse connectives are shown in (Miltsakaki et.al, 2004). The next section explains detail methodology of the system that is designed.

Methodology: Identification of unseen text from given text is a crucial and complex task in Discourse analysis. It is related with social media insides as well as interaction between groups or two persons. Following are the steps that are performed for this task. For training and testing datasets from Kaggle and Keras library (IMDB ratings dataset) having 1,10,000 reviews is used. Figure 1 shows step-by step procedure.

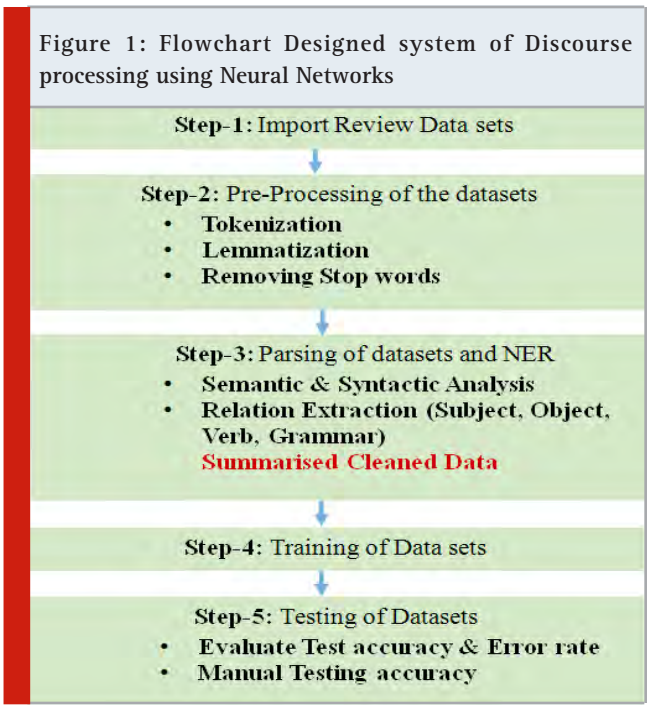


Figure 1: Flowchart Designed system of Discourse processing using Neural Networks

Pre-Processing of the datasets: In this module, the dataset will be breaking down into separate sentences/ words from paragraphs in order to make programming a lot easier and this process is known as Tokenization. Cleaning is done through stop word removal. The words

like 'a', 'the' etc. are removed. Next, task is to identify part of speech to know a noun, a verb, adverb model, proper noun, an adjective and so on. This task is very important as this will convey the major information in the given sentence. In addition to that it informs the user its purpose also.

The working of the model is shown in figure -1 mentioned below where each step is elaborated.

Text Lemmatization and Removing Stop-words: This module will perform the lemmatization of each tokens in a sentence i.e. identifying the base form of each word/ text in the given sentence or paragraph. Then it identifies the stop words from the datasets and filters out them as they don't add any meaning to the sentence. (e.g: 'a', 'the', 'and', etc.)

Parsing of datasets and NER: This module will identify relatedness of each word from the sentences. This is called dependency parsing. Then it will perform NER (Named Entity Recognition) that gives the entity information like: person information, industries, species, organizations, locations, quantities, Information of time, monetary values, percentages, etc.

Training and Testing of datasets: The IMDb (Internet Movie Database of data related to movies, television programs, home videos, video games etc.) dataset for movie reviews is used for this purpose. We have used 60 percent data for the training and 40 percent data for testing purpose. The system uses all total 1,10,000 reviews. The network is trained and various Activation function are used to govern the output of neural network like yes or no. It plots the resulting values in between 0 to 1 or -1 to 1 etc. We have used the ReLU function which is the most used activation function as in convolutional neural networks or deep learning. Using these functions model is designed which uses test dataset in order to test our model's accuracy.

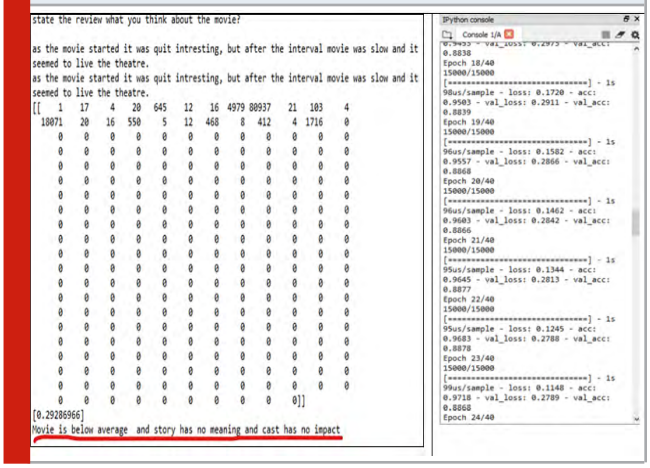
RESULTS

The developed application is a prototype of Implementation of discourse processing for identifying hidden meaning. We have used 60 percent data for the training and 40 percent data for testing purpose. The system uses all total 1,10,000 reviews from IMDb. Sample output is shown below in figure 2. The system's efficiency is around 87% and error rate is 0.311. Referring Figure 2. First part, depicts for the given input data: as the movie started it was interesting, but after the interval movie was slow and it seemed to live theatre.

Output: Movie is below Average and story has no meaning and cast has no impact.

Referring Figure 2. Second part, Sample epochs are shown along with in between accuracies during runtime. The system is tested through human evaluation also. The systems output is verified against human experts. We have evaluated five hundred samples for this purpose. And found that around 82 percent systems results are matching with human experts output results.

Figure 2: Sample output of Designed system



CONCLUSION

So, the developed application can be installed on any system which will meet the average hardware & software configuration. This application is a prototype of initial level of Natural Language Understanding, which is initially works on the movie reviews which can later be extended to common human conversation or chatting platform. In this application, the system will analysis the reviews and check for the semantic and syntactic analysis, then based on these analysis and training of these movie review datasets it will interpret how good or bad the movie is. Currently, our application can predict the movie review with that much accuracy as expected. The system can be applied for different twitter databases and review databases. Further efficiency also can be increased with different activation functions and techniques.

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Real Time on Bed Medical Services : A Technological Gift to the Society

Girish Talmale[1*] and Urmila Shrawankar[2]
[1]*Research Scholar, Department of Computer Science and Engineering,*
[2]*Associate Professor, Department of Computer Science and Engineering,*
[1, 2]*G H Raisoni College of Engineering, Nagpur (MS), India*

ABSTRACT

Nowadays due to the emergence of pandemic diseases like Covid-19, chronic and contagious diseases where remote patient monitoring plays an important role which protect doctors and other healthcare workers from getting contaminated. In India 70% of the population lives in rural areas where expert medical services are not provided with affordable prices in real time. The existing system is not able to provide real time Medicare services to remote patients. There is a requirement of real time remote prioritization of medical services for remote patients when there is critical change in health parameters. This research presents the real time computing framework for on bed medical services for patients. The real time processing done at the sensor node using real time tasks scheduling. The sensor node data gets analyzed on fog nodes taking time critical actions. The healthcare data is then sent using Kafka real time streaming using Kafka pipeline. The real time processing and analytics of large scale healthcare cloud data using Spark. The proposed framework provides the following benefits over existing systems a) Real time processing of sensory healthcare data b) Real time analytics using fog computing for quick action in critical situations c) Real time data streaming using Kafka pipeline and d) Spark for large scale real time data processing and analytics. The proposed system reduce the requirement of medical resources ,workload of medical staff ,medical expenses for poorly people and mortality rate of patients with pandemic and chronic disease.

KEY WORDS: REAL TIME SYSTEM, FOG COMPUTING, KAFKA, SPARK, COVID-19

INTRODUCTION

Rice As of now, the world is confronting the most genuine worries in human services including the ascent of human services costs, the development of the maturing population and the rise of new chronic and pandemic diseases such as Covid-19. Recent advancement in computation and communication technologies plays an important role in improving Medical services. In A country like India where 70% of the population lives in rural areas, it is very difficult to provide expert medical services with affordable prices. Real time on bed patients monitoring systems is the only solution to handle the pandemic diseases like Covid-19. Elderly patients with chronic disease, patients with disability and premature children's require on bed medical services and real time action when there is change in critical health parameters.

The healthcare resources and medical staff in India are limited to handle the pandemic disease like Covid-19 and also there is huge possibility of spreading infections of such disease to doctors and healthcare staff and patient's relative during treatment Implementation of ob bed medical service is the only situation to handle such a pandemic and chronic disease [K. I. Mohammed 2019]. The on bed medical service provides many advantages such as

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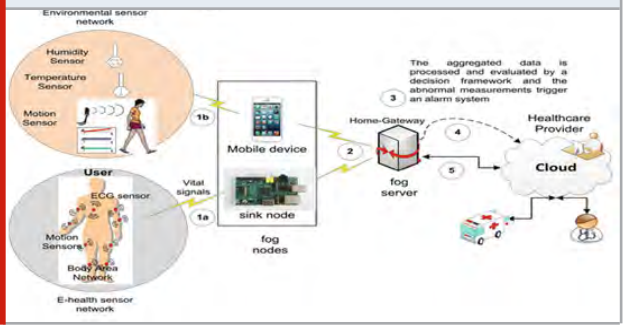
continuous monitoring of health parameters, proactive way to detect and treat illness in real time, prevention from worseness of diseases, reduce the hospitalization fee, real time health parameter monitoring with daily life activities, patients with disability and mobility issues [Iqbal 2019].

Background Work: Existing solutions use telemedicine in which medical information is delivered to remote locations using electronic communication but this system fails to provide real time medical service in case of emergency. Develop mobile healthcare monitoring system to monitor [Hussain 2015] the patient's heart rate using mobile. The drawbacks of this system are to focus on only one parameter and not provide real time response in critical condition. The virtual reality based elderly patients monitoring system with wireless sensor area network for communication which face challenges such as low battery issue, security and less communication speed [Okura 2016] . An e-health system which used Wireless Body Area Network with dynamic priority based architecture which also faced the problem of real time communication [S. Gambhir 2016].Erden in 2016 discussed remote health monitoring using image and signal processing.

Figure 1: Real Time Healthcare Monitoring System [Gu L 2017]



The limitation of this research is not providing real time response systems as it uses cloud based solutions. Abdulnabi presents distributed architecture for medical data exchange and the wireless based patient monitoring system which is used to detect the patient's respiration and sensors to detect coughing [Abdulnabi 2017]. Zhanjal present medicine remainder and monitoring system using IoT in 2015 [Zanjal 2016].The proposed research work presents the real time system framework for on bed medical services which used different sensors like Heart Beat sensor, Glucose sensor, oximeter, Asthma Tracker, Temperature sensor, Camera, Bp sensor , Microphone for cough monitoring, motion sensor , humidity sensor, ECG sensor etc. is used to collect healthcare parameter from patients and process the data in real time using fog nodes on which real time scheduler is used to priorities the the tasks based on criticality of vital healthcare parameters. The sensor data is then first analyze by the fog server and real time quick action or alert is actuate to protect from health hazards . The fog server further send the data to cloud server using real time Kafka data streaming pipeline and Spark is used to process and analyze that large scale healthcare data in real time and provide it to healthcare staff and other government agencies to take further actions as shown in fig.1.

The main objectives of this paper are as follows:

1. To provide real time framework for healthcare monitoring.
2. To implement real time sensory data acquisition system using real time scheduling of critical tasks.
3. Real time data analytics for healthcare monitoring using fog computing.
4. Real time healthcare data streaming using Kafka pipeline.
5. Spark based real time analysis of healthcare data on cloud.

METHODOLOGY

Real time framework for healthcare system is as shown in Fig.1 where different types of sensors used to collect health information from patients suffering from pandemic and chronic disease, elderly, premature babies . The sensory healthcare data is processed in real time on fog nodes using real time scheduler to priorities the critical tasks and send the real time healthcare information on fog server. Fog server analyzes the data in real time and takes the quick action in real time based on criticality of data. The fog server further stored data on cloud server using real time Kafka streaming pipeline. Spark processes and analyze the large scale healthcare data and provide the analysis to doctors and medical staffs and government agencies as shown in Fig.2.

Real Time Sensing for Healthcare Monitoring: Real time framework provides various healthcares and medical service which helps to take corrective actions in real time. The summary of such application and different types of sensor used for collection of data for these applications is mentioned in the table 1 as follows [A. Botta 2016].

Fog Computing for Real Time Healthcare System: Sensors collect information from patients and send the sensor information to fog nodes for real time analysis . Embedded microcontroller gets information from sensor and processes the real time sensor data to fog nodes. Medical applications are different from other cyber physical system in which remote monitoring requires reliability and security and all operations must be performed in real time which is not possible with cloud computing.

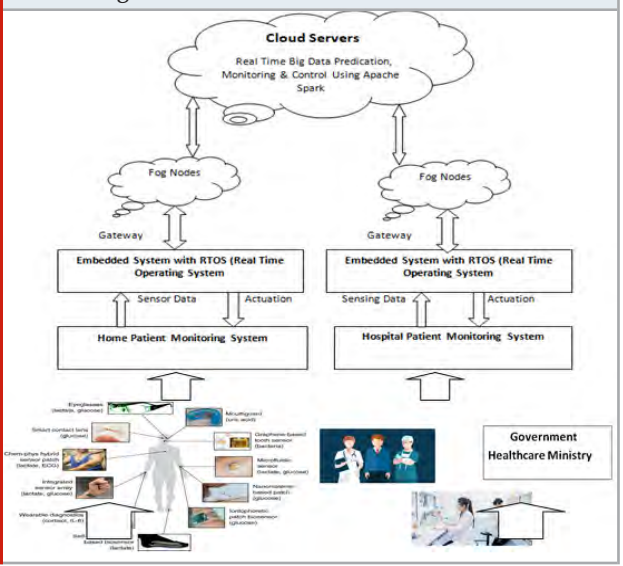
So to implement real time analytics for time critical application such as healthcare fog computing plays an important role. Fog computing in real time health care system provide following advantages [Rahul Neware 2020].

1. Fog computing architecture is distributed which helps to provide reliability to healthcare application
2. Communication is directly with edge devices to provide real time communication service for healthcare application
3. Data processing in fog computing is done very close

to source of information to take quick corrective action.

4. Large nodes can be connected in fog computing which helps in formation of cyber physical system for healthcare system
5. Fog computing provides less latency require for real time analysis of healthcare system
6. Fog computing provide various protocol standards and higher security as compare to cloud computing.

Figure 2: Real Time Framework for Healthcare Monitoring



Kafka for Real Time Healthcare Data Streaming: In real time healthcare system can be many to one or many to many system where many sensors sending messages at regular interval. Kafka is a pipeline architecture used to store large amount of data to database on real time. It can be configured as many to many and many to one mode for real time healthcare system. The Kafka is configured and runs using Zookeeper server. The pipeline is created using Kafka topic. When Kafka topic created and it is in running mode then any number of sensor nodes can send data to Kafka topic and any number of actuator nodes can read data from Kafka broker [Kreps, Narkhede & Rao 2011]. Kafka has the ability to store data for some time in buffer storage and processes the data in real time within the pipeline itself. The cyber physical real time healthcare system architecture consists of sensor within cluster send messages over MQTT cluster for communication. Sensor nodes inside the cluster send data to gateway. Gateway is used to write data to Kafka topic. Kafka pipeline act as real time injection layer that inject data into the HDFS (Hadoop Distributed File System) as show in fig.3.

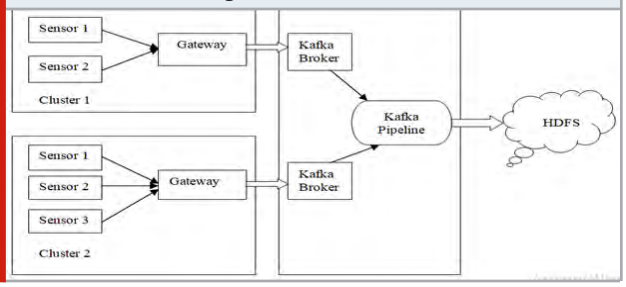
Spark For Real Time Big Data Processing of Health Data: Healthcare data analysis used machine learning algorithms. Existing hadoop system to handle machine learning algorithm has some practical difficulties. Machine learning and deep learning algorithms take long time to produce output. It is executed in multiple stages using MapReduce program in back end [R. Singhal and P. Singh 2014].

Table 1. Real Time Sensing for on Bed Healthcare System

Sr.No	Healthcare Application	Sensor and Operations
01	Monitoring and Control of Heart rate	Heartbeat sensor is used to track changes in volume of blood in body.
02	Diabetic Patient Monitoring	Glucose Sensor is used to monitor level of sugar and real time alert
03	Asthma Patient Monitoring updates the real time information to cloud	Asthma Tracker is used to track the patient asthma level and
04	Pulse Rate Monitoring	iOximeter is used to monitor pulse rate
05	Temperature Monitoring System	Temperature sensor used to monitor temperature of patients and store in information the cloud
06	Blood Pressure Monitoring	BP sensor is used to monitor the real time value of blood pressure
07	Cough Monitoring system	Microphone used track the real time cough analysis.

The problem with map reduce is that it loads the data into memory, processes the data and then store it back. The read and write operation on memory take huge time as comparing to processes data. In healthcare application data must be processes in real time to take corrective action immediately to avoid any risk. Spark is new framework for replacement of MapReduce framework in Hadoop2.0. Table 1.2 shows the difference between spark and hadoop map reduce based on different parameters [M. Armbrust 2015].The spark uses resilient distributed dataset (RDD) and directed acyclic graph.

Figure 3: Kafka Based Data Pipeline Architecture for Real Time Data Streaming



The Spark application read data from used code and placed it into the RDD. The RDD are not changeable and each step it creates new RDD [Mohsin 2018]. The conversion processes is designated as directed acyclic graph and submitted to cluster. The conversion processes consist of arithmetic, logical and set or map based operation. After conversion process RDD get shuffle, then combined and final result get produced. The advantages of using Spark framework in cyber physical healthcare real time system is shown in directed acyclic graph execution step. Directed acyclic graph used end to end processes in that first data get read, transformed and then stored in database but in MapReduce there is memory write operation for each transformation of job.

Figure 4: Spark Framework Architecture for Handling Real Time Processes

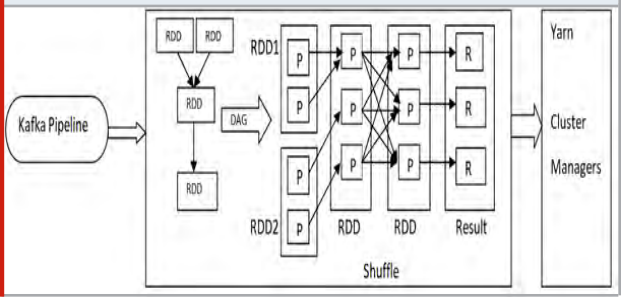


Table 2. Comparative Results of Proposed Real Time on Bed Medical Service Framework

Sr.No	Performance Attributes	Existing Systems	Proposed System
01	Automatic	Semi Automatic	Full Automatic
02	Real Time	Not Real Time	Real Time
03	Maintenance of Healthcare Data	Difficult	Easy
04	Analysis of Healthcare Data	Not Efficient	Efficient
05	Real Time Prioritization of Healthcare Task	No	Yes
06	Error Rate	More	Less
07	Fault Tolerant	No	Yes
08	Real Time Processing in Fog Node	No	Yes
09	Real Time Analysis on Fog Server	No	Yes
10	Real Time Data Streaming	No	Yes
11	Analysis of large scale data using	No	Yes
12	Data Analysis at Fog Server	No	Yes
13	Security	Less	High

Yarn is used as cluster management of tasks to produce the result . The Spark framework store intermediate result into another RDD and combine it during processing which reduce the time require for execution depending upon the job and machine learning or deep learning model as shown in fig.4.

RESULTS AND DISCUSSION

The real time framework for on bed medical services provides several benefits over existing remote patients monitoring systems. The table 2 represents the comparative analysis of existing remote patients monitoring system with our proposed on real time bed monitoring system.

CONCLUSION

This paper proposes the novel framework for real time on bed medical services for patients suffering from pandemic and chronic diseases. The proposed framework shows how the real time patients monitoring done at different stages in the healthcare system such sensor node real time data processing and scheduling, real time data analytics at fog nodes , real time streaming of data using Kafka pipeline and real time data processing and analysis of large scale healthcare cloud data using Spark. The proposed framework helps in real time, reliable, fault tolerance and secure on bed patients care and monitoring. It also reduce the requirement of medical recourses including physical recourses, requirement of medical staffs, healthcare expenses and also reduce the death percentage of patients with pandemic and chronic diseases. In future the framework is implemented using cluster based cyber physical system for embedded sensor nodes using fog computing.

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Recognition of Diabetic Retinopathy Levels Using Machine Learning

Kanak Kalyani[1], Rina Damdoo[2] and Jignyasa Sanghavi[3]
[1, 2, 3]*Assistant Professor, Shri Ramdeobaba College of Engineering & Management, Nagpur, India*

ABSTRACT

Diabetes is one of the major causes of Diabetic retinopathy (DR), it causes damage to eye retina and may lead to blindness. According to the International Diabetics Federation around 77 million cases of diabetes are registered in India in 2020. It is estimated that around 8.5% population over 18 years and around 45% population over 60 years is being affected by diabetes in India. The percentage of people being affected by the diabetes is increasing exponentially and the consequences hamper the human life. Therefore awareness and early detection are the key factors in the prevention of diabetic retinopathy. In this paper, we have presented a survey on the latest work carried by the various researchers in the domain along with their contributions. In this paper we have highlighted various research datasets available to work in this field. In this paper we present a model to predict the various class labels of the diabetic retinopathy. In the proposed paper we use data augmentation methods along with histogram equalization. Randomized Hough Transform is used to find the edges. Deep CNN model is used to classify the images. Accuracy of the classifier is around 95% with sensitivity around 90%.

KEY WORDS: DIABETIC RETINOPATHY, NPDR, PDR, CNN, DEEP CNN, RANDOMIZED HOUGH TRANSFORM

INTRODUCTION

Diabetic Retinopathy (DR) is one of the diabetic eye infection, which harms the retina of an eye because of diabetes. It may inevitably prompt visual impairment. Notwithstanding these scary insights, research demonstrates that at around 80 to 90% of the new cases could be reduce if there were legitimate and careful treatment and checking of the eyes in the early stage. The diabetic retinopathy is developed in the person who is suffering from diabetics may a while. Study stated that the person who is suffering from diabetics since four months can have a symptoms of Diabetic retinopathy (DR). That's why early detection and diagnosis plays an important role in the prevention of this hazardous disease. It is considered to be a challenging task because of unawareness about the consequences of diabetic can cause on the other human body parts by the patents of diabetics that may lead into blindness. The blindness caused by the diabetic retinopathy is not a curable disease, which makes permanent blindness.

The rate of diabetic peoples is increasing day by day and the need of automatic detection mechanism for this disease is the today's need. The severity of this disease is classified into two classes as proliferative Diabetic retinopathy (PDR) and non-proliferative Diabetic retinopathy (NPDR). The NPDR is further sub-categorized as Sever NPDR, Moderate NPDR, Mild NPDR and Normal. In order to identify these categories and the severity levels the key feature and a measure is blood vessels, microaneurysms, hard executants and cotton wool spots observed into eyes. In the automatic detection

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**Corresponding Author: kalyanik@rknec.edu*
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and classification mechanism, the eye fundus images are considered and based on these images the classifier has been built in-order to classify the images into its appropriate diabetic retinopathy classes and levels. The Diabetic retinopathy occurs when the sugar level in the eye exceeds the certain level which damages the tiny blood vessels of eye. It equally affects the both of the eyes. The DR has four stages (Mansour, 2017, p. 334; Qummar et al, 2019, p. 150530) as follows:

a. Mild Non-proliferative Retinopathy (MNPDR): Clear swellings in blood vessels are being found in retinal images which is previously tiny and thin.

b. Moderate Non-proliferative Retinopathy (NNPDR): Blockings in the blood vessels which shows clear spike in the fundus images. It may cause due to the damage caused to the blood vessels.

c. Severe Non-proliferative Retinopathy (SNPDR): Complete blockage in the blood vessels that affects the load on some of the unblocked blood vessels. It may leads to retinal loss.

d. Proliferative Retinopathy (PDR): New blood vessels are being created due to complete blockage of all the existing blood vessels that leads to the complete loss of vision.

Related work: The various mechanisms have been developed until now for the early detection and classification of severity leaves of diabetic retinopathy. In this section we have analysed various approaches presented and discussed by the research community in the field of diabetic retinopathy. There are many solutions are proposed using machine learning: NN, Regression, PCA, deep learning: CNN, Image processing based approaches, etc. Qiao, Zhu and Zhou (2020, p. 104292) proposed a system that will analyse the occurrence of microaneurysms in fundus retina images using deep learning with the integration of graphic processing unit that will help to boost a system performance. Classification of the fundus images into a class of diabetic retinopathy or normal retina has been done using semantic segmentation which shows better accuracy than the other existing methods. Kumar and Kumar(2018, p. 359) the author introduce the mechanism for classifier Diabetic retinopathy using linear support vector machine (SVM) along with experimental results with accuracy more than 90%. In this author also brief about pre-processing and the intermediate process followed to classify the fundus images into an appropriate class. In this for pre-processing morphological and histogram equalization has been used. In the next step of detection of MA, the constraint based adaptive histogram equalization (CBAHE) has been used.

Table 1. Comparison of existing work

Author	Methodology/ Technique	Positives	Negatives
Dai et al. (2018, p. 1149)	Deep learning	high-performance and low-latency inference and high accuracy	Need GPU to attend high accuracy
Roychowdhury, Koozekanani and Parhi (2014, p.1717)	linear support vector machine	sensitivity and specificity is more than 90 %	Not suitable for multi class diabetic retinopathy
Cao et al. (2018, p.191)	Machine Learning (ML) and PCA based Methods	Able to classify retinal vasculature	Not able to classify the retinal data into severity class.
Walter et al. (2002, p. 1236)	Image processing	Classifier Accuracy more than 90%	Complex data structure

Alzami et al(2019, p. 272) author presents fractal analysis as a key component for classification of retinal vasculature. In this fractal analysis fractal dimensions are considered that will help to categorize the retinal data into appropriate class with the help of classifier. In this work the author consider the random forest classifier to categorize the images into diabetic retinopathy or normal retinopathy using the MESSIDOR dataset which is one the scientific dataset that contains multiclass retinal images. Deperlıoglu and Kose (2018, p. 1) suggested the method of classification of retinal fundus images into appropriate classes based on Image processing and deep learning techniques. For feature selection and extraction image processing is used and based on these techniques appropriate deep learning method is implemented in order to classify the dataset into appropriate classes of retinal fundus images. The CNN based classifier has been used along with HSV, V transform algorithm and histogram equalization as a feature selection method. Finally the Gaussian low pass filter is applied to get the selected features.

Dataset; In this proposed area of work various datasets are made available to the researcher by the various communities around the world. The description of some of the dataset available and used in our research is as follows:

The various stages in the proposed methodology are:
Stage 1: In the proposed method the data is augmented by various parameters like rotation, rescaling, thresholding, histogram equalization.

Stage 2: The edges of the images are detected using Randomized Hough Transform. Randomized Hough Transform performs exceptionally well when we consider 3-Dimensional Data as per Borrmann et al. (2011)

Table 2. Dataset Details

SNo	Dataset	Link
1	KAGGLE	https://www.kaggle.com/linchundan/fundusimage1000/data
2	MESSIDOR	http://www.adcis.net/en/DownloadThirdParty/Messidor.html
3	FAZ	http://www.biosigdata.com/%3fdownload%3dcolour-fundus- images-of-healthy-persons-patients-with-diabetic-retinopathy
4	DRIVE	https://drive.grand-challenge.org/
5	DIARETDB1	http://www.it.lut.fi/project/imageret/diaretdb1/

Figure 1: Sample Dataset Images

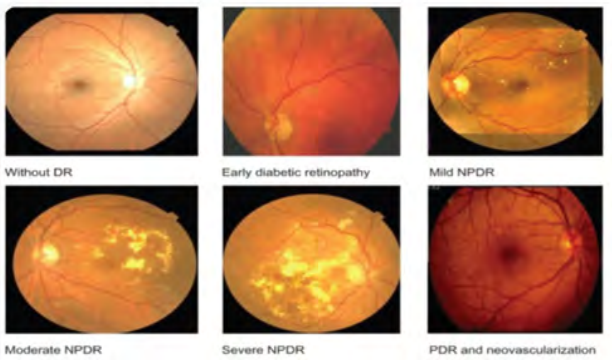
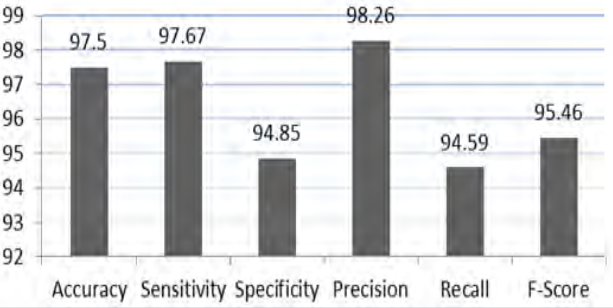


Figure 3: Score of Evaluation parameter



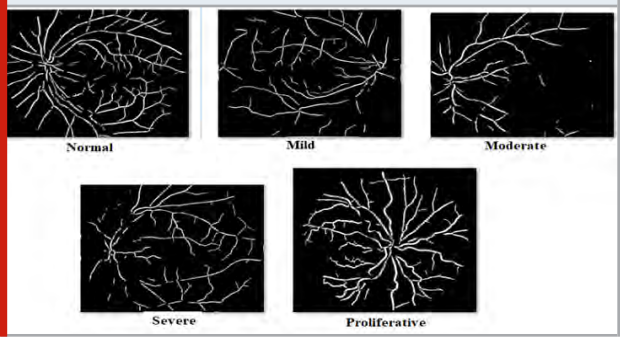
Stage 3: These image are given to Deep convolutional neural network model(DCNN). The DCNN Model is a stack of Convolution, Max-pooling and Dropout layer, which helps to improve the prediction accuracy. The DCNN model consists of following layers:

i. Convolution Layer: Combination of filter and Convolution matrix (Gaussian low pass filter of size 5x5 to 3x3 and convolution matrix (256x256 to 4x4))

ii. Max-Pooling Layer: MAX operation over the region 2x2 of input image.

iii. Supervised Dropout Layer: Performance improvement by preventing the network from over-fitting

Figure 3: Classifier predicted images Normal and Diabetic Retinopathy levels



iv. Hidden Layers and Feature Pooling: Optimization and Rearrangement after Dropout.

v. Activation Function:non-zero gradient rectifier activation function for intermediate layers and softmax probability distribution activation function for output layer.

Output Class Distribution: Proliferative (PDR), Severe, Moderate, Mild Diabetic Retinopathy, Normal/ No Infection.

Prediction Evaluation parameters: Figure 3 shows the classifier output of various predicted classes named as normal, mild, moderate, severe, and proliferative. The images are considered from KAGGLE dataset for classification into appropriate diabetic retinopathy classes. We have also presented the score obtained by our classifier while classification. The proposed classifier is based on the benchmark parameters like Accuracy, Sensitivity, Specificity, Precision, Recall and F-Score. The proposed classifier shows the success rate is around 95% shown in figure 4.

CONCLUSION

In this work we provide the various factors and the key points that we need to take care while developing the classifier for the fundus images. We have presented the multilayer machine learning methodology to predict

the various classes of diabetic retinopathy images along with the detection of blood vessels, spike in the blood vessels caused due to blockage, hard exudates, etc. We have used Randomized Hough Transform for detection of edges which provides better performance when compared to standard Hough transform and generalized Hough transform. The Deep convolutional neural network is used as a key classifier in this proposed work. We have recommended this methodology for deep classifier that predicts hidden classes in the predicted class. Our classifier also able to locate microaneurysms found near to the blood vessels. The proposed methodology has been analysed based on the accuracy, sensitivity, pension, recall and F-score and we found the better results in terms of the analysis of the proposed methodology.

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Hand Writing Board – Online Tool Used as a Means of Interactive Communication Using Images

Krunal Pande[1], Kunal Khadkeshwar[2], Nachiket Satpute[3], Pranshu Singh[4], Yash Gupta[5] and Vrushali Bongirwar[6]
[1, 2, 3, 4, 5, 6]*Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

ABSTRACT

This is a web application which can be used for two way communication. In the world of the pandemic where the face to face meeting and classes are affected this application can be used to communicate in this situation. The application provides a feature where one member has to create a room and then share the link of the room with other member. Both video and text chat option are available in the application. During the meeting or class members can in real time share the video of the sheet where one is writing or drawing. Also one can take a picture of the sheet and the picture is shared with all member. For the creation of room and video and text chat WebRTC module was used as it provides a real time communication ability and in fast. When we click a photo we need to erase the background, for this we used binarization. Using the binarization technique we eliminated the white background of the picture so that only the written or drawn part is visible. One the image is binarized it is send to the members. Then anyone who wants to append his/her side in the same image can do so which is implemented by image overlay method. Thus the member's interaction can be a two way communication.

KEY WORDS: WEBRTC, BINARIZATION, IMAGE OVERLAY, ONLINE COMMUNICATION

INTRODUCTION

There are challenges in taking classes online or holding an online meeting under the influence of corona. So, video meet in a good method to communicate [Sullivan, 2012]. In face-to-face class and at meetings, one can see the process of having someone write on a white board, handwriting on the board, and having another student or co-worker take notes. Now, there are a lot of scenes where it is very disruptive to not be able to do this, and they often communicate in one way and it is difficult to say that it is in a normal place.

We read different papers for a way of communication and also found their limitations [Merchant J., 2016][Mandy M., Rachel C., Mavourneen G. Caseyand M 2009] [Chaimeeboonand J., Namee K 2017].After reading and discussion we came to a certain conclusion. All you need is a white paper, a black pen and a smartphone. Members in one room can see what they are writing in real time and edit it together. Using this application one can track the process in real time to find out which student process. Teachers are far away and can find where they stumble, making the answer easier. Classes and meetings such as going around the white board with several people will be able to be done online.

Literature Review: Md. Habibur Rahaman has surved on the real-time and a fast solution for communication which helped our thinking[Rahaman M. 2015]. The importance of video chat/conference can be taken in note

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*****Corresponding Author: pandekv@rknec.edu
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from the paper of Sullivan[Sullivan, Jessica R. 2012]. From the papers of Jirayu Chaimee boonand Khanista Namee [Chaimeeboonand J., Namee K 2017] about Cisco Webx, John Merchant[Merchant J., 2016] about skype,Mandy M. Archibald1, Rachel C. Ambagtsheer, Mavourneen G. Caseyand Michael Lawless[Mandy M., Rachel C., Mavourneen G. Caseyand M 2009] about zoom, we found out that there is no method of communication as of ours which uses images for two way interaction. After going through this paper we came up with the idea of sharing images and able to communicate with the members along with voice and text chat.

Zinah Tareq Nayyef, Sarah Faris Amer [Zinah N, Sarah F 2018] paper and also paper of Cui Jian, Zhuying Lin [Jian C., Lin Z 2015] shows the implementation and importance of peer to peer communication using WebRtc. From the paper of Wan Azani Mustafa, Mohamed Mydin M. Abdul Kader [Wan M. 2018] we got to know about the binarization of image. For the threshold value of binarization Wan Azani[Wan M. 2018] Mustafa proposed the value. Paper of J. Trein, A. Th. Schwarzbacher, B. Hoppe, K.-H. Noffzand T. Trenschel[J. Trein, As Th., Hoppe B., Noffzand T 2007.] helped us with the idea of image overlapping. Christina Davidson's[Davidson C. 2009] paper gave us a thought to think about transcription and so does the paper of Karez Abdul wahhab Hamad , Mehmet Kaya [Karez H. ,Kaya H. 2016] about Optical Character Recognition .

MATERIAL AND METHODS

App Flow

1. Create a room.
2. Share the link made to students / colleagues.
3. After the meeting has started one can send the necessary pictures to the room.
4. Click on the image
5. Binarize the snapshot.
6. Send a photo to all users in the same room.
7. Change the white part of the bulk image and display the camera image below the scanned image.
8. This process can be repeated several times.
9. Send photos from your camera to users in the same room.
10. You can now control which photos are displayed on your camera or in a third party camera.

3.1. WebRtc: Significant advances in present day innovation in sending sight and sound and PC interchanges require elevated level correspondence between individuals [Zinah N, Sarah F 2018]. To meet this developing need, a continuous correspondence measure has been created. Continuous (RTC) correspondence is another and extensive approach to grow a web perusing model that permits admittance to data, for example, web-based media, talk, video, and online TV, just as coordinated interchanges. Clients of these applications can see, record, remark, or transfer video content. In the open source application WebRTC has empowered clients of these applications to see video substance or record, remark or stream on it to accomplish ongoing correspondence between internet browsers. .

Figure 1: WebRTC support in browsers

WebRTC is a type of constant correspondence innovation that has improved API (Application Programming Interface) innovation to empower ongoing mixed media transmission, for example, voice, and video (counting codes) accessible on an internet browser without a top notch sight and sound correspondence module from Peer-to-peer is accessible to web designers without the conventional module highlights utilizing JavaScript codes. WebRTC is an open source accessible to Google in 1122 for mixed media web applications. Presently, it is introduced on Web programs, for example, Firefox, Chrome, drama, and so on. Later on, this innovation will be applied to all programs aside from module parts, which can eliminate viral weaknesses while giving intelligent network. presents a program that pays for sight and sound web-based features, for example, video and video, distinguishes the client and finds different clients of the program, fulfills the essential prerequisites that will be viewed as secure without establishment or complex activity inside an internet browser on different gadgets and applications utilizing WebRTC.

WebRTC follows the semantics-server client promoter in the sense of peer-to-peer communication between browsers. Connectivity controls the media path to allow direct flow between browsers. Network signals are transmitted during Web Server which helps to convert, translate or manage signals, as required by WebSocket or HTTP. It was noted that the interface between the browser and the server is not the same as in WebRTC, where it is part of the application. Web servers can communicate using a standard signature protocol such as SIP (Session Initiation Protocol) or Jingle. Otherwise, the property is signed the law may be used for this purpose microphone, to more advanced video streaming and screen sharing apps.

3.2. Signalling and Negotiation: We need to know where user is located to connect with the user. The IP address allows to the Internet enabled devices to send information/data directly between each other. RTC Peer Connection is used for this. After locating each other on

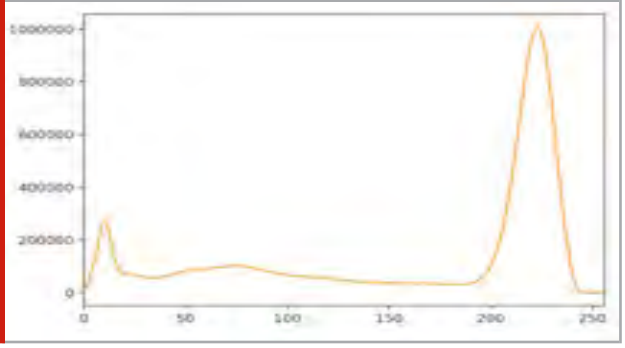
the internet, they start to share/exchange information between each other. They share information about which protocols and devices each device supports. Only Thing user need to do is exchange details of contact and rest of the process is done by WebRTC. This process is called as Signalling and Negotiation [Jian C., Lin Z, 2015].

There are some steps mentioned below:

1. Create a list which contains candidates for peer connection.
2. User needs to choose candidates for peer connection.
3. Another user is notified by Signalling layer about connection request.
4. User who sent request is notified of the status of the offer.
5. First user starts RTC Peer Connection with requested user.
6. They start to exchange the software and hardware information by means of signalling server.
7. They share location information with each other.
8. At last Connection is successfully established or failed.

3.3. Binarization: Binarization means converting a colour image into an image created only with black and white pixels[Mustafa A., Mohamed M. Abdul Kader, 2018]. A binary image contains only of black and white pixels, 0 for white and 1 for black. Used in OCR and Image Processing, and a Grayscale Image has all the pixels in a range 0-255 of grey. We used greyscale images to distinguish between object parameters and paper background.

Figure 2: Comparing frequency v/s pixel value



We utilized thresholding to change over grayscale picture to paired picture[Mustafa A., Mohamed M. Abdul Kader, 2018]. It fragments all pixels to either 1 or 0. All pixels (0-255) are planned and pixels crossing edge are fragmented to 1 or 0, 1 being white and 0 being dark. For characterizing the limit an incentive there are different methods. The calculation introduced in this work comprises of two stages. It consolidates the basic parallel thresholding and OTSU thresholding. It computes the t-esteem for which the weighted inside class difference of the two classes, 1 and 0, are limited.

In the Image, threshold is decided by comparing frequency v/s pixel value. Implementation using OpenCV cv2.threshold method, in JS or NodeJS. Cv2.threshold has options for thresholding as: THRESH_BINARY, THRESH_BINARY_INV , THRESH_TRUNC , THRESH_TOZERO. Used THRESH_BINARY to convert image pixels above threshold.

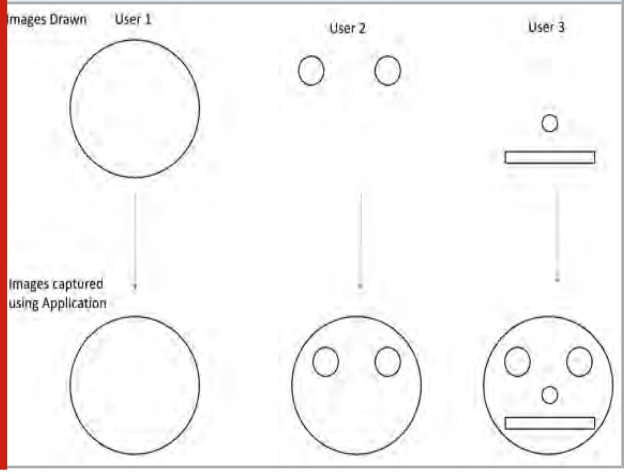
Code Snippet:

```
img = cv2.imread('gradient.png',0)
ret,thresh1 = cv2.threshold(img,127,255,cv2.THRESH_BINARY)
```

How Will Binarization be used?

- Binarization will convert user captured image to 1bit image. Now, the white part will be treated as transparent and only the black colour image will be displayed on the camera.
- User will capture a diagram and turn in for other users to modify. The other users will modify the image and turn it in for others to see. The overlap will reduce efforts of redrawing the entire image.
- Binarization will help in detecting transparent part of image since it consists only of black and white pixels, which are either 0 for white or 1 for black
- Implementation: Binarization can be achieved through thresholding technique in OpenCV using JavaScript. (cv.threshold, cv.adaptiveThreshold etc.)

Figure 3: Image Overlay



3.4. Image Overlay: Image overlay is used to place captured images by the user onto the already present image[J. Trein, As Th., Hoppe B., Noffzand T, 2007]. This is achieved using HTML and CSS. First place the background image as relative so Next place the overlay image as relative to the first image. Then images are formatted. Z-index is used to decide stack ordering of image.

RESULTS AND DISCUSSION

There are many of instruments for online communication that can be seen together in the world, the most significant

thing was to have the option to share manually written things progressively and alter them on the spot, so we zeroed in on that point. We were also stuck on running on a browser without installing an app so that anyone could easily achieve this. Ability to chat the members. Video Call facility for all to access. In the future we can also add the transcription and Optical Character Recognition (OCR) in the application. We thought of this topic and had a brief discussion about it. It will be helpful for the users. Transcription is a method of converting audio to text [Christina Davidson, 2009]. OCR is a technique to process the image and gather all text in the image [Karez H. ,Kaya H., 2016].

CONCLUSION

Rather than single direction correspondence like on-request conveyance, this application can without much of a stretch and very much impart progressively with any individual who has white paper, dark pen, and cell phone.

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Survey and Research Issues in Data Stream Mining

Lalit Agrawal[1*] and Dattatraya Adane[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

These days, an immense assortment and volume of information is constantly getting created from heterogeneous sources accordingly prompting a huge enthusiasm for the rising field of information stream mining. Information stream mining is where information is extricated from the data accessible in the information streams. There exist numerous applications which require this information for impromptu creation and business needs. Therefore preparing information streams in a proficient way is investigated by the specialists. In this paper, we present a short survey of different strategies accessible for the information stream mining.

KEY WORDS: CLASSIFICATION, DATA MINING, DATA STREAMS MINING

INTRODUCTION

Conventional frameworks for dealing with information digging were reasonable for the essential and appropriately orchestrated sort of data. Along these lines this sort of framework takes a lot of time in assortment of information, stockpiling of the information and their preparation. However, with the adjustment in situation these days, the choice must be taken "on-the-fly". Before delving into the subtleties of the different difficulties and their answers accessible in the writing it is critical to talk about the idea of the information stream. The stream is ceaseless and perpetual in nature. As a result of this property it is hard to store the whole stream into a concentrated information base and afterward apply a calculation to separate information accessible inside it. Other than capacity, handling this huge volume of information additionally gives certain difficulties [Khalilian M., 2010]. To beat various issues, the analysts have planned an alternate sort of information digging calculations and approaches for capacity and investigation of information constantly getting created from information streams [Han J., 2011].

Exploration in the field of information stream is essentially inspired by numerous applications which include volume of information age from an assortment of sensor information, information from different Supermarket applications, phone logs, information from satellites and different sources. Conventional methodologies are insufficient to mine information in the present condition which requires a constant examination and fast activity to inquiries as the information recently was Static and changing intermittently yet these days it is persistent and quickly changing hence new calculations are required[Agrawal L., 2020]. This paper is organised as follows: Section 1 provides the introduction about the data streams. Section 2 provides various methodologies for processing the data stream. Section 3 explains various stream mining algorithms which are available and section 4 describes various researches that have been carried out in the field of data stream mining.

Methodologies of data stream processing: Information streams are tremendous in volume, accordingly it is exceptionally hard to store information locally before handling. Subsequently it is clear that there is a compromise between the precision and the storage space

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needed. Synopsis [Aggarwal Charu C., 2007] is a kind of data structure that provides a summary of the data. This is smaller than the actual data sets but covers all the major aspects of the data. Hence the output generated considering the synopsis is approximately correct. We need efficiency both in terms of time complexity and space complexity. In the segment below we will discuss various such techniques which improve the accuracy of the prediction.

A. Random Sampling: Random sampling is considered as the simplest method for synopsis construction. In this type of method, data streams are sampled periodically. In this the specialisation of representation is not carried out instead multidimensional representation is generated related to the data points, hence the synopsis can be used with a variety of applications. Reservoir sampling is a technique which is utilized to choose arbitrary components which are fair with no substitution [Vitter J.S., 1985]. To choose tests of impartiality we should know the length of the information in advance yet since it is absurd on account of an information stream, this methodology is changed a bit. The primary concept in random sampling is selection of a reservoir of a sample of size[Gibbons P.B., 1998].

B. Sliding Windows: Instead of sampling data periodically, a new concept of sliding window can be used for analysis. The main motivation in this method is instead of computing a sample only the recent data is taken into consideration to make the decision which will replace the older data [Poosala V., 1999]. Window Size is 'a' and 'b' is considered as the arrival time of the new element. Considering this the expiry of the node can be calculated as 'a + b'. It also solves various problems of a memory requirement as only the data of the window size which is of a smaller size needs to be maintained.

C. Histograms: A synopsis data structure which measures the frequency distribution of values in a stream of information is known as histograms. It creates various extents by separating the information along the attributes to maintain the count of each bucket. The depth of histogram is further decided by the rule which is used to divide the data. Answers to the range queries can be effectively given using this strategy and in light of the fact that the main thing is to be determined is the bucket in which data falls, the query resolution can be additionally made proficient by deriving various methodologies from the available histogram [Poosala V., 1999]. The variant of this method is proposed as V-Optimal histograms [Jagadish H.V., 1998].

Data stream mining algorithms: The research in data stream mining has evolved continuously because of the enormous volume of data that is getting generated from a variety of applications and their business requirements. Various procedures have been proposed to extract meaningful information from the continuously evolving data streams.

A. Clustering: Various applications require the bifurcation of available information into different segments. Those segments are referred to as clusters. Various techniques are available to cluster the static information but it requires an additional overhead to cluster the dynamic, continuously evolving data streams as it has to be done in a single pass. Few methods for clustering data streams are mentioned below:

STREAM – Guha, Mishra, Motwani and O'Callaghan proposed a k-median based Stream Clustering Algorithm. It relies on the divide and conquer approach. In the initial stage this algorithm first fragments the incoming data stream into smaller fragments and after that it tries to identify smaller fragments by using the k-median algorithm. In the subsequent stage, weighted cluster centers are grouped in a small number of groups. This algorithm doesn't consider the concept evaluation concept in the stream.

CluStream [Aggarwal C.C., 2003] clustering methodology Works in two phases that are online and offline. In the online phase it stores the summaries of the data which is coming in the form of an information stream into the micro clusters. This idea is basically the advanced state of BIRCH [Poosala V., 1999]. Bigger segments are created by Offline components by applying the k-means grouping algorithm. ClusTree [Kranen A., 2009] Clustering methodology also works in two phases that are online and offline. In the Online phase it learns from the micro clusters. Any miscellaneous collection of algorithms can be utilized for offline components. This algorithm is termed as one of the best dynamic models.

HPStream [Aggarwal C.C., 2004] focuses on the grouping of multidimensional data streams. This technique gives more weight age to the more recent data whereas reducing the preference or the importance of the old data. It updates on incremental bases and it is different for every dimension. Hue Stream algorithm [Meesuksabai W., 2012] augments E-Stream algorithm [Udommanetanakit K., 2007], which has been discussed before this.. Probability distribution function is presented in this algorithm to support the vulnerability in various attributes functions. In this algorithm the proposed function is further utilised to join various incoming clusters or the new information which is approaching and it further decides the data where to put in by using the histogram methodology.

POD Clus[Rodrigues P.P., 2008] Is a popular model for grouping various incoming information streams. POD is known as probability and Distribution-based Clustering. This algorithm is better for two reasons: first it is appropriate for grouping by illustrations and it is also good by variable selections. To create the cluster data and to update it on the fly the data summary in the form of say means, standard deviation is utilised in this algorithm. This algorithm suits for the concept evolution because it allows the new groups to appear, the splitting of the existing groups and it also helps in merging of the two groups and removal of few groups.

B. Classification: Variety of classification strategies are available for stationary data. This is basically a two-step process where the new model is created by properly arranging the incoming data and then it is further utilised to predict the unknown class names from this new information. In traditional use the training information is stored in the database and it is available for screening multiple times but in the information streaming storing this continuously coming high speed data is impossible and not available for several times screening. We have mentioned below the few popular classification algorithms for the streaming data:

Hoeffding Tree Algorithm is proposed by Domingos and Hulten focuses on the concept of the splitting decision tree called the Hoeffding Tree. This name is derived from the Hoeffding bound.The core logic in this algorithm is that the hoeffding bound provides you with a certain level of assurance about the best attribute to divide further. The main advantage of this algorithm is that it gives high accuracy even if the data set is small in nature and in a single pass of screening. The main disadvantage of this algorithm is that it is not capable of handling the concept scenarios.

Fast Decision Trees [Hulten G., 2001] which is proposed by Domingos et al. made an serious effort to improve the rate and precision of classification. It divides the tree by identifying the current best attributes for splitting.The main advantage of this algorithm is that it gives better accuracy even if the information stream is small in nature and the main disadvantage of this algorithm is that it cannot handle the change in concept that is concept drift. To overcome this advantage this algorithm is further modified as Concept-adapting Very Fast Decision Tree(CVFDT). It uses the sliding window concept. Classification on Demand is based on the concept of Clustream [Aggarwal C.C., 2003]. The clustering process is further divided into two segments: in the first segment the analysis of data is carried out and in the later segment classification is carried out.

Research Issues: There are various research issues related to the extraction of data streams from heterogeneous sources and merging them to gain more accurate Insight. Few of these are mentioned in [Agrawal L.S., 2016].

- Handling the variety of input streams in real time
- Memory requirements to store and compute this information
- Privacy of the data
- After mining, the format of presentation is a research issue for heterogeneous data streams
- Data gets evolved continuously. So how to consider new knowledge and update the prediction is an important issue.
- Various tools are being developed by the researchers towards the analysis of data streams and features to include to cater all kind of data streams
- How the addition of new streams and removal of old streams will affect the current prediction and changes for future
- Genuine information may come at any time. How to differentiate between the outliers are common issues
- In data mining, data is discarded after it gets processed. Mechanism for data recovery if data is needed in future for reference
- Models to mine data streams should be smart enough to differentiate between change in concept and noise in data.

CONCLUSION

Many challenges are presented by the continuously evolving data streams and it has made researchers to focus and develop new ways to deal with such heterogeneous groups of data.In this survey paper, we highlighted the different issues raised by the data streams and review of a variety of clustering and classification approaches developed by the researchers to handle this information. One algorithm or technique is not suited to mine all kinds of data streams. The search for the best method to handle this data is still going on because of a variety of issues like accurate prediction, adaptability to the changing environment etc. We have presented a few popular algorithms in the field of clustering and classification of data streams.

From this survey we can conclude that the data streams are a huge volume of information, dynamic and contain many information needed for a variety of applications. So applying a static data mining algorithm is very difficult. The research in this field is still in its early phase and various issues mentioned in earlier sections can be solved by carrying out research in this domain. It is definite that data mining will play an important role in future business strategies.

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Automatic Text Summarization for Code-Mixed Language using Fuzzy Logic

Madhuri A. Tayal[1], Animesh Tayal[2] and Pratibha Kokardekar[3]

[1]*Assistant professor, Shri Ramdeobaba College of Engineering and Management, Nagpur. Information Technology Department, India*

[2]*Assistant professor, S.B. Jain Institute of Technology, Management and Research, Nagpur. CSE department.*

[3]*Assistant professor, Shri Ramdeobaba College of Engineering and Management, Nagpur. Information Technology Department.*

ABSTRACT

Natural Language Processing (NLP) is a domain of computing and natural linguistics. It is related to the unique conversation among machines and languages used by human. We are leaving in the era of machines, data and intelligence where the amount of information on the Internet is raising continuously, the method which are competent to build it preserved for users, e.g., by text summarization, question answering chat bots etc. The difficulty is highlighted with news stories, where numerous news providers account on same measures by same facts. Application like Automatic text summarization can resolve this challenge. By creating a wide-ranging summary of a given set of documents, Summarization can deal with the problem of information load through retrieving and showing the main content. This is still increased via the escalating quantity of information in community media where collection opinion in diverse languages can be verified. This paper addresses the boundaries of summarization by means of upward techniques that work in an extremely tall quantity and for multilingual scenario. Still the evaluation of automatically formed summaries in diverse languages is a exigent problem for the summarization community, as because human hard work are multiplied to make model summaries for each language. The retention ratio for above method is found to be around 75%.

KEY WORDS: NLP, POS-TAGGER, SUMMARY, TEXT DOCUMENT, EVALUATION, FUZZY LOGIC.

INTRODUCTION

World Wide Web is constantly generating content which is in many languages (code-mixed). Such data is difficult to handle, language detection and translation of these text fragments have become an extremely important problem. Many efforts have been done in one language like [Madhuri. A. Tayal, 2017]. This approach was applied for English language. In this approach title of the document [Madhuri. A. Tayal, 2013] was identified, syntax analyzer was built [Madhuri. A. Tayal, 2014] as well as semantic representation is done. This method uses semantic sentence and word similarity method [Madhuri. A. Tayal, 2014] as basis for text summarization. The above method was also applied for toddler stories [Madhuri. A. Tayal, 2018].

The development of social media texts such as chats, micro-blogs, Whatsapp, and blogs has formed a lot of novel opportunities for information retrieval and language technology, but also numerous novel challenges. Code-mixed data is the data which is in two or more languages

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and the source language for code-mixed data is free order as it is the user generated text. Whereas, the target language for this data is fixed order. Challenges in code-mixed data may occur due to contractions and transliteration. The existing language identification and translation systems are not intended to transaction with code-mixed text. [Ben King, 2013]

Codemixed text over social media may be in any language. The most common languages used in India are english and hindi. It is very difficult to process such kind of data. Currently, challenges faced are Handling the syntax of such sentence for detecting the languages, translation of such kind of sentences into one fixed languageso that it can further be processed for summarization.

Types of Summarization:

- Abstractive Text Summarization [Atif Khan, 2016]: This method builds an internal semantic demonstration and later uses natural language production technique to generate a summary. This summary is nearer to what an individual might express.
- Extractive Text Summarization [Tanveer Siddiqui]: This method retrieves the resultant output based on title, keywords, cue words and TF-IDF etc. from the original document.
- Hybrid Text Summarization: Using extractive summarization techniques, as well as abstractive methods it selects salient codes from the input reviews and embeds them into an automatically generated summary.

Literature Review: Worldwide utilization of computer mediated communication like Email, chats and most in recent times used, on social media like facebook and twitter has verified that code-mixed data is reasonably prevalent to the internet. In case of social-media data, there are various complications due to contradictions, non-standard spellings and structure as well as mixing of scripts. Many languages that use non-roman scripts like Hindi, Chinese, Bangla, and Arabic are often present in a romanized form. [G. Rohini, 2014], Very less work has been done on computational models of code-mixing due to deficiency of code-mixed data in conventional text corpora which makes data intensive methods hard to apply. To deal with the identification and labeling of the parts of text which are in different languages remains the first step, POS tagging and normalization remain the hard part to solve. There are existing methods, one of the challenging tasks is to identify the language. Spandana Gella and team have tried language identification task for short code-mixed documents containing one or two languages. [Spandana gella, 2014]

1. Angla Bharti and CDAC [RMK Sinha, 1995].

Anglabharti is an Indian machine translation system was developed by IIT, Kanpur under Prof. R M K Sinha. It uses a pattern directed approach using context free grammar like structures. The stratergy used in this lies between the transfer and interlingual approach. We referred this system but we cannot use this as Anglabharti supports translation from English to Indian languages and our work requires translation aid from transliterated hindi to English language [U. Ahmed, 2011] C-DAC has solutions for conversion of English to Hindi and other Indian languages like Assamese, Malayalam, Nepali, Bangla, Punjabi, Telugu and Urdu. A number of solutions have been developed in this area including Mantra, AnglaBharati and MaTra. Some of these are developed as part of multi institution consortium projects. These systems iffer in their underlying approach to translation as well as in language pairs and domains supported. The problem arrived to use this was same as this doesn't support translation from hindi to English.

2. Text Rank [Rada Mihalcea, 2004] [G. Rohini, 2014]: Text Rank is a graph based ranking algorithm. It runs on graph which is specially made for NLP application.e.g. key phrases etc.

3. Text as a Graph: It Identifies text units that best describe the task at hand, and add them as vertices in the graph. Identify relations that connect such text units, and use these relations to draw edges between vertices in the graph. Edges can be directed or undirected, weighted or unweighted. Until convergence iterate the graph-based ranking algorithm, sorts vertices based on their final score.

4. Cluster based method [Ganpathiraju,2002]: Clusters for summarizing has proved efficiency and gained popularity the principle behind similarity-based summarization is that important information is repeated in different sentence on the same event. Two features, verb similarity and noun similarity, are computed over the two primitive types, ranking of clusters would be done using tf-idf.

5. Fuzzy Logic [F. Kiyoumarsi, 2010]: Fuzzy logic is an extractive approach. This method extracts the sentences on the basis of its importance in the paragraph defined by the fuzzy analyzers. In this the importance of sentence is classified as the truth value with may have a real value between 0 and 1. The process is:

1. Fuzzify all the input sentences into fuzzy membership parameters.
2. Applying all the rules to generate the fuzzy output functions.
3. Defuzzification of fuzzy output functions to get crisp output values.
4. It was only for single language.

6. Vertex Cover Algorithm [Ansamma John, 2015]: This algorithm represents division of its vertices which can cover up all the edges of the graph. Each vertex of the graph will represent a sentence from a document. Each edge is to be maintained when two sentences share some similarity and i. e through combined cosine similarity and Normalized Google distance measures12. This algorithm is applied on this graph which finds the vertexes having

maximum information compared to others. Then according to score the sentences are incorporated in the final summary.

METHODOLOGY

In This method Domain Specific Input is used. Code-Mixed strings are taken as input. These strings are then checked or Hinglish(English+ Hindi) sentences. If there are no Hinglish sentences, it collects the string and it is directly used as final output. But, if there are Hinglish sentences, they are separated into English and Hindi Strings. This separation is done using wordnet and shabdhkosh. Hindi String is passed for transliteration. Using the translation API the Hindi word is converted to English. It is then concatenated with the English string and a new sentence is generated with the same meaning. This new sentence is again checked for Hinglish words. If any word is found then it goes through the same process. If not, then it is kept as final output.

Dataset: The dataset is domain specific that is the information in the input text will just concentrate on one particular area. For which two domains of five hundred sentences are created i.e. Knowledge and Art.This will contribute towards better summarized text.

for example:
1. Code-Mixed Text
Nowadays बच्चों के लिये free education provide होती है This is very useful उनका future build करने के लिये|
Many students उसके advantages ले रहे है|

2.Translated Text: Nowadays kids are provided with free education provide. This is very useful for building their future . Many students take these advantages.

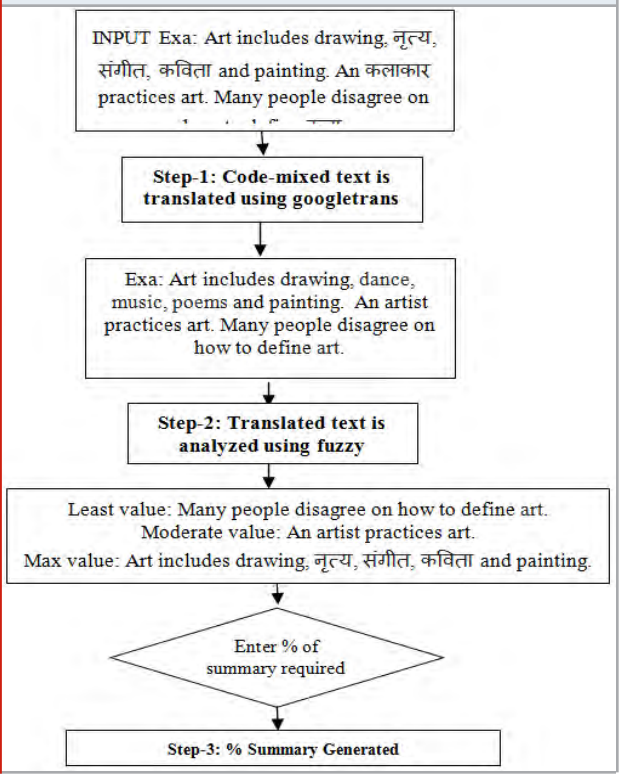
3.Summarized Text: Free education provided for kids builds their future and provide advantages to many of them. The elaborated method explained below in figure-1.

The input that is the source language is free order (codemixed of any two languages) and the output desired is fixed order (any one language among the two). Graphical User Interface was created using Tinkter. Python programming was done in Anaconda Spyder IDE. We have used Spyder i.e. statistical calculating environment through the sustenance of current libraries such as Pandas, NumPy, SciPy, or matplotlib etc. The process is explained here in detail.

Step-1 Translation Process: Translation was done by using Googletrans which is a free and limitless python library that implemented google translate API. This uses the Google Translate Ajax API to make calls to such methods as detect and translate. The maximum character limit on a single text is 15k. Stepwise one of the sample outputs is shown at the end of this paper.

Features of Googletrans include
1. Auto language detection
2. Fast and reliable-it uses the same servers that translate.google.consumes
3. Bulk translations
4. Customizable service URL.
5. Connection pooling (the advantage of using requests session).

Figure 1: Summarization Process Using Fuzzy Logic



Step-2: Summarization Process: The text summarization system takes a domain specific input and processes it by applying fuzzy analyzers. Fuzzy analyzers used are

- The number of important thematic words and keywords in the sentence.
- Whether the sentence is first, middle or last sentence. (i.e. is the location of the sentence).
- This gives the priority of the sentences based on the logical parameters. Then the extracted text obtained by applying fuzzy analyzers gives the output summary.

- **Importance of Using the Fuzzy Analyzers:**

1. Keywords: In a summary there are certain keywords that are used a greater number of times and have high weightage in the paragraph. Also, there words that are relatively important based on the domain of the paragraph.

2. Location: Also, the position of the sentence helps to prioritize sentence as in a summary the last sentence plays an important role as it gives the gist of and has a higher precedence than middle sentences. Also, the first

sentence is more important than the middle sentence as it gives the idea about the paragraph.

Table 1. Categorization of words according to keyword and location

Location / Keyword	LAST	MIDDLE	START
LEAST.IMP	BETTER	GOOD	BETTER
MODERATE.IMP	BETTER	GOOD	BETTER
MAXIMUM.IMP	BEST	BETTER	BEST

In the above table 1, Input taken is keywords and location. Keyword has been categorized as least important, moderately important and max important. Location has been categorized as last, first and middle sentences. These parameters have been assigned a crisp input values so that they can produce crisp output values. The output is categorized as good, better and best. The values will be a real integer between 0 and 1. IF – THEN rules are made out of the input parameters and based on this the output i.e. good, better, best sentences are taken out. Deffuzification of these fuzzy variables is done for getting the parameters into crisp value. Thus, the output will be produced. In the above table 2, based on the importance of keywords, they are categorized as least, max, moderate. They are assigned a range of values between 0 to 1.

Table 2. Values of keywords

FUZZY VARIABLE	CRISP INPUT VALUE OF KEYWORD
LEAST IMPORTANT	0 - 0.3
MODERATELY IMPOTANT	0.25 - 0.6
MAXIMUM IMPORTANT	0.55 – 1

Table 3. Values of location

FUZZY VARIABLE	CRISP INPUT VALUE OF LOCATION
MIDDLE	0 – 0.3
FIRST	0.25 – 0.7
LAST	0.65 – 1

In the above table 3, location of sentences is classified as first, middle and last. They are assigned a range between o and 1 on the basis of their position. In the above table 4, the output value of the sentences based on crisp value of keywords and location is assigned a range between 0 and 1.

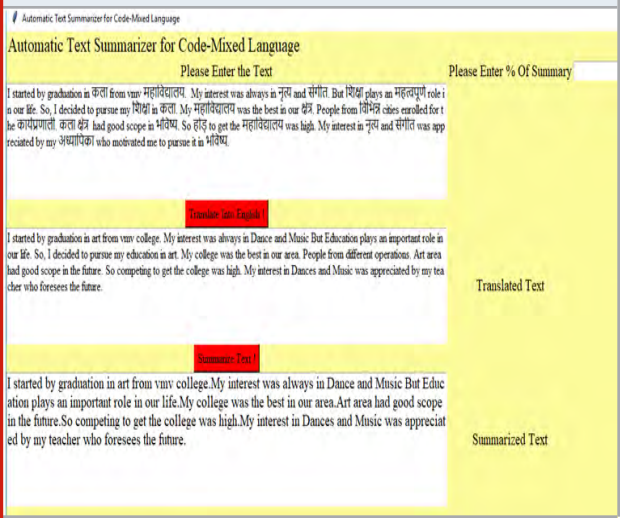
Table 3. Values of location

FUZZY VARIABLE	CRISP INPUT VALUE OF LOCATION
MIDDLE	0 – 0.3
FIRST	0.25 – 0.7
LAST	0.65 – 1

Table 4. Crisp output values

FUZZY VARIABLE	CRISP OUTPUT VALUE
GOOD	0 – 0.2
BETTER	0.15 – 0.6
BEST	0.55 – 1

Figure 1: Sample Output for Automatic Text summarization for code mixed language



RESULTS AND DISCUSSION

Compression ratio and retention ratio are two parameters for Evaluation of Summary. We have not used compression ratio as we are taking input for percentage of summary required from user. The text is evaluated using retention ratio as the parameter,

Retention Ratio: RR= (No. of Sentences generated by System)/(No. of Sentences generated by Human)

We have tested our system for two domains Knowledge and Art. For each category five hundred documents of each category were tested. table 5 shows the sample of some documents from these two domains. Approximately our system retains 75% of Summary as compared to Human Expert.

Figure 3: UV-VIS Spectra of the compound, PA-B-ester

DOMAIN 1 - KNOWLEDGE					DOMAIN 2 - ART		
Sample Docs	System generated summary	Human generated summary	Retention ratio	Sample Docs	System generated summary	Human generated summary	Retention ratio
Knowledge 1.doc	5	7	5/7	Art1.doc	4	6	4/6
Knowledge 2.doc	4	6	4/6	Art2.doc	7	9	7/9
Knowledge 3.doc	5	6	5/6	Art3.doc	6	7	6/7
RR for Domain-1		0.738		RR for Domain-	2		0.767
Average of Both domains=0.752							

CONCLUSION

In this paper we represented different multilingual/ code mixed approaches of text summarization. The work of tokenization of words and sentences was done using Natural Language Toolkit. Translation of source and destination language has been done using GoogleTrans API. Various translation methods were studied like goslate, anglabharti, Moses. Tkinter was used for making graphical user interface. Summarization was done using Fuzzy Logic. We have used location and keywords as input values. In future more, more input values can be taken for better results and more intelligent methods can be applied.

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Slouch Detection Using Open Pose Architecture

Manav Shah[1*], Rohit Singh[2], Nimit Haria[3], Krish Fadia[4] and Kriti Srivastava[5]
[1, 2, 3, 4, 5]*Dwarkadas J. Sanghvi College of Engineering, Nagpur India*

ABSTRACT

Slouch detection refers to computer vision techniques that detect human figures in images in order to determine the current posture and check if a person is sitting ergonomically. This is an important subject because following poor posture habits is known to be one of the primary causes of back pain because of its adverse influence on the transverse abdominis muscle. Maintaining good posture could help improve one's health in the long run. This paper implements slouch detection using OpenPose architecture, which first finds the relative position of joints with respect to the body. This information then helps determine whether the human subject in a given image is sitting ergonomically or not. In this paper's implementation, high accuracy was achieved and slouch detection was made more feasible by eliminating the need for several sensors.

KEY WORDS: SLOUCH DETECTION, POSTURE DETECTION, OPENPOSE ARCHITECTURE, MACHINE LEARNING.

INTRODUCTION

In today's modern world, it has become easier than ever to find yourself slouching in-front of a laptop or television screen. Not positioning yourself correctly for a long period of time can take its toll on your muscles, joints, and ligaments. When your body gets used to being hunched over for hours, it can be easy to continue that same posture, even when you're not in front of a screen. Maintaining correct posture while sitting or otherwise, benefits both our mental [Peper, 2017] and physical health. Aside from the fact that good posture aids in preventing health issues, it also contributes to achieving a more comfortable working experience in workplaces.

On the flip side, improper posture has a detrimental effect on mood, thus leading to reduced quality of performance and satisfaction. Furthermore, various musculoskeletal injuries, health issues such as sprains, back pain, carpal tunnel syndrome and neck pain could also be attributed to poor sitting positions. As per [Lindsay Olson, 2013], 86% of Americans remain seated for the majority of their work-day. Hence, it is essential that people in the workplace be cognizant of their sitting posture in order to reduce health risks over a long period of time. According to [Alyazyah Alsuwaidi, 2017], 76% admitted that their posture was not good. More than 90% of these people were found to be experiencing back pain on a regular basis. This motivated us to implement a solution that caters to a large section of the population and this paper aims to minimize these health issues by reminding the user to correct their posture when it is detected that they are slouching. By using OpenPose architecture, improper posture was detected by taking a lateral view image as input. The position of a human's spine, ear and hip were then used to classify whether the person is slouching or sitting straight.

Related Work: In [Michael Battaglia, 2015] Michael Battaglia et al list the different approaches that have been tried before it to improve poor posture practices. Lumo Back was an independent device, Nekoze was a webcam application and keeping in mind their limitations, they came up with a Microsoft Kinect based approach, which works by tracking the left shoulder, right shoulder, center shoulder and head. These measurements are then

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averaged out over multiple frames. They also normalize the positions such that the neck joint would lie on the y-axis only. Therefore, the difference between positions can be found. They have used kNN for classification. The implementation is done by correctly identifying the shoulder joints and fails when the user is sitting in an extreme position (perpendicular to camera). This paper has improved upon this by considering the side view of the body.

A deep learning model to detect real time postures in gymnasts has been implemented using OpenPose model [W. Wen, 2019]. They have used the OpenPose model to extract the key points of the gymnasts. A convolutional network is used to extract features and correctly link body parts like elbows or shoulders. The method inputs an image that is processed by a VGG-19 convolutional network. Part Confidence Maps and Part Affinity Fields are then extracted by a CNN. Bipartite Matching is then used to find part association. It results in good real-time performance. This method can get key points such as ears and hips to tell the angle at which they are aligned and predict the slouching of a person. While they have implemented this model to find the posture of the gymnasts, this paper uses this model for slouch detection. Also, the OpenPose model is used for multi-person key-point detection, but it is possible to use this for a single person detection by using only the Confidence Maps for body part detection.

In [A. Abobakr, 2017], a deep residual network is trained to calculate joint angles from a single image in order to evaluate ergonomic metrics. The primary purpose of this paper is to help develop a method to estimate the risk of work-related musculoskeletal disorders (MSDs). [Plantard P, 2017] dives into 3 assessment methods: self-report, direct measurement and observational methods. It explains why self-report can be misleading and inaccurate, and direct methods often require high tech sensors, which make that method infeasible in several situations. This paper utilizes Kinect SDK for perceiving 3D joint positions. ResNets (deep residual convolutional networks) are heavily employed in this method. Motion capture data is mapped onto virtual human figures by using various anthropometric measures. However, this approach has trouble dealing with cluttered environments and is computationally expensive. This paper motivated us to use the joint based approach for detecting posture and to try and come up with a method that does not require dedicated gadgets.

In [Alyazyah Alsuwaidi, 2017], sensors attached to clothes are used to identify the angle of the spine. However, excessive calibration for most postures is a necessity. Accelerometers as well as gyroscopes are utilized for dynamically assessing changes in position. Even though the thoracic angle was accurately obtained, differentiating between regular bending and improper posture was problematic. Visual analysis as well as principal component analysis was carried out, but because the intended results were not met, it was concluded that a single sensor might not be reliable for this purpose.

Boundary extraction and contour selection is utilized in [8] for detecting objects. Orientation of a posture is detected by the help of analyzing head positions. Once a human figure is found in the input image, a neural network is used to find the lower or upper body after which the head is found and final posture is classified. An image is often split in order to find contours. In this paper, they create two separate and compare halves of the upper and lower body to predict the action being carried out in a video that was enhanced using filters. An accuracy of close to 90% was reached by combining head detection with lower/upper body recognition.

MATERIAL AND METHODS

This paper uses the OpenPose model [Zhe Cao, 2018], to identify the location of important joints on the human body. Below is the architecture of an OpenPose Model:

Figure 1: OpenPose Architecture

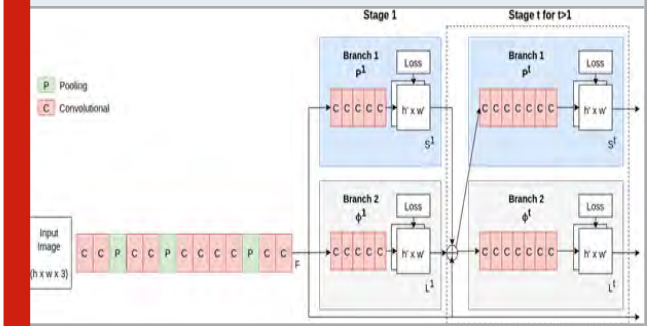
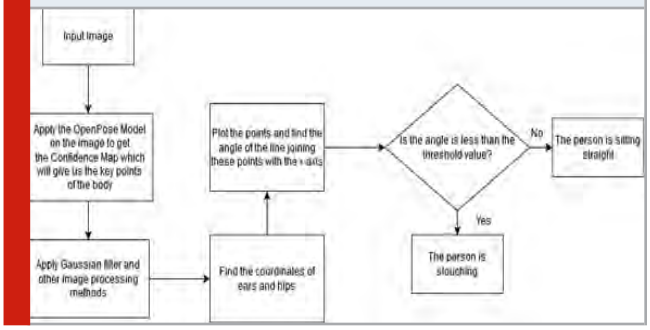


Figure 2: Flowchart of Implementation



This model takes as input, an image of size (h x w) which is then passed through the following structure made up of two stages:

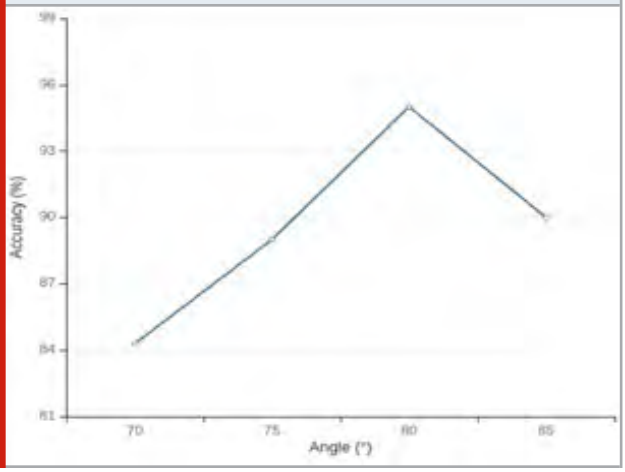
1. Stage 0: Feature map is created in this stage by the leading ten layers of the VGGNet [M. F. Haque, 2019].
2. Stage 1: This stage consists of two branches of CNN. The first branch predicts 2D Confidence Maps (S). A Confidence Map is a grayscale image with higher values at locations where a certain joint is likely to be present. For the 18 point model, the first 19 matrices give Confidence Maps. 2D vector fields (L) of Part Affinities (PAF) are determined by the second branch. The output is the confidence map of key-point pairs along with Part Affinity

Heatmaps. OpenPose model has been trained on Coco dataset, an open-source data set with 14,000 relevant images.

In order to detect the key points, the model first finds the confidence map to detect the body part and part affinity field which would help us pair the associated body parts. Then comes the post-processing stage, where a Gaussian filter is applied. Next, the coordinates of ears and hips are calculated which are further used to find the angle and check if it is less than the threshold value.

Experimentation was performed with various angles in order to find the optimum angle for detecting slouch. Tests for the following angles were conducted: 70, 75, 80 and 85. As evident in fig. 4, accuracy rises till 80 degrees and then falls. Since 80 degrees is the peak, it was concluded that maximum accuracy is found at an angle of 80 degrees. This maximum accuracy is 95.31%.

Figure 3: Threshold Angle vs Accuracy



RESULTS

Accuracy, Recall, Precision and F-Score for our implementation are all shown in table 1

Table 1. Evaluation Metrics

Accuracy	0.9531
Recall	0.9697
Precision	0.9411

Consider the following example for testing the output given by our program. Two images were provided to the model as input, in order to predict whether the person in the image is slouching or not. In the first image, the person was sitting in a straight position and in the second image, the person's back was slouched. The model correctly predicted the output as "Straight" and "Hunchback" respectively for the two images, as shown below. Furthermore, the joints that the OpenPose model returns are depicted as dots of various colours.

Figure 4: Human sitting straight

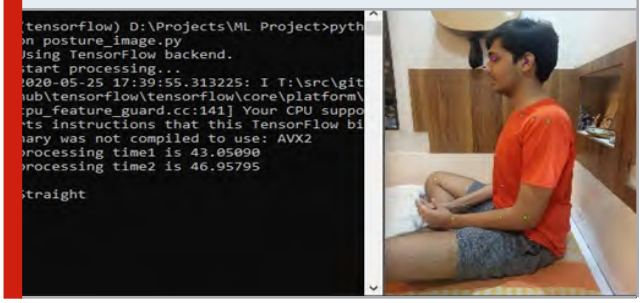


Figure 5: Human sitting with a hunchback

CONCLUSION

In conclusion, after considering traditional methods and their drawbacks, this paper has implemented a new approach to detect slouch in the sitting posture of humans based on OpenPose architecture. This method is able to determine whether a person in an image slouches or not with high accuracy. This paper has made an effort to make this implementation feasible by reducing the need for specialized sensors as well as improve upon most shortcomings that the earlier implementations had.

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Improved K-Means Clustering Algorithm Based on KD-Tree Approach

Manish Bhardwaj[1] and Dattatraya Adane[2]
[1]*Ph.D. Scholar, Computer Science and Engineering Department, Shri Ramdeobaba College of Engineering and Management, Nagpur (MS), India.*
[2]*Department of Information Technology, Shri Ramdeobaba College of Engineeing and Management, Nagpur (MS), India.*

ABSTRACT
The Cluster Analysis is a vast area of application such as security, Image recognition, scientific investigation, business intelligence, biology, and web search. K-Means clustering algorithm is not performing well with huge data sets in terms of Execution time. To overcome this, A Parallel Approach is used to implement the K-Means algorithm using OpenMP API with the KD-Tree approach to provide dynamic load balancing, optimized execution time, and maintaining accuracy. The experiments are performed on handwritten digits and Bagofword data sets by using a system with multi-core. After the analysis of the Sequential approach and Parallel approach of implementation of K-Means, it is observed that the parallel approach outperforms with similar accuracy utilizing the computing resources available with the multi-core systems.

KEY WORDS: K-MEANS, CLUSTERING ANALYSIS, OPENMP, PARALLEL APPROACH.

INTRODUCTION

A Clustering is the process of grouping similar data sets objects into clusters. The objects they are similar belong to the same cluster and the object they are dissimilar belong to other clusters. This concept of different applications in many areas such as biology, web, business, and security, etc. K-Means is a popular clustering technique. In the K-Means clustering parameter k, which is defined by the user is used to calculate the centroid. It is based on an iterative process that filters the result. If the calculated cluster point becomes the convergence then they are considered as the final result. In this process, the nearest neighbor search operation is used [Jiawei Han, 2012].

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*****Corresponding Author: manish.bhardwaj1sept@gmail.com
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Different Clustering methods are used and can be classified as Partitioning methods, Hierarchical methods, Density-based methods, and Grid-based methods. K-Means Clustering is a Partitioning based method.

Parallel processing is used to solve a problem to reduce the time requirement of it. In Task partitioning, decomposition of solving procedure, and distribute them among the number of processors available and/or Data partitioning technique, data is divide and distributed among available processors and processor work with data in parallel. KD-Tree is a type of binary search tree, which is used for dynamic partitioning and overcome the problem associated with a static one. KD-Tree is constructed in parallel and shows better scalability. OpenMP API is useful in a shared memory environment, it take the advantage of multiple cores available in the system. The task is the process by multiple threads in a synchronous manner and the load is distributed among all threads. The Numbers of threads are created according to the number of processing elements present in a system. Independent blocks of code are required to find out and

after the appropriate directives are placed before it. These are the indicators to compile the presence of a region that can be executed in parallel.

Related Work: Giuseppe Di Fatta and David Pettinger proposed and implemented improved K-Means algorithms based on the Binary Search Tree data structure called KD-Trees. To overcome the problem associated with static partitioning, dynamic partitioning is used for parallel implementation in a heterogeneous environment and it shows better scalability as compared to parallel brute force K-Means. The parallel algorithm totally depends on how the data sets are partitioned. KD-Tree construction is done in parallel. At last, the load is distributed using a dynamic load balancing technique [Giuseppe Di Fatta, 2010].

Qing Liao et al. proposed two strategies. Distance Measure strategy is the first approach in which the value of q is used to choose the value of Distance. If q is less than or equal to 8.495 Euclidean distance is chosen, if q is greater than this value Manhattan distance is chosen. The initial centroids selection strategy is the second approach if the data object belongs to a high-density area, in this case, it will be chosen as a centroid. By using this better stability and accuracy can be achieved [Qing Liao, 2013].

Mohammed Baydoun et al. implemented the K-Means algorithm in parallel by using OpenMP, Cilk Plus, MPI, and CUDA environment. OpenMP and Cilk Plus using a multithreaded programming model. In the CUDA environment, multiple GPUs are used, first threads are used to take care of the pattern and each thread maintained local memory to store the sample data which is used to choose the centroid. After analysis, they concluded that with small size data sets the OpenMP is performed better than all other but once the data size increase in that case with large data sets CUDA implementation shows better speedup [Mohammed Baydoun, 2016]. XiajKang Li et al. proposed the K-Means clustering method that is based on density. The mean shift algorithm is used to get local density maxima as initial cluster centers in place of computing the local density of each point cost O(n2) time. The mean shift algorithm is an iterative process to detect local maxima of the data set. The benefit of this approach is to choose parallel K-appropriate local density maxima as initial cluster centers to cluster the data set in parallel [XiajKang Li, 2014].

S.N Trirumala rao et al. Proposed the parallel K-Means algorithm by using OpenMP API and mmape() function, to utilize the system page which improved the I/O operation. First the data set is partition into the different block and one block at a time is cached into memory. In OpenMP API multiple threads are processing the data in parallel in a synchronous manner. This is the key factor for better I/O and speedup [S. N Tirumala Rao, 2009]. Yufang Zhang et al. used a Master and slave technique to implement the K-Means in parallel. The master code is available in the host system. Its function is to distribute the data sets among multiple slaves and collect back the clustering result from them. The Load of the slaves is dynamically balanced. They proved that master and slave techniques show better efficiency [Yufang Zhang , 2006]. Juby Mathew et al. proposed the K-Means algorithm based on the concept of Firefly. The concept is based on the behavior of Firefly, how they are attracted to the light intense Firefly, in the same manner, the optimal cluster centroid can be obtained, and by using this optimal centroid the K-Means algorithms find more accurate clusters [Juby Mathew, 2015].

Improved Parallel Approach For K-Means Clustering: In Parallel approach for implementation of K-Means clustering, OpenMP construct play important role. It is working in the concept of Fork-Join. Where the task is divided and performs concurrently with the help of multiple threads, with proper synchronization and results are combine to generate overall result. First specific number of K is selected after that initial points are chosen by number of threads, each of the thread execute the Perform_clustering ( ). All threads are perform the operation in proper synchronization and cluster wise totals and cluster wise count is calculated. Once new Cluster points are calculated , they are compare with the previous cluster points , if both of the cluster points are same it is display as the final cluster points, Otherwise new cluster point is set as a currents cluster point and same operation of calculation of cluster points perform again till the convergence not meet.

Step 0. Select a suitable number of clusters, k.

Step 1. Select k initial cluster points.

Step 2. Choose the number of threads (let say 4 threads).

Step 3. By using section construct parallel section starts Perform_clustering ( );

Step 4. Apply the appropriate barrier for different threads.

Step 5. Calculate and use cluster wise count and Cluster wise total by using KD-Tree to dynamically balance the load among threads.

Step 6. Calculate again cluster points. Compare this cluster points with previous cluster points. If both the cluster points are existing cluster point is the same in this case display result otherwise again calculate the cluster point and repeat the previous condition.

Step7. Display Converge cluster points as a result.

Section constructs divide the task among threads. The Barrier construct is used to provide proper synchronization. Operations are performing in parallel with the help of Parallel construct with the proper declaration of shared and private variables [D. S. Bhupal Naik, 2013].

Experimental Analysis: In order to evaluate K-Means

clustering method. It is implemented on system with Intel i3 CPU M380 processor with 4 GB RAM and 320 GB Hard Disk and Intel Pentium 4 processor with 1 GB RAM and 80 GB Hard Disk. The system is loaded with Ubuntu 18.04 and Ubuntu 16.04 operating system respectively. GCC compiler is used to execute the Parallel and Sequential implementation of Programs. The UCI Machine Learning Data Sets Repository and MNIST Database of Handwritten Digits are chosen and data repository. The K-Means Clustering method has analyzed on 2 Data Sets. Handwritten Digits and Bagofword. The analysis is performing on the basis of their sequential execution and parallel execution time requirement. Later the same is used for defining speedup and comparison between the sequential and parallel implementation of programs.

Table 1. Performance Analysis of Handwritten Digits data with Number of Objects=2000

Number of Cluster	PTime (in seconds)	STime (in seconds)	Speedup
2	0.3606	0.9347	2.5806
4	0.5391	1.4775	2.7406
6	0.6526	1.8436	2.8250
8	1.1439	3.2829	2.8699
10	2.0694	6.0241	2.9079

Table 2. Performance Analysis of Handwritten Digits data with Number of Objects=70000

Number of Cluster	PTime (in seconds)	STime (in seconds)	Speedup
2	12.3169	32.0211	2.5997
4	21.5585	59.5629	2.7628
6	33.6989	96.2007	2.8547
8	48.0502	139.2176	2.8973
10	111.7732	311.9214	2.7906

Table 3. Performance Analysis of Bagofword data with Number of Objects=3710423

Number of Cluster	PTime (in seconds)	STime (in seconds)	Speedup
2	0.1913	0.4001	2.0914
3	0.2157	0.4788	2.2197
4	0.2559	0.5996	2.3431
5	0.2828	0.7237	2.5590

The Table I show the time required of data set with 2000 objects in seconds for clustering. Its shows both sequential as well as parallel implementation time requirements. The Speedup achieved by parallel execution is ~ 2.78. The

Table 4. Performance Analysis of Bagofword data with Number of Objects=69679430

Number of Cluster	PTime (in seconds)	STime (in seconds)	Speedup
2	3.5246	8.0604	2.2868
3	3.9926	14.043	3.4847
4	4.7307	14.7532	3.1186
5	5.2536	16.9116	3.2190

Figure 1: Performance Graph based on Table I

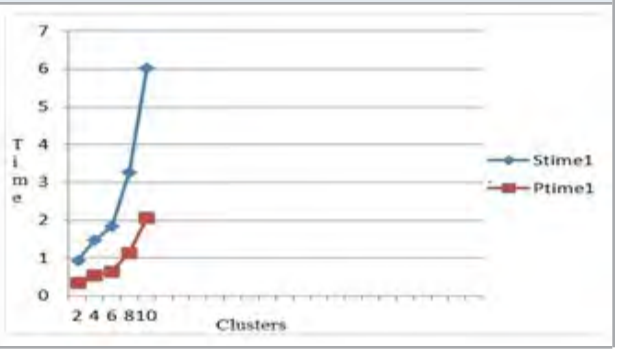


Figure 2: Performance Graph Based on Table II

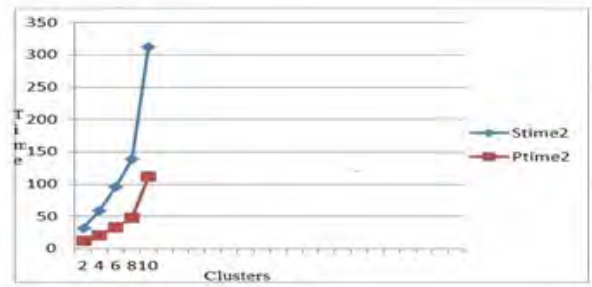


Table II shows the time required of data set with 70000 objects in seconds for clustering. Its shows both sequential as well as parallel implementation time requirements. The Speedup achieved by parallel execution is ~ 2.78. The Table III shows the time required of data set with 3710423 objects in seconds for clustering.

Figure 3: Performance Graph Based on Table III

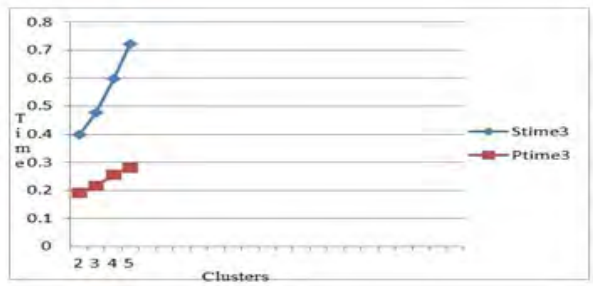
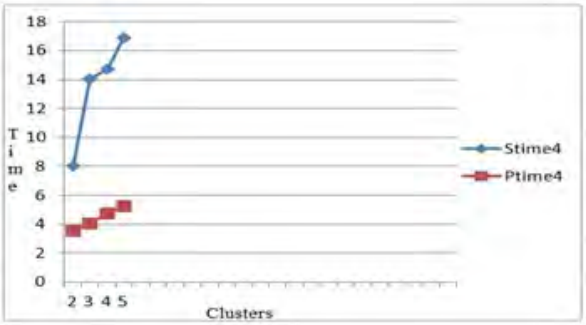


Figure 4: Performance Graph Based on Table IV



It is shows both sequential as well as parallel implementation time requirements. The Speedup achieved by parallel execution is ~ 2.3. The Table IV shows the time required of data set with 69679430 objects in seconds for clustering. It is shows both sequential as well as parallel implementation time requirements. The Speedup achieved by parallel execution is ~ 3.02.

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Improved Parallel DBSCAN Algorithm Based on Radix Sort

Manish Bhardwaj[1] and Dattatraya Adane[2]

[1]Ph.D. Scholar, Computer Science and Engineering Department, Shri Ramdeobaba College of Engineering and Management, Nagpur (MS), India.

[2]Department of Information Technology, Shri Ramdeobaba College of Engineeing and Management, Nagpur (MS), India.

ABSTRACT

DBSCAN is one of the main density-based clustering algorithms and can find arbitrary shaped clusters and eliminate noise data. However, DBSCAN has a Quadratic time complexity, making it difficult in application with a large data set. Parallelization, DBSCAN to improve its performance is a challenging task because of OpenMP or MPI environments, there is no guarantee of proper load balancing and fault tolerance. We present the improved parallel DBSCAN algorithm using the OpenMP environment based on the Radix sort to solve the problem of load balancing. Shared memory programming is used to divide the task and then uses the Radix sort method to select data points for DBSCAN for clustering. With a large number of data points original DBSCAN unable to compute the clusters with limited memory, this improved parallel DBSCAN can able to handle the same. Experiments show that this improved method obtains better results with original DBSCAN while shows significant improvement in computation time requirement.

KEY WORDS: PARALLEL CLUSTERING, DBSCAN, SHARED MEMORY PROGRAMMING, PARALLELIZATION, RADIX SORT, OPENMP.

INTRODUCTION

Clustering divides the data into groups that are useful or meaningful or both. Data objects that are similar to each other within the same cluster and those are dissimilar to the objects in another cluster. Clustering based on density can discover the arbitrary shape clusters and able to remove the noise. Clustering has a wide range of application areas such as a statistic, information retrieval, pattern recognition, biology, and data mining. DBSCAN is presented in 1996. One of the main density-based clustering algorithm. DBSCAN is a density-based method that finds clusters according to a density-based connectivity analysis. DBSCAN calculates the density by counting the number of points in a fixed-radius neighborhood and considers two points as connected if they lie within each other neighborhood. Core points are points with a dense neighborhood. Border points are points that belong to a cluster but whose neighborhood is not dense. Core points are points with a dense neighborhood. Border points are points that belong to a cluster but whose neighborhood is not dense, Noise can be defined as the set of points in the database not belonging to any of its clusters [Martin Ester, 1996].

Different Parallel approaches are being used to reduce the load balancing problem faced by Clustering algorithms. Multiple Parallel DBSCAN algorithms are created and try to break the sequential processing. Most of the Parallel implementation tries to solve the following problems: Load Balancing: The DBSCAN execution time varies due to skewed data distribution to different processing elements. Some of them lightly loaded the other are heavily loaded.

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*Corresponding Author: manish.bhardwaj1sept@gmail.com
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1. Data Split: A region split approach make the work more complicated, if we consider the data points distribution in each sub- region. It increases the overall time requirement of computation.
2. Expensive Merging: The sum of data points processed in sub-region is always greater than the overall sum of all data points. This increase overall execution time.

It is observed that DBSCAN computation is performed sequentially. To take the advantage of multiple processors (core) available in today's system. Fist the sequentiality is required to break. Data structure like R –tree, R*, Disjoint set data structure can be used to improve the performance. In our approach, we use a shared-memory programming API called OpenMP to take the advantage of Fork-Join Model to perform the independent subtask. The Radix sort approach is used to handle load balancing among different threads [Guoping Xiao, 2014]. The data points are sorted by their attribute values which are used for clustering. This is the key of all partition allocated to the different thread are having proper load balancing and points which belong to similar clusters. OpenMP API contains a good number of the parallel directive and constructs which help to perform the task in parallel.

First of all the parallel blocks of codes are identified after that proper parallel constructs are used to operate in parallel. In Fork-Join model Task is divided into multiple subtasks and this subtask is independently performed by different threads. Once all threads complete their subtask the sub results are combining by a single thread to compute the overall result. Shared memory programming required proper synchronization among different thread otherwise the result calculated by the thread may not be acceptable [Barbara Chapman, 2008]. This paper is organized as following: Section II, briefly introduce the related work, Section III, presents the improved parallel DBSCAN, Section IV, explained the Experiments and Evaluation results , Section V, we conclude our work .

Related Work: A number of parallel algorithms are proposed to solve the load balancing problem associated with DBSCAN. In most of the methods they try to achieve the better speedup using parallelization. They used different platform to implement their code, most of the cases they take the advantage of data structure. Different partitioning techniques are used for better load balancing. Stefan Brecheisen et al. they cited two limitations of DBSCAN: first, it is facing difficulty while running it on a very large databases duo to limited scalability; second, most of the available implementation not deal well with heterogeneous data sets where the similarity between item is represented by arbitrary complex functions. They target both problems and proposed an approximated, scalable, distributed DBSCAN implementation which can handle arbitrary data items and can able to handle symmetric distance function.

The algorithm is based on vertex-centric design compute a neighbor graph, a distributed data structure use to find a neighborhood of data points. Computations of clusters are based on the neighbor graph so the name is NG-DBSCAN. This DBSCAN is implemented in Spark, suitable to enable distributed vertex-centric. Graph-Based Clustering takes as input graphs and edges represent item similarity [Stefan Brecheisen, 2006].

Domenica Arlia and Massimo Coppola first addressed the performance of region queries by applying a simple replication approach. They absorb most of the processing time is utilized by region queries. The parallel implementation used the Mater Slave approach. The master module performs cluster assignment and the Slave module answers neighborhood quires by using R*-Tree. Two problems associated with Parallel implementation are the separation of spatial and labeling information. This can be avoided by nurturing local information by Slaves. The Slaves utilize it to eliminate unessential results. The parallel version of the code has been run on the cluster of 10 personal computers and uses the two data sets. This shows the scaled-up property of the code. With the help of the Parallel version of the code, 6 times speedup is achieved by using 8 numbers of salves [Domenica Arlia, 2010].

Min Chen et al. they cited that DBSCAN computational cost is expensive when the database is huge. They present P-DBSCAN, a novel parallel version implemented in a distributed environment. It uses practically efficient and optimal Priority R-Tree. The database is partition into several parts; each computational node builds a PR-tree and can perform clustering independently; Sub results will be required to aggregate into the final result. They show the comparison between P-DBSCAN and original DBSCAN, they found that P-DBSCAN is superior to the DBSCAN in terms of quality of the result, Speedup achieved, and Scalability [Min Chen, 2010].

Md. Mostofa Ali Patwary et al. they cited access sequential way of DBSCAN, to break it they present a new Parallel DBSCAN algorithm (PDSDBSCAN) which takes the advantage of disjoint-set data structure. The steps involved in their approach are as follows: The algorithm first creates a single node tree for every dataset; after that disjoint-set data structure is used to merge the trees belongs to the same cluster until all clusters are not discovered. Merging is performed arbitrarily and this is the key approach. PDSDBSCAN shows better scalability and load balancing. They implemented their algorithm by using the Shared Memory and Message passing approach. OpenMP implementation used 40 numbers of processing elements and MPI they used 8192 numbers of processing elements and achieved 25.97 times and 5765-time speedup respectively [Md. Mostafa Ali Patwary, 2012].

Tatsuhiro Sakai et al. they proposed a master-worker model using data parallelism. A spatial cluster can be extracted independently of other spatial clusters by DBSCAN at the data level. Data Partitioning is applied to geo-social databases by dividing the overall database into two or more partitions by using grid partitioning. The proposed model uses the task pool to distribute the loads. Processing of spatial clustering for a partition

associated with a complex grid is referred to as a task. The master thread manages the task pool. Clustering is performed by each worker after they obtain a task from the task pool. If workers complete processing and no more tasks available in the task pool then the work is completed [Tatsuhiro Sakai, 2016].

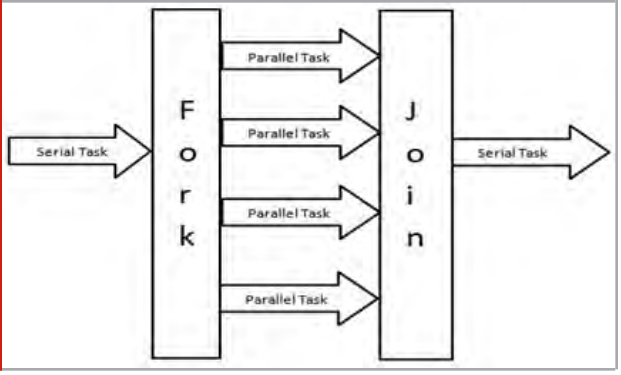
Yinghua Lv et al. they proposed a solution. Firstly, they improve the locality sensitive hashing method to perform a fast query of nearest neighbors. Secondly, nearest neighbors and reverse neighbors are taken into the consideration to construct influence space of each object. In the final step, this influence space is utilized to differentiate border and noisy objects. In the improved algorithm IS-DBSCAN, they use the influence space (IS) to obtain a better estimation of the neighborhood density distribution. This method is symmetric in nature and able to identify any objects [Yinghua Lv, 2016]. Hawan Jun Song and Jae-Gil Lee propose a Random Partitioning-DBSCAN (RP-DBSCAN) that takes benefits of the random split strategy and removes the same split restriction. Two approaches are used to solve the technical problem associated with partitioning. The first is called a pseudo-random technique and the second is a two-level cell dictionary. This is basically a two-level tree. A cell is represented by the first level of a node and the second level shows the sub. Every node encodes the number of points in each cell and its position. They proved by experiment that the overhead is solved to some extent [Hawan Jun Song, 2018].

Gan and Tao first cited that the worst-case complexity of DBSCAN is O (n2) proven. They showed that till 2-dimensional data DBSCAN can run in O (n log n) and quickly start showing quadratic behavior with high dimensional data. They proposed DBSCAN++, a modified DBSCAN which only required computing the densities for a chosen subset of points. DBSCAN++ is based on the observation that, it is only required to compute the density estimates for a subset m of the n data points where m is much smaller than n. It is sufficient to construct the clusters properly. To choose m points uniform and greedy k-center-based sampling is used. The resulting procedure shows O(mn) worst-case runtime. This is proved by the experiments they have done.

Improved Parallel DBSCAN: To speed up the performance of DBSCAN, we proposed the improved parallel DBSCAN including two approaches (1) OpenMP API (2) Radix Sort approach.

(1) OpenMP API: The application programming interface OpenMP is Open Multiprocessing shared-memory multiprocessing programming supported by C, C++, and Fortran. It is based on a model called Fork-Join. This is the key approach to break the computation sequentiality associated with DBSCAN. OpenMP supports parallel directive and constructs, like parallel loop construct which is help to perform the computation in parallel. Task decomposed in multiple sub tasks and performed by multiple threads, run in synchronized manner. If task is not divided into sub task it required to perform atomically by single thread.

Figure 1: Fork-Join Model



(2) Radix Sort Approach: OpenMP implementation of DBSCAN using parallel constructs in which multiple threads are performing the computation. To take the advantage of this approach data set is dividing into multiple partitioned. For proper load balancing of thread, the data partitions are sorted so the points belong to the same clusters are allotted to a specific thread. This way the global clusters are computed by using multiple local clusters. OpenMP breaks the sequentiality of DBSCAN and Radix sort help for proper load balancing among threads. Proper numbers of threads are required to create otherwise synchronization takes more time. This approach takes the advantage of both OpenMP and Radix Sort.

Experimental Analysis: Data sets: We use ten KEEL data sets named Quake, House16, Layout Histrogram, Color Histrogram, Color Movement, Transaction10k, Transaction20k, Transaction30k, Transaction40k, and Transaction50k to compare the performance analysis in term of execution time. In tables presents Name of data sets Name, Number of data points N, Execution Time T, Number of Clusters C, Noise Points NP, Minimum Number of Points M, Radius E and Dimension of the Data Sets represented by D.

Evolution System Hardware: We use the system with following characteristics a) Processor: Intel Core i3 processor @2.53GH b) Ram: 4 GB c) Operation System: Ubuntu 18.04LTS d) Program: C++ using OpenMP API. In order to evaluate improved parallel DBSCAN clustering algorithm. GCC compiler is used to executer the Parallel implementation of Programs. The Experimental Data Sets are chosen from the KEEL Data Sets Repository. Improved parallel DBSCAN and original DBSCAN are implemented.

The analysis is performing based on execution time and other factor such as No. of clusters and noise point find by both programs. Execution time is used for defining speedup of improved parallel implementation of DBSCAN. Table I and Table II shows when data sets size

is small both of the program execution time relatively equal. But original DBSCAN algorithm unable to handle data sets with large number of data points such as Transaction30k, Transaction50k, Transaction70k and Transaction90k. Which is represented in Table I by "?". Table II is shows the Improved DBSCAN Computation of the Clusters. Improved Parallel DBSCAN can able to calculate clusters for all and its shows 26 times speedup for Transaction10k data set.

Table 1. DBSCAN Computation of Clustering

S. No	Name	N	T	C	NP	M	E	D
1	QUAKE	2185	0.023812	3	65	10	10	2
2	HOUSE16	22804	10.82550	13	3316	10	10	2
3	LAYOUT HISTOGRAM	66651	0.029158	3	13	10	10	2
4	COLOR HISTOGRAM	68076	0.028135	2	13	10	10	2
5	COLOR MOVEMENT	68053	0.028730	1	1	10	10	2
6	TRANSACTION10K	120433	1034.28	4	7	10	10	2
7	TRANSACTION30K	284290	?	?	?	10	10	2
8	TRANSACTION50K	475655	?	?	?	10	10	2
9	TRANSACTION70K	665476	?	?	?	10	10	2
10	TRANSACTION90K	855373	?	?	?	10	10	2

Table 2. Improved Parallel DBSCAN Computation of Clustering

S. No	Name	N	T	C	NP	M	E	D
1	QUAKE	2185	0.021812	3	65	10	10	2
2	HOUSE16	22804	8.238900	13	3316	10	10	2
3	LAYOUT HISTOGRAM	66651	0.764452	3	13	10	10	2
4	COLOR HISTOGRAM	68076	0.906587	2	13	10	10	2
5	COLOR MOVEMENT	68053	1.031820	1	1	10	10	2
6	TRANSACTION10K	120433	39.6971	4	7	10	10	2
7	TRANSACTION30K	284290	168.030	4	7	10	10	2
8	TRANSACTION50K	475655	493.144	4	7	10	10	2
9	TRANSACTION70K	665476	1014.14	4	7	10	10	2
10	TRANSACTION90K	855373	1735.37	4	7	10	10	2

CONCLUSION

The experimental analysis clear that it is convenient to adopt the Parallel approach based on OpenMP. In Parallel approach all processing elements. The Parallel approach required less time as compared to the Sequential approach. In this improved parallel DBSCAN, it uses the Radix sort, which helps to divide the overall data set into a small number of the partition. Each processor is working with different partitions and computing clusters. This way better speedup is achieved. It is clear from the experiment that the original DBSCAN implementation unable to calculate clusters for data sets Transaction30k, Transaction50k, Transaction70k, and Transaction90k with available primary memory. Improved Parallel DBSCAN able to compute the clusters and with Transaction10k its shows 26-time speedup.

There are some directions for future research:

1. The same approach can be used with other density based clustering algorithms with some changes.
2. This approach can be modified for MPI programming environment for better speedup and for large data sets.

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A Review on Preference Based Information Retrieval Models

Manisha Singh
Shri. Ramdeobaba College of Engineering and Management, Computer Science, Nagpur, India

ABSTRACT

Personalization of e-services demands powerful and flexible preference modeling techniques to cope up with the new challenges in information retrieval models. This paper presents a historical review of major milestones in development of various preference based information retrieval models over time covering topics like Pareto preference, Skyline operator, Best Match Only(BMO) query model, Top-k query model, Preference SQL, etc. by constructive analysis through summary and comparison along with merits and drawbacks as applicable for each model. It is concluded by providing practical utility and benefits of these models and a general relation between them. Lastly, some important open fields of research in Preference based Information Retrieval area is jotted down.

KEY WORDS: PREFERENCE BASED IR, SKYLINE OPERATOR, PARETO PREFERENCE, BMO, PREFERENCE SQL.

INTRODUCTION

Most of the database query models work on "hard constraint" principle, i.e. one must specify the requirement in a rather rigid way. If the constraint matches, the result is displayed or else empty set will come. But then there is a "real world"! Natural human instinct is to look for the best match available for our need. But if that is not possible, people are willing to compromise with other alternatives available for the same. Consider a scenario where the user must book a flight or a hotel for a specific region under a certain price range. After all the work of setting the explicit filters of distance, cost, brands, etc. the user notices "flights not found" or "hotels not found" as an output. The user is then asked to refine his query or change the filters to see other options. This is quite a tedious process.

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In such scenarios, users will be at ease if the system instead of working on hard constraints, considers the query given by the user as a soft constraint or just a preference. This means considering the query entered by the user as user's first preference. If found, then return the exact match. Else, instead of giving an empty set, return the other possible options. Now consider the reverse scenario where the query is not so well formulated or too generalized. There the user will be flooded with results which might not even be relevant. These are the two classical issues, the infamous "empty set" and "flooding effect" which researchers are trying to solve using preference based information retrieval models to make the system more flexible and efficient to handle real world human behavior.

Many studies and researches have been carried out in the area of preference based information retrieval since decades. This paper tries to outline some of the important aspects and milestones of these studies ranging from 1987 to as recent as possible. Section 2 covers the discussion on 4 different research papers which have proposed different models for preference based query construction and evaluation. Section 2.1 talks about the research paper "Preferences: Putting More Knowledge into Queries"[Lacroix, 1987] which is based on preference clause PREFER. Section 2.2 talks about research paper

"The Skyline Operator"[Borzsony, 2001] based on a very practical requirement of getting the result based on multiple contradicting preferences. Section 2.3 covers the discussion on the research paper "Foundations of Preferences in Database Systems"[Kießling, 2002] which has proved to be one of the most significant research in the field of preference models. And last but not the least, section 2.4 discusses about the research paper "The Preference SQL System – An Overview"[Kießling, 2011] which is an extension to SQL and a practical working model with good query optimization techniques. Section 3 covers conclusion as a comparative study of these discussed models.

2. Preference Models

2.1 Preferences: Putting More Knowledge into Queries: The model given by M. Lacroix and P. Lavency in 1987 is one of the earliest approaches to model preferences in classical (relational) databases [Lacroix, 1987]. It proposes a preference mechanism which is presented as an extension of a language of the Domain Relational Calculus family (DRC) by adding a preference clause PREFER in the existing traditional query language [Lacroix, 1987]. It first evaluates the result without the preference clause. Then it applies the preference clause on the result obtained by previous evaluation. If after applying the preference clause the result set turns to be empty, the preference clause is treated as void. Else, in best case it reduces the cardinality of the result to the most preferred options by the user thus trying to handle both the issues of "empty set" and "flooding effect".

2.1.1 Simple preference clauses

SELECT houses HAVING status = "built complete"
FROM WHICH PREFER THOSE
HAVING roomsize = "2BHK"

Consider a scenario where a new house is to be found to move in. The above query will first select the houses whose construction is completed. And then it will check among those houses which have 2BHK and return the new reduced cardinality result set if applicable, else in case of empty set, it will not restrict it to 2BHK..

2.1.2 Compound preference clauses (multiple preferences)

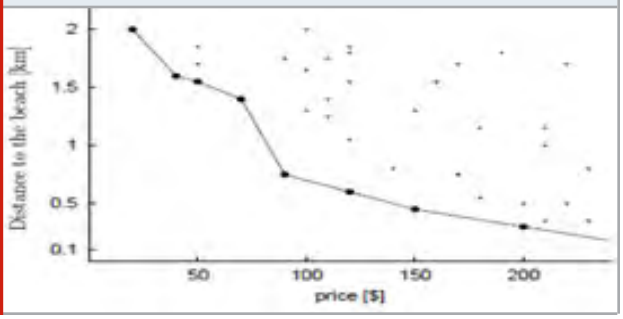
Nested preferences: This is considered as a multi level preference. First preference clause being the highest priority, then on that evaluated result, apply next filter of second preference clause as next priority and so on. For relative importance preferences, repeat the "from which" clause. The result is unrestricted by the preference clause if it is not found on given data set or it makes the result set empty at any stage. The priority is decided as the order in which the preference clauses including "from which" is written.

Equally important preferences: This is similar to the nested preferences except that here all the preference clauses are of same priority. Its functioning is more like "OR" operation. For equally important preferences, repeat the "prefer those" clause.

In case of very large programs one may need the same qualification of preference for different modules which can result in a lot of repetition. This can be avoided using second order constructs provided by this model. Other approaches [C.L. Chang, 1976] have been proposed before to handle preferences but it works on numerical metadata and calculates distance, etc. to find best match. This numerical data is not always available. Also, how that numerical value is assigned plays a very important role in query evaluation and can dominate the result. This issue is resolved in Lacroix's and Lavency's model as they do not rely on numerical metadata. Though this model provides a good insight and approach in dealing with the preferences, but the fact that preference clause is integrated in Domain Relational Calculus (DRC) makes it less efficient because DRC queries are combinational functions over the preferences which make it very complex. Also, in case of complex compound queries the time complexity increases as it doesn't deal with any optimization techniques in proposed approach.

2.2 The Skyline Operator: This model was given by Börzsönyi, Kossmann and Stocker in 2001. It is based on practical real time issue of contrasting preferences. The Skyline is defined as those points which are not dominated by any other point. A point dominates another point if it is as good or better in all dimensions and better in at least one dimension [Borzsony, 2001]. This type of dominance is called Pareto Dominance. Let's take the example given in paper [Borzsony, 2001] where a person needs to travel to Nassau (Bahamas) and is looking for cheap hotels near the beach. These two are contrasting preferences as hotels near beaches are comparatively costly. The Skyline operator will try to filter out interesting hotels from potentially large set of hotels in Nassau by applying filter of min(cost) and min(distance) from beach. The skyline query constructor extends the SQL's SELECT statement by optional SKYLINE OF clause as follows:

Figure 1: Skyline of hotels



SELECT ... FROM ... WHERE ...
GROUP BY ... HAVING ...
SKYLINE OF [distinct] d1 [min | max | diff]..... dm [min | max | diff]..... ORDER BY ...

An advantage of this approach is that only simple modifications to parser and query optimizer is required making integration of the Skyline operator into a traditional SQL query processor extremely

simple. Important skyline implementation factor is the transitivity of dominance i.e. if p dominates q and q dominates r, then p also dominates r. One-dimensional Skyline is equivalent to a min, max, or distinct SQL query without a SKYLINE OF clause and can be done easily with the help of sorting. But simple sorting doesn't work on two-dimensional or multi-dimensional skylines. It needs special algorithms for that.

2.3 Foundations of Preferences in Database Systems: This preference model was proposed by Werner Kießling in 2003 [Kießling, 2002]. It works on the principle of strict partial order. It considers preference in terms of "better than" perspective, mathematically which can directly be mapped as strict partial order. Strict partial order can be represented as:

Preference P = (A, <P) on dom(A)
"x <P y" is interpreted as "I like y better than x"

Among all other models available, it can be said that this model is one of the most rich, simple and flexible model semantically. It has proved to be a milestone in building of personalized applications. The preference constructor here covers a wide range with many different criteria as follows:

2.3.1 Base preference constructors

Non-numerical:
POS preference: POS(A, POS-set) : preference given to elements mentioned in POS set.
NEG preference: NEG(A, NEG-set) : don't prefer the elements of NEG set unless the result set is turning empty.
POS/NEG preference: POS/NEG(A, POS-set; NEG-set) : prefer POS set elements, try eliminating NEG set
POS/POS preference: POS/POS(A, POS1-set; POS2-set) : acts as a two level preference
EXPLICIT preference: EXP(A, E-graph) : explicitly specify the preferred elements/criteria

Numerical:
AROUND preference: AROUND(A, z) : prefer values around the given value (min difference)
BETWEEN preference: BETWEEN(A, [low, up]) : prefer values in the given range
LOWEST, HIGHEST preference: LOWEST(A), HIGHEST(A) : prefer the lowest and highest value in given domain
SCORE preference: SCORE(A, f) : uses a function to calculate a score, which can later be used in rank retrieval

If preferred data available, consider that. Else, keep the result unrestricted to avoid returning empty set.

2.3.2 Complex preference constructors
Pareto preference: P1⊗ P2 : both preference are equally important.

Prioritized preference: P1 & P2: preference P1 is first priority followed by preference P2

Numerical preference: rank(P1, P2) : calculate rank based on score, then return top-n results (only with score)

Apart from these there is also aggregating preference constructors like intersection, disjoint and union preferences.

BMO Query Model: The exact match query model adapted by SQL doesn't necessarily hold in real world. Thus, preference works on Best Match Only (BMO) query model which is a match-making between wishes and reality. Return perfect matches if they exist, else, deliver best alternatives, but never worse objects (effect of discarding non-maximal values on the fly). In BMO, query relaxation is implicitly applied and the behavior is always non-monotonous depending on the quality of data rather than quantity.

Efficiency and optimization issues are not directly addressed in this paper. But, it does provide a backbone for optimization approaches like divide-and-conquer by laying the foundation in the form of decomposition of Pareto preferences into '+' and '♦', which in turn can be decomposed further. Merit of this model holds on Pareto accumulation that gives user the best-match automatically without any overload of explicit query refinement.

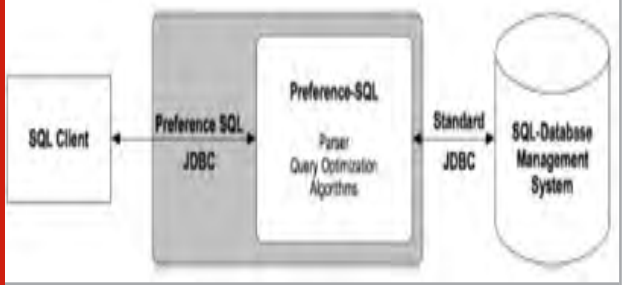
2.4 The Preference SQL System: This preference model was proposed by Endres, Kießling, & Wenzel in 2011 [Kießling, 2011]. Preference SQL is a declarative extension of standard SQL by strict partial order preferences, behaving like soft constraints under the BMO query model, discussed in previous model. By default, Preference SQL has implicit SV-Semantics but it is still under development and enhancement (as of 2019). The preference constructor here is derived from previous model with an addition of more advanced functionalities. The schematic query structure of Preference SQL is as follows:

SELECT ... <selection>
FROM ... <table_references>
WHERE ... <hard_conditions>
PREFERRING ... <soft_conditions>
GROUPING ... <attribute_list>
TOP ... <k>
BUT ONLY ... <but_only_condition>
GROUP BY ... <attribute_list>
HAVING ... <hard_conditions>
ORDER BY ... <attribute_list>
LIMIT ... <n>

Statements select, from, where, group by, having, and order by are the standard SQL keywords. Along with that, special preference based keywords are integrated into it. The evaluation order first groups Preference Selection then Top-k Interface. Here But Only is a hard selection (after-filter) which helps in reducing the novel "flooding effect". HAVING is a hard selection too for groups using grouping attributes or aggregate functions.

The PreferenceSQL prototype is based on a Java-Middleware (JDBC) containing PSQL-JDBC-Driver (Server) and Preference SQL (Parser, Optimizer, Algorithms). It is a declarative extension of SQL by preferences. The preference query optimizer performs algebraic transformations of preference relational algebra as well as cost-based algorithm selection e.g. Hexagon algorithm for efficient Pareto / skyline [Kießling, 2007]. As PreferenceSQL system lies only on the server, it becomes easily maintainable and simple extension of PreferenceSQL without changing the standard SQL component of database systems along with no updates of the clients as it is in the form of JDBC middleware. But it does face higher runtime or even worse performance issues as more time is needed for computations based on middleware. More efficient algorithms and join approaches are needed for overcoming this issue.

Figure 2: System architecture of Preference SQL



CONCLUSION

This paper presents an overview of the key models for preference based information retrieval along with merits and areas of improvement as applicable for each. All the discussed models are built up on SQL, letting integration with standard database query model possible. Pareto preference has played a major role in all 4 discussed models. Apart from that, Lacroix & Lavency's model incorporates prior preference, the skyline model includes skyline preference and both rearmost models encompasses prior and basis preferences. Lacroix & Lavency's model is not as efficient and user friendly as the latter three models. In terms of practical usage, the skyline model and the Preference SQL have a strong utilization aspect. BNL-style algorithm is used in Lacroix & Lavency's model. The latter 3 models cover different algorithms like BNL, SFS, SaLSa, LESS, Scalagon, etc. The Lacroix & Lavency's model was only a prolog (prototype) whereas the skyline model has an implementation model built on PostgreSQL.

The model given by Kießling [Kießling, 2002] is one of the richest models which have laid a foundation for various implementations based on preference based information retrieval. The PreferenceSQL is an empirical adaption of Kießling's model. The well known implementations of Endres's models are Preference SQL, an implementation based on MS SQL Server, PostgreSQL and EXASolution. Though many studies and researches have been going on in the field of Preference based information retrieval, but it still lags behind compared to exact match standard SQL models. The current day-to-day applications having exact match query model as base can be attempted based on preference based information retrieval for efficiency and least repetitive query refinement from user's end. A very crucial open area of research in this domain includes optimization techniques for complex preferences.

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Energy-Efficient Lifetime Maximization Clustering Approach for "Wireless Sensor Networks": A survey

Namrata Mahakalkar[1*] and Mohd.Atique[2]
[1]*Research Scholar,* [2]*Professor*
[1,2]*Department of Computer Science and Engineering Sant Gadge Baba Amravati University Amravati, India*

ABSTRACT

WSNs are autonomous sensors that are distributed spatially than can supervise conditions that can be physical or environmental, such as temperature, sound, pressure, etc., and to transfer their data to a main location cooperatively through the network. Events are detected by Nodes and then sent to the Base Station(BS) relevant data. Replacing batteries quite often in remote locations is not feasible. Using the clustering approach, the energy consumption of such networks is minimised. One of the important methods to extend the life of the network in wireless sensor networks (WSNs) is clustering. For all the clusters, it involves grouping sensor nodes into clusters and choosing cluster heads (CHs). Cluster heads are subject to excessive battery drain in those near the BS. In this paper, therefore, approaches are discussed for increasing energy efficiency and network lifetime.

KEY WORDS: SENSOR, ENERGY EFFICIENCY, CLUSTERING, LIFETIME, WIRELESS SENSOR NETWORK

INTRODUCTION

Because of its potentially large application area, the WSN is rising as a main research subject. The WSN consists of nodes, from a few hundred to even thousands, in which each node is constructed.It has one (or sometimes several) sensors connected to it. Every node has restricted capabilities. But a useful network catering to disaster applications can be created collectively such as management, detection of forest fires, tracking of vehicles, habitat monitoring, etc. Deployments in real life is mostly done with 30-40 nodes due to scalability, conservation, reliability and energy issues. [P. Corke, 2010] In order to deal with issues such as network lifetime and energy, clustering over a distributed method is progressing. "Communication connectivity" in a clustered WSN, various nodes are shown in Figure 1. There is one or more Cluster Heads (CHs) in every cluster. Near a sink node, sensor nodes suffer from the heavy traffic load imposed on them and their energy is strongly depleted. This phenomenon is called the energy hole problem. One way of reducing energy depletion is by aggregating data. To solve many problems such as scalability, energy and lifetime problems of sensor networks, clustering into sensor nodes is very important [V. Katiyar,2011].

The objective of this algorithm for clustering is to partition the network into several clusters. The benefits of an algorithm for clustering are:

- "reducing routing table size,
- reducing the redundancy of exchanged messages,
- reducing the energy consumption, and
- extending the networks lifetime."

II. Related Work: Algorithms can be fully sequenced in, "i) Probabilistic, (ii) Deterministic, (iii) Fuzzy logic"-based algorithms and cluster range are computed by selecting CHs.

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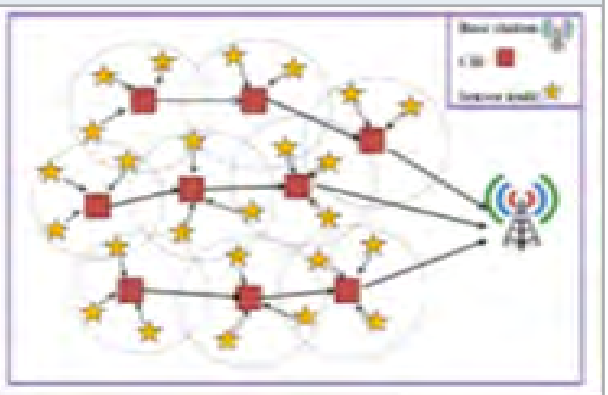
Figure 1: A clustered WSN



Algorithms Probabilistic: The clustering algorithms based on probability are straightforward and have little complexity of time and communication. With quicker convergence, they have been discovered to be efficient in energy.

i. LEACH [W. R. Heinzelman,2000]: This is a hierarchical protocol that transmits most of the nodes to cluster heads, also the aggregation of data and compression by cluster heads forwarded to the base station (sink). In each round, each node uses a stochastic algorithm to determine if the cluster head will become the cluster head in that round. Global energy is minimized by the protocol which is clustering-based routing protocol and load is distributed to all nodes at different times. LEACH surpass static cluster algorithms. Each node has the load of obtaining data from cluster nodes at different times, merging data to acquire the aggregate signal, and transmitting the aggregate signal to the base station. "LEACH" is fully distributed in order to operate LEACH, that require no control information from BS & nodes.

ii. Stable Election Protocol (SEP) [G. Smaragdakis,2004]: In order to become the cluster head which is dependent on the energy which is remaining in each node ; is based in each node on the weighted election probabilities. The stability period and higher average throughput are always extended to SEP than one obtain using existing clustering protocols.

iii. Unequal Clustering Driven by Energy (EDUC)[J. Yu,2011]: In EDUC, cluster heads use different spans of contention to construct clusters of different sizes. In principle, clusters at a long distance from the BS have small sizes to conserve some energy for long-distance data transfer. The energy consumption surrounded by cluster heads, therefore, is constructively stabilised. An energy-driven cluster head alternation scheme is formulated on this clustering arrangement to reduce the avoidable waste of energy. During the entire life of the network, each node serves as the cluster head no more than once. The additional costs are minimised by EDUC and high energy efficiency is achieved.

iv. Efficient Unequal Clustering for Energy (EEUC) [C. Li,2005]: The EEUC protocol is used in wireless webwork for systematic data collection. The clusters are divided into uneven clusters and smaller than those far off the base station near the base station. The clusters are smaller. This means that cluster heads can conserve energy to redirect inter-cluster information near the base station. The unequal clustering process stabilizes the use of energy well in the midst of all sensor nodes and attain a clear network lifetime development.

Algorithms Deterministics: Selection of CHs and cluster formation take into account standard metrics in deterministic algorithms such as residual energy, node degree, centrality of the nodes, distance from BS.

i. Energy-aware Algorithm for Routing (ERA) [Pawandeepkaur,2015]: Instead of the minimum energy consumption path,ERA helps each sensor to connect its cluster head to find a direction with the most amount of energy left behind. Simulations are carried out to test efficiency in terms of network life and allocation of energy between nodes. Over current WSNS protocols, ERA shows fairly significant results, but the use of node waiting time to become CHS is neglected. For a long time, certain nodes may not become CHS.

Algorithms Fuzzy Based: Fuzzy logic is manipulated in the Wireless Sensor Mesh to effectively select CHs. For CH, Fuzzy logic chooses input specifications such as surplus energy, distance to BS, distance from neighbours, degree of node, similarity, assumed surplus energy, and the CH selection option and cluster size is the output framework. In an unequal clustering algorithm, different fuzzy-based viewpoints are suggested to achieve energy efficiency.

i. A unequal clustering strategy based on fuzzy logic-has been suggested so that hot spot issue with the DFCR algorithm can be addressed [N. Mazumdar,2018]. Soaring preference is given to sensor nodes near to the BS and with higher energy that needs to be selected as CHs. Based on their current status, the CHs adapt their cluster radii dynamically. The CHs transmit the data to the next-hop CH, which correlate with minimum cost value, to balance the energy consumption.

ii. DECUC algorithm [J. Yu, 2011]: A distributed clustering algorithm that uses fuzzy logic to produce a trade-off between energy consumption and coverage specifications .In order to maximize coverage maintenance of the target area, cluster formation is considered in this algorithm as well as Energy and coverage parameters. In addition, unprecedented clusters are developed to confront with the hot spot problem, so that more CHs are accessible closer to BS to share large data forwarding loads, Network liftime , protection of coverage and energy efficiency.

III . Issues in Previous Work: We have investigated various clustering algorithms and found that certain energy-efficient algorithms improve network existence and consume routing energy as well .While every attempt is made to include a full and reliable state-of-the-art

survey of energy-efficient clustering algorithms with LEACH and its advanced protocol, as relevant to WSNs. Issues addressed in previous work are:

- Some applicable algorithms for homogeneous WSNs.
- Bad performance (due to the problem of link breakage) when the nodes are mobile.
- On the base station, more overhead, so it's not suitable for large networks.
- Decreased level of energy.
- Sometimes, loss of data, such as when some CH hop dies.
- Inefficient consumption of energy.
- Inefficient data rate of delivery.
- Packet Loss when CH moves.
- It increases the use of energy, particularly when transmitting data to the base station. Provides the base station with increased overhead.

Fig 2, Fig 3, Table 1. Represents the correlative work of every considered algos with regard to various cluster parameters

Figure 2: No of alive nodes per round

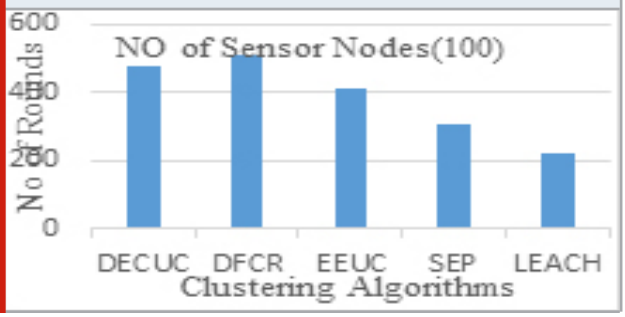
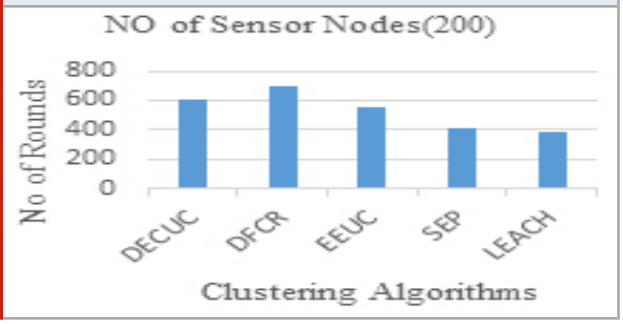


Figure 3: No of alive nodes per round



Proposed Work: In proposed research, the virtual concept is used for the formation of cluster head assistance which will be helpful for pretty the life span of network and for communication between cluster head through different cluster head with the base station according to efficient energy. Hierarchical clustering can make a major contribution to system scalability, lifetime and energy efficiency in WSNs. Hierarchical routing is an important way to minimize the energy usage of the cluster and to gather and unify data for the sake of reducing the number of messages sent to the BS.Communication and packet transfer between different nodes without forming cluster

- Communication and packet transfer between different nodes
- Communication and packet transfer between different nodes in single cluster out of any no. of clusters
- Communication and packet transfer between different nodes in all clusters
- Communication and packet transfer between different clusters multiple parameters
- Performance Analysis of both the Technique.

Figure 4: "Communication Process of WSN Network"

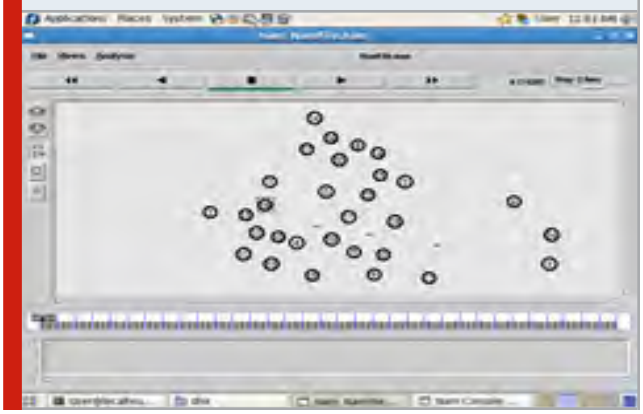


Figure 5: "Analysis of Delay vs Time"

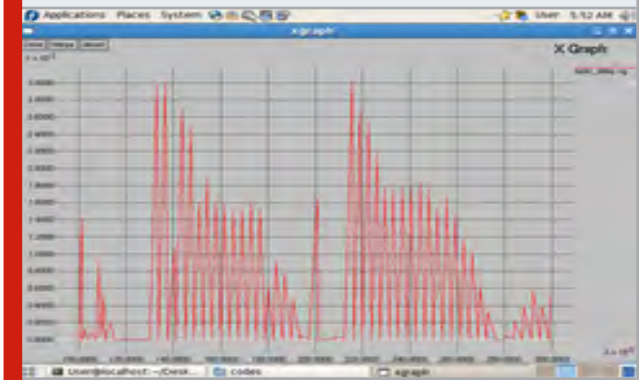
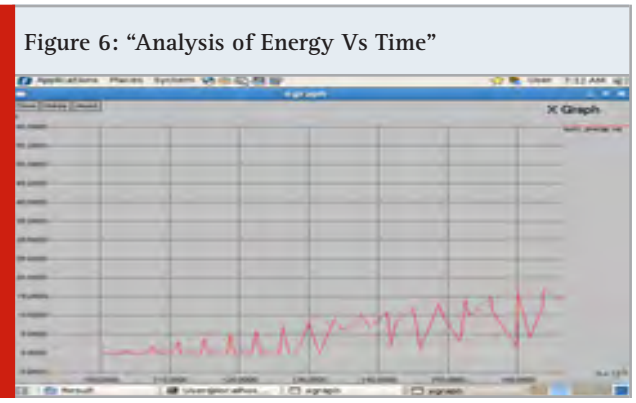


Figure 6: "Analysis of Energy Vs Time"



Comparison of three approaches where we use routing with i) "Normal approach where no cluster head has been

found; ii) Approach where only QoS included; and iii) Approach of Qos with cluster head included. Considering the routing of the Qos with the cluster head, the data transmission is only carried out by the cluster head in that case". The cluster head choose to check the energy levels of the individual nodes. Figure 4 shows the WSN communication process in which the source node begins to transfer information using protocol to the sink node, using this process to find out the QoS parameters such as Delay, Jitter, Throughput, Energy, and Packet Delivery Ratio.

Analysis of delay vs time is shown in Fig. 5, and simulation process can reduce the delay .

Table 1. Comparison of Different Clustering and Routing Algorithm

Protocol	Cluster properties						
	Distributed/ Centralized	CH selection	Unequal cluster cluster size	Intra-single hop	Inter-cluster multi-hop	Coverage aware	Fault tolerant
LEACH [3]	Distributed	Random	N	Y	N	N	N
SEP [4]	Distributed	Hybrid	N	N	Y	N	N
EDUC [5]	Distributed	Random	Y	Y	Y	N	N
EEUC [6]	Distributed	Hybrid	Y	Y	Y	N	N
ERA [7]	Distributed	Weight	N	Y	Y	N	N
DFCR [8]	Distributed	Fuzzy	Y	Y	Y	N	N
DECUC[9]	Distributed	Fuzzy	Y	Y	Y	Y	N

CONCLUSION

The above-mentioned clustering approaches fused with multi-hop routing in energy inhibited WSN possess remarkably decreased the use of energy. However, the network lifetime of such protocols is deteriorating due to the hotspot problem. The reshaping of the perspective of unequal clustering showed a significant refinement in network life. The multifaceted procedure of the fuzzy logic construct has shown the significance of numerous frameworks such as node degree, density, cluster formation energy and cluster range estimation. Considering various clustering parameters, all the algorithms discussed are explored and a simulated inspection is still carried out for few selected ones. A routing protocol approach combined with a clustering protocol for a network to be energy efficient for QoS is suggested by the ongoing proposed work.

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Scanning Methodology for Deployment of Femtocell as Secondary Network

Nikhil P. Wyawahare[1*] and Sampada Wazalwar[2]
[1]*Assistant Professor Department of Electronics Engineering,*
[2]*Assistant Professor Department of Information Technology,*
[1,2]*G H Raisoni College of Engineering, Nagpur, India*

ABSTRACT

In this paper Secondary network requirement frequency scanning is implemented to show new scanning methodology. The Min-Max algorithm is to formulation of a fair channel allocation is the maximum interference occur in the network transmission link reduce to a minimize value is shown by using Energy detection, Cognitive scanning, a special CYWM6935 cypress scanner module. The main reason behind spectrum sensing is the detection of vacant channel in the scanned spectrum. Energy detection does not require any information regarding primary signal. Thus it is used for both time and frequency domain. The use of CYWM6935 is used to display the 2.4 GHz of ISM band in the range of 50 meter, where detected signal will then display in the LCD. Here design used RSSI, SSID, MAC Address maximum and achievable data rate, security is major ways to test. In this paper new modified type of scanning is also introduced in comparison to dynamic & initial scanning which gives the more precision in detection white space in spectrum. A cognitive scanning is used to improve the methodology by optimizing antenna, Tran's-receiver, controller unit, switching unit & special power supply is implemented. A comparison to RSSI level is used to make decision for free to use, busy with week connectivity, busy with strong connectivity is proposed to show signal strength in dB. At final implementation cypress module is used to scan for Urban, Rural & for other specific application mode is deployed to scan for 2.4 GHz band. Depending on these results are shown for advance scanning for 1 & 6 channel which was always a dominating channel out of 14 channels in Wi-Fi.

KEY WORDS: CYPRESS MODULE, RSSI, MIN-MAX, ISM, COGNITIVE, ENERGY DETECTION.

INTRODUCTION

In the research part design Femtocell is required to utilize a free communicating channel by client, these channel are available in network which is actually dynamically given to client to used promptly ch no. 1, 6 & 11 only. In normal there are total 14 channel are there to utilize. Due to effect of co-channel interference these channels are mostly preferred as shown in figure 3.1 2.4 GHz channel and its co- channels availability, [Jaeweon Kim, IEEE-2010, John Sydor, David Roberts, Bernard Doray and Amir Ghasemi, IEEE INFOCOM 2011] how these are separated with respect to channel centre frequency with 22 MHz width. In research observation channel no 14 i.e. 2.484 GHz frequency typically available at last and rarely it's been used if all channels are busy at same time.

Which reflects the 99% of channels utilization which is not possible through access point/router in any network deployment. If a corrective solution is designed also by any router only channels 1, 6 &11 used by any way! Thus eventually 2, 3, 4, 7, 8, 9, 10, 12, 13 are getting affected due to these three. Looking toward this approach [Farzad Hessar, IEEE-2013 & Kazushi Muraoka Hiroto

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*Corresponding Author: nikhil.wyawahare@raisoni.net
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Sugahara Masayuki Ariyoshi, IEEE-2011] "Design and Implementation of Configurable Femtocell base on White space" is need to design to utilize not only for already established network but also for the new external network created Femtocell. In this case of design Femtocell is working in poor signal strength reception location. Adequate channels to communicate with easy sharing of data between all clients. [Nikhil P. Wyawahare, Dr. S. L. Haridas, Helix-2019] This is possible if cognitive scanning of channels are done through external source and finding out which channels are busy-partial busy-free as per load, RSSI strength, offset frequency like parameter observation which is not available in normal access point.

Implementation: Fig.1 illustrated Channel allocation is defined as allocation of channel of frequency spectrum in such a way so that all the users which are keen to carry out their communication through the spectrum will be proficient to transmission and reception of data without having interference with each other. [Wyawahare NP, Haridas SL, IC3I -2014, Nikhil P. Wyawahare, S. L. Haridas, IJST-2017 & Rizwan Musani, Nikhil P.Wyawahare, IEEE-2015] The following points to allocate channels are taken into account by Min-Max algorithm. Allocations of the resources are done on the basis of demand. The objective of this algorithm is formulation of a fair channel allocation is the maximum interference occur in the network transmission link reduce to a minimize value. This algorithm is used for allocation of channel and to use data given by the RF module which is used to sense the spectrum. Min-Max algorithm firstly divides the frequency spectrum in suitable number of division. Further then frequency division of above divided spectrum is done into appropriate number of divisions. After that the phase and magnitude of the scanned spectrum is calculated.

Figure 1: Min Max Algorithm

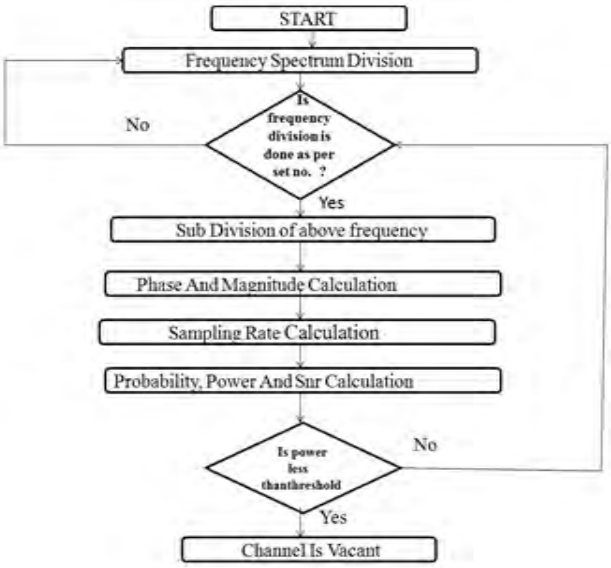


Figure 2: Flow Chart of Tx -Rx Over Serial Port

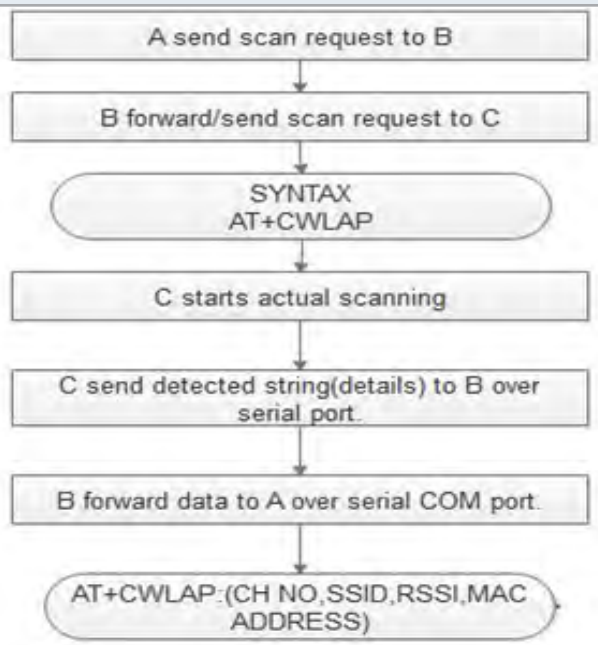
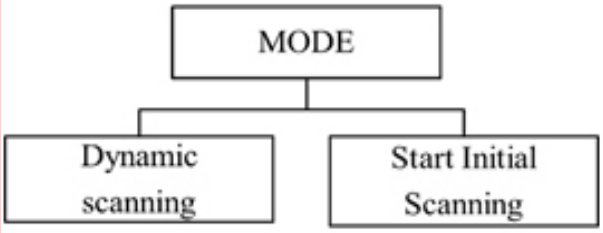


Figure 3: Modes of Scanning



PART A: Energy Detection Method: For white space based application devices the main task is spectrum sensing. The spectrum sensing is the continuous scanning of frequency spectrum. The main reason behind spectrum sensing is the detection of vacant channel in the scanned spectrum. The spectrum should be used by secondary users in such a way that there will be no interference among the primary and secondary users. Energy detection method is the method used here for the spectrum scanning. This method does not require any information regarding primary signal. [Rohit Nandanwar, Nikhil P.Wyawahare, ICESS-2016 & Nikhil P. Wyawahare, Dr. S. L. Haridas, IJCA-2017] This method can be used for both time and frequency domain. In Scanner design all parameters like SSID, RSSI & MAC address are going too measured. Using Wi-Fi scanner all 14 channels of 2.4GHz band is scanned. Scanner is attached with access point to serve the service in maximum allocated distance and no of users. Fig.3 illustrated modified scanning mode for the cognitive white-fi scanner, in comparison to Active and passive scanning. It is specially design for Femtocell network to seek ideal channel for communication by initial scanning & dynamic scanning.

Initial scanning is done at initial stage, when scanner starts scanning. [Shyamali Amale, Prof. Nikhil Wyawahare, IJIRCC-2017] At initial stage it will start scanning number of free channels and number of busy channels and go for free channel to utilize. & in Dynamic it scans continuously and generate result for busy channels as well as free channels. Even after getting free channel to utilize it will start scanning for best vacant channel to utilize.

PART B: Cognitive Scanning System

RESULTS AND DISCUSSION

Figure 4: Cognitive Radio scanning Antenna Unit

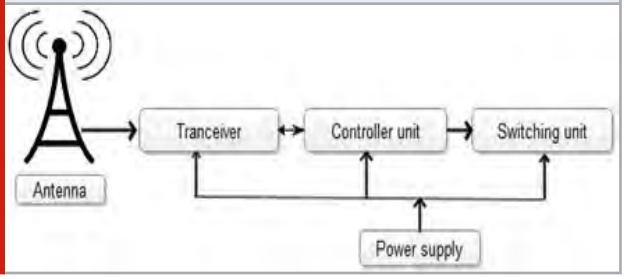
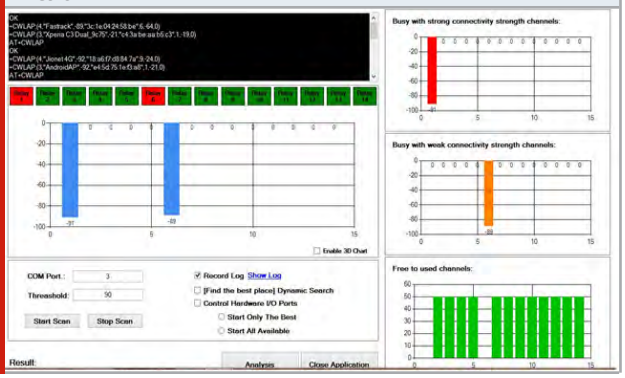


Figure 5: Advance scanning result of spectrum for channel 1 & 6



Scanning result for 14-channel number 1, 2, 6 and 11 are busy and remaining 10 channels are free. Result showing received signal strength for each device, E.g. RGI which present on channel number 2 with strength -86 and Mac address "e3de272b1fd5" Fig.6 illustrated graphical representation for SSID "Mahima", strength vs count. Here Strength for SSID mahima varies between -88dB to -83dB thus above graphs are plotted by taking interval as 10.Graph plotted by taking frequency as parameter, for selected SSID graph is generated by taking interval 8.Above graph is result for offset frequency which fluctuates between negative and positive scale. Graph is generated for SSID "mahima" by taking interval of 8 and plotting graph for channel Vs count is as shown in above diagram. Where, count represents value of repetition result for selected SSID and channel is use to show channel number which was used by that device. Fig.7 illustrating the Femtocell having the very strong reception of signal RSSI at -10 dB to -13dB in range.

Figure 6: Graphical plotting for SSID vs. Strength Parameter & SSID vs Frequency Parameter

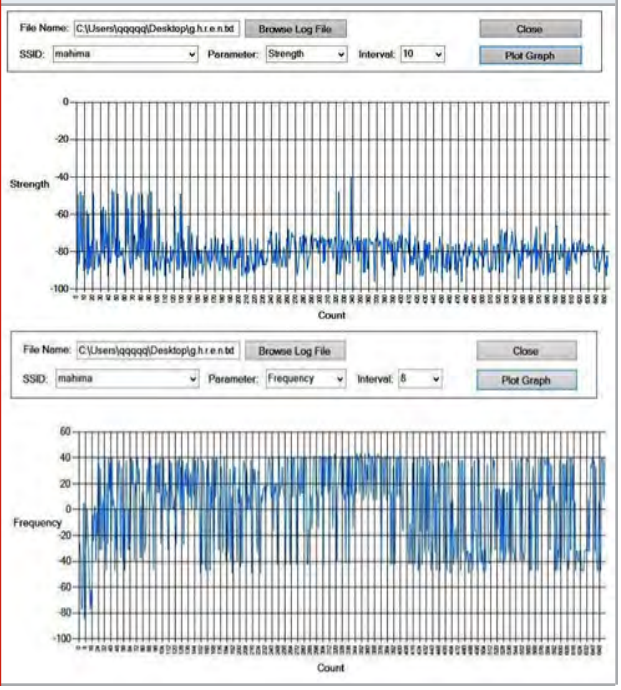


Figure 7: Graph for channel Vs count for selected SSID

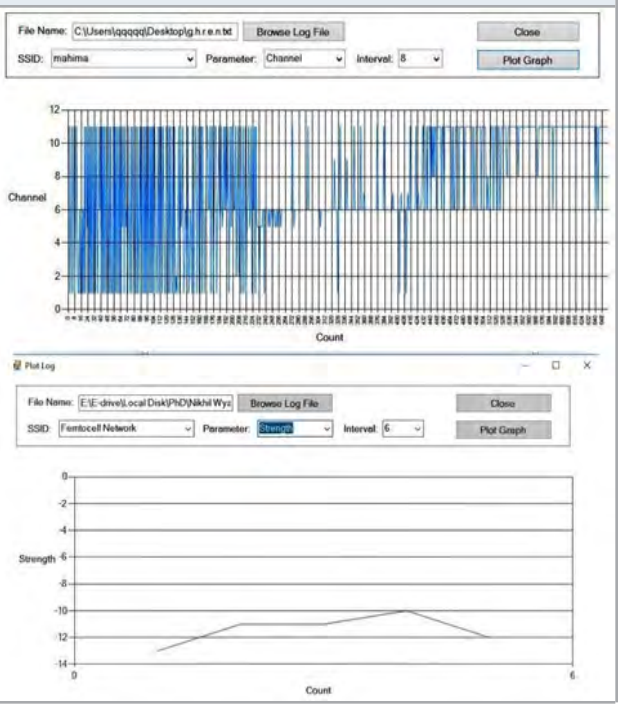


Fig.8 illustrating the graphical representation to have Femtocell SSID scanning in offset frequency VS Count. Offset frequency is representing the adjustment in the frequency component over the co channel interference problem. Channel no 10 is frequently used by the SU network to provide services through base station and allotment of channel through switching relay section.

Figure 8: Graphical Plotting of Femtocell SSID Frequency VS Count

CONCLUSION

Scanning is done with feature detection technology to find channel band in 2.412 to 2.248 GHz. Over to this type of controller is required to take decision faster as to release channel relay for call establishment in Secondary network. Following results are oriented in two main time slot of testing as illustrated in fig.5 Due to this change any signal change at any moment will be easily detected and scanned as per certain parameter like, RSSI, Offset frequency, channel no likewise. Feature detection of Min-Max algorithm which is implanted in improved scanner module working as "Cognitive White- Fi scanner" or "Hot- Spot" i.e. Femtocell base station server to be facilitated with the appropriate spectrum channel utilization. At final scanner is initial scan to search actively, on later its change to dynamic scanning.

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Scene Text Detection Using YOLOv4 Framework

Nisarg Gandhewar[1], S. R. Tandan[2] and Rohit Miri[3]
[1]*PhD Scholar, CSE Dept, CVRU, Kota, (Chhattisgarh), India*
[2,3]*Associate Professor, CSE Dept, CVRU, Kota, (Chhattisgarh), India*

ABSTRACT

Extraction of printed information from different certifiable pictures in machine readable format is treated as tricky chore in the domain of computer vision. This has gained plenty of consideration due to its extensive applications in industries and our daily life. Recently developed deep learning based techniques for detection of text have obtained encouraging results with respect to different standard datasets. But, they typically fall behind when exposed to tricky situation. Still there is a contest between speed and accuracy for text detection. Traditionally for text detection mostly the two stage detector techniques like Faster-RCNN, Fast-RCNN and R-CNN were explored. In this work, we put forward a straightforward pipeline for detecting text in common scene pictures. Here we used recent state of art one stage object detection framework known as YOLOv4 (You Only Look Once version 4) with darknet framework which is comparatively faster and accurate, contrast to existing object detectors. It gives us speedy and precise detection of text from common scene pictures. Experiments performed on state of art datasets including ICDAR 2015, ICDAR 2013, ICDAR 2003, SVT, IIIT5K, MSRA-TD500 display that the proposed pipeline significantly performs better except for ICDAR2015, compare to existing techniques with respect to correctness.

KEY WORDS: COMPUTER VISION, OBJECT DETECTION, DARKNET, TEXT DETECTION.

INTRODUCTION

Text is the key discoveries of humanity, which has played a vital role in human's life since from earliest times. The specific information embodied in the image is very useful in a broad range of applications because of its realistic applications in updating inventory, understanding scene, analyzing documents, navigation of robot, industrial automation and retrieval of image. Text is a major aspect in a variety of scenes and acts as a one of the primary way for people to communicate among each other. Recently detection and recognition of text from an image have turn out to be a trending topic of research in several fields like document analysis and computer vision. Object detection is treated as more complex problem than classification, which can also recognize objects but doesn't let you know precisely where the object is positioned in the image and it didn't work for images that includes more than one object. The chore of detecting object is to uncover all concerned objects in the image, and find out their category with exact position. It's one of the main issues in the computer vision field. A range of objects has dissimilar appearances, postures and shapes, coupled with the interference of occlusion, lighting and other factors during imaging, target detection has at all times been the most tricky problem in the computer vision field. Object detection job has shown promising result with increasing use of techniques based on deep learning framework. Current techniques consider text as precise entity and explore general object detection framework to solve text localization problem.

ARTICLE INFORMATION

*Corresponding Author: nisarg.gandhewar@gmail.com
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As compared to conventionally used OCR system, detection and recognition of scene text can adapt to any scene, exclusive of sole needs, like traffic signs, hoardings and different bills. Recently, deep learning based object detection techniques have made great impact in the community of computer vision to solve many problems, which can be generally grouped into two types. One is object localization dependent on the area of intrigue. Here the primary guideline is to utilize locale suggestion to produce post-chose targets, and afterward use Convolutional Neural Network to deal with them. They ordinarily have a high precision, however are frequently insufficient progressively. It incorporates different techniques of RCNN family. Another type of object detection techniques are depend on regression technique, that accepts an issue of detection as a problem of regression to resolve and straightforwardly predicts target object position and its class in one stage.

These types of techniques usually have faster speed but low accuracy and it includes YOLO, SSD, YOLOv2, YOLOv3. As compared to the traditional family of RCNN, YOLO has better speculation when used in different fields. Yet object detection begins growing in the last few years, the contest left over fierce. YOLOv4 not only achieve very good accuracy but also have high processing frame rate. It attains an accuracy of 43.5% AP and 65.7% A Pover the MS COCO dataset along with an around 65 FPS inference speed over Tesla V100. In object detection, high accuracy is not the only considerable factor but we want the model to run smoothly in the edge devices. YOLOv4 obtains promising outcome at a continuous speed over the MS-COCO dataset. Advanced precise models require numerous GPUs for training with an enormous mini batch size, and doing this with one GPU makes the preparation truly moderate and illogical. YOLOv4 tends to this worry by making an object locator that can be prepared on a sole GPU with a smaller mini batch size [A. Bochovsky, 2020]. So as to accomplish effective scene text detector, this paper chooses a pipeline dependent on YOLOv4.

Related Work: Detection of text from common scene pictures involves locating text in pictures and creates bounding boxes for it. Traditionally connected component based, Sliding window based, Texture based techniques have been extensively exploit for locating text but in recent year's deep learning-based techniques have witness incredible enhancement for detection of text. Now a day's text detection techniques are characterized into two classes as general object detection and technique based on segmentation [H Lin, 2019].

General Object Detection Based Techniques: These types of techniques generally anticipate candidate bounding boxes legitimately by considering objects as text. This type of techniques is frequently skilled by using annotations based on bounding box. Techniques based on General object detection are classified into two classes as one stage and two stage detector technique. Even though the two stage detector achieves top accuracy, recent works dependent on one stage detector additionally uncover quicker text detection with equivalent exactness. Dissimilar to FCN based techniques, this class of techniques employs text as a particular object and gives various powerful frameworks of object detection like SSD, Retina Net, YOLO, RCNN, Faster RCNN and Fast RCNN to detect text or words from images directly.

Linjie Deng et al. proposed a technique rely upon RetinaNet for arbitrary oriented detection of text, having aim to incorporate the learning mechanism borrowed from two stage RCNN structure into the one stage detector [L. Deng , 2019]. Minghui Liao et al. present text detection technique TextBoxes which is fit for identifying text in a sole network, having no post process excluding non max suppression [M. Liao, 2017]. Minghui Liao et al. also developed TextBoxes++ approach based on SSD for multi oriented detection of scene text having both high precision and proficiency [M. Liao,2018]. Zhida Huang et al. developed approach based on Mask RCNN having backbone of (PAN) Pyramid Attention Network meant for multi oriented detection of text [Z. Huang, 2019]. Pranav Adarsh et al. proposed YOLO v3-Tiny one stage improved model based on YOLO speeds up object detection while guarantees the precision of the outcome [P. Adarsh, 2020].

Segmentation Based Techniques: These types of techniques are inspired by FCN, generally use to deliver more explicit text regions. Those techniques are experimented over the multi size text detection, yet they are ineffectual while locating singular text lines and words. These techniques first obtain blocks of text from the division map produced by FCN and then by complex post processing the bounding boxes of text are generated. Dan Deng proposed PixelLink an instance segmentation based technique where text sample is first segregated by connecting pixels inside the identical instance collectively. Bounding box for text is then obtained from the segmentation output directly, exclusive of location regression [D. Deng, 2018]. Xue et al. use text fringe semantics for exact confinement of texts in the scene [C. Xue, 2018]. Wang et al. presents PSENet to locate text sample of random shapes and produce the diverse size of kernels for every sample of text and steadily enlarge the minimal scale kernel to the sample of text of entire shape [W. Wang, 2019]. Yao et al. consider identification of text as a semantic segmentation issue and identify curved texts in diverse scene images [M. Liao, 2020].

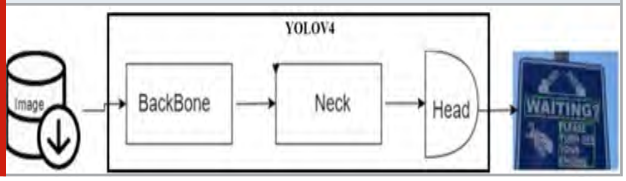
METHODOLOGY

The proposed pipeline for detection of text is demonstrated in fig.1 Here first an python based image annotation tool called Labelimg is used to annotate all images and prepare the dataset like ICDAR 2015, ICDAR 2013, ICDAR 2003, SVT, IIIT5K, MSRA-TD500 in a format accepted by YOLO framework.

The Labelimg generates the text file for every image containing information like object class, x centre, y centre, height and width, all these value's were normalized between 0 and 1. These prepared datasets are submitted

individually to YOLOv4 framework for training which makes use of a novel backbone CSPDarknet53 that can improve the learning capability of CNN. So as to enlarge the receptive field and split out the most significant context features, the spatial pyramid pooling block is added over CSPDarknet53. The path aggregation network (PANet) is used as neck for parameter aggregation for different detector levels. The use of the neck block is to add extra layers between the backbone and the head. Finally the head block is used to locate bounding boxes and classify what's inside each box similar to YOLOV3 with dense prediction.

Figure 1: Proposed Text Detection Pipeline



In order to train a model over the different benchmark dataset, we put the values of hyper parameters as, batch=64, subdivisions=32, width=608, height=608, channel=3, momentum = 0.949, decay = 0.0005, saturation = 1.5, exposure = 1.5, hue=0.1, learning rate = 0.00261, maximum batches = 4000, Policy = steps and steps= 80% and 90% of maximum batches as 3200, 3600 and filters=18. Here we use only first 137 layers out of 162 from yolov4.weight which is trained on MS COCO dataset to get better result.

Table 1. Outcome of text detection technique on IIIT5K dataset

Technique	P	R	F
Our YOLOv4	97	97	97

Table 2. Outcome of text detection techniques on SVT dataset

Technique	P	R	F
Our YOLOv4	87	67	76
Tian [X. Liu, 2019]	68	65	66
Zhang [Z. Zhang, 2015]	68	53	60
Rong [X Rong, 2017]	29	27	28
Gupta [X. Liu, 2019]	26.20	27.4	26.7
Jaderberg [H. Lin, 2019]	53.6	62.8	46.8
Kittler [H Lin, 2019]	55	81	62
Kasar [T. Kasar, 2007]	70	71	69

RESULTS AND DISCUSSION

The experiment is carried out on system with Tesla T4 GPU, with 12GB of VRAM, using open source framework called as Darknet. So as to estimate the feat of proposed pipeline and different existing techniques, parameters like F-measure-(F), precision-(P) and Recall-(R) are considered. An experiment is carried on state of art dataset like ICDAR 2015, ICDAR 2013, ICDAR 2003, SVT, IIIT5K, MSRA-TD500 and result obtained by our pipeline and existing techniques are summarized in below tables.

Table 3. Outcome of text detection techniques on MSRA-TD 500 dataset

Technique	P	R	F
Our YOLOv4	83	78	81
Zhou [X. Zhou, 2017]	87.2	67.4	76.08
Zhang [Z. Zhang, 2015]	83	67	74
He [X. Liu, 2016]	77	70	74
Turki[X Liu,2016]	72	79	75.3
Liao [M. Liao, 2017]	87	73	79
Deng[H. Lin,2019]	83	73.2	77.8
Liu [H. Lin, 2019]	84.5	77.1	80.6

Table 4. Outcome of text detection techniques on ICDAR 2013 dataset

Technique	P	R	F
Our YOLOv4	89	94	91
Zhong [X Liu,2019]	93	86.7	89.7
He [X Liu,2019]	92	81	86
Gupta [H Lin,2019]	92	75.5	83
Liao[M Liao,2017]	89	83	86
Zhang [Z. Zhang, 2015]	88	74	80
Lyu [H Lin,2019]	92	84.4	88

Table 5. Outcome of text detection techniques on ICDAR 2015 dataset

Technique	P	R	F
Our YOLOv4	69	68	69
Zhou [X. Zhou, 2017]	83.27	78.3	80.7
He [X Liu,2019]	82	80	81
Liao [M Liao,2017]	87.8	78.5	82.9
Lyu [H Lin,2019]	89.5	79.7	84.3
Zhong [X Liu,2019]	89	83	86
Xie [W Wang, 2019]	84	81.9	82.9
Wang [H Lin,2019]	86.9	84.5	85.7

For IIIT5K dataset our pipeline got impressive result shown in table1, whereas for SVT dataset our pipeline got better result for precision and F-measure compare to existing techniques whereas Kittler got better result for recall shown in table 2, similarly for MSRA-TD 500 dataset our pipeline got better result for F-measure compare to existing techniques whereas Turkey got better result for recall and Zhou for precision shown in table3,

also for ICDAR 2013 dataset our pipeline got better result for Recall and F-measure compare to existing techniques whereas Zhong got better result for precision shown in table 4. For ICDAR 2015 dataset Zhong et al. got better result for F-measure while Lyu et al. got better result for precision and Wang et al. for recall as shown in table5. For ICDAR 2003 dataset our pipeline got better result for precision and F-measure while Kittler got better result for recall as shown in table 6.

Table 6. Outcome of text detection techniques on ICDAR 2003 dataset

Technique	P	R	F
Our YOLOv4	83	82	83
Kittler [H Lin,2019]	75	89	78
Kasar [T. Kasar, 2007]	72	64	65
Sauvola [X Liu, 2019]	65	83	67
Howe [N.Howe,2011]	76	84	76

The values shown in bold in all tables represent the best result for respective performance metrics. Overall our pipeline got better results over the state of art datasets like ICDAR 2013, ICDAR 2003, SVT, IIIT5K, MSRA-TD500 except for ICDAR 2015 as compare to existing techniques used for detection of text.

CONCLUSION

There exist several techniques with a compromise in speed performance and exactness of outcome to identify text in scene images. In this manuscript, we have presented a simple pipeline for locating text using current state of art object detection YOLOv4 framework and the working principle with training process of YOLOv4 are illustrated in detail. The efficacy of our proposed pipeline has been verified on several public benchmarks datasets like ICDAR 2015, ICDAR 2013, ICDAR 2003, SVT, IIIT5K, MSRA-TD-500 by considering commonly used performance metrics like precision, recall and F-measure. Our pipeline shows promising result as compare to existing techniques of text detection over several benchmark datasets except ICDAR 2015.

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Facial Expression Recognition Using Transfer Learning on Deep Convolutional Network

Ramchand Hablani
[1]*Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

ABSTRACT

A novel method is proposed for facial expression recognition. We have implemented two techniques for automatic facial expression recognition. First, we applied transfer learning to AlexNet, and VGG19 for classification. Second, we used AlexNet and Vgg19 for feature extraction and cascaded it with an SVM for classification. We achieved 86.11% accuracy with AlexNet and 94.44% with AlexNet-SVM cascade. We also achieved 94.44% accuracy with VGG19 and 86.11 with VGG19-SVM cascade. We used JAFFE Data Set to train our four models. Our system achieves an improvement in accuracy for JAFFE Data Set.

KEY WORDS: FACIAL EXPRESSION RECOGNITION, ALEXNET, VGG19, TRANSFER LEARNING, FEATURE EXTRACTION.

INTRODUCTION

We humans are very good at recognising various facial expressions. At an early age a child learns to recognise different facial expressions. Automatic facial expression recognition by computer in varying external conditions has not achieved that much success [Ramchand Hablani,2013] [Sarika Jain, 2014]. Deep learning especially convolutional neural network (CNN) has successfully been applied for object recognition in the computer vision domain [S. Li, 2018]. First few layer of CNN extract abstract features of the image, in the later part of CNN this abstract features combined to form a meaningful features. For different classification problems, researchers have proposed different architectures of CNN, some of the architectures are AlexNet, GoogleNet VGG19 and FaceNet [Wang J, 2018].

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There are basically three approaches for using convolutional neural network for image classification; the first approach is using a trained network (trained on few millions of images) for differencing [S. Li, 2018]. The drawback of this approach is that if we are presenting images of objects which do not belong to any class of trained network, then test accuracy is not up to the mark [Minaee S, 2019]. Suppose network is not trained on various facial expression images, then the test accuracy of this trained network on facial expression images is very low. The second approach for using CNN for image classification is to train the complete network from scratch. There are two problems in this approach. The first one is that few millions of images are required to train network from the scratch. For the task of facial expression recognition, that much large data set is not available. Second problem is that a very powerful GPU system is required to train CNN from scratch.

There is a third approach between these two extreme approaches, called transfer learning. In transfer learning, the fully connected layers are changed according to our classification problem. Weights of convolutional base are freeze, and weights of fully connected layers are learned by presenting the images and corresponding target outputs to the network. There is another approach in transfer learning, flattened values of the convolutional base are

considered as extracted features of network, and then these features are used as input to some robust classifier like SVM. This classifier is trained by using features and corresponding target values. We have implemented both the methods of transfer learning on AlexNet and VGG19. We have used SVM as a classifier to classify the given image into one of the six possible emotions. We train, and fine tune [Minaee S, 2019], the AlexNet using 227x227x3 input images, and train and fine tune VGG19 using 224x224x3 input images. Then, we classify each image as one of six possible emotions.

2. Literature Review

2.1 Convolutional Neural Network: There are four operations in the CNN

1. Convolution operation: Convolutional neural network is based on convolution operation. The convolution operation in one dimension is define as

$$y(n)=x(n)*h(n) \quad (1)$$

$$y(n) = \Sigma_k x(k)h(n-k) \quad (2)$$

Where x(n) is the input, h(n) is called the kernel (filter) and y(n) in is the output. The convolution operation in two dimensions is define as

$$y(m,n) = x(m,n)*h(m,n) \quad (3)$$

$$y(m,n) = \Sigma_j\Sigma_i x(i,j)h(m-i,n-j) \quad (4)$$

The parameters of the kernel h are not fixed but are learnt from the data.

2. Activation function (ReLU): After the convolution operation which is linear, 2nd operation is nonlinear that is an activation function. ReLU is applied as an activation function.

3. Max Pooling or Sub Sampling: Pooling layer reduces the size of outputs of convolution filters. Pooling layer doesn't have any learnable parameters. There are two types of pooling operations, max pooling and average pooling. Max pooling is generally used in convolutional neural network. The convolution, activation functions and pooling is called a convolutional layer. In CNN architecture, there are many convolutional layers. All these layers of convolutional layers is called conversional base of the network.

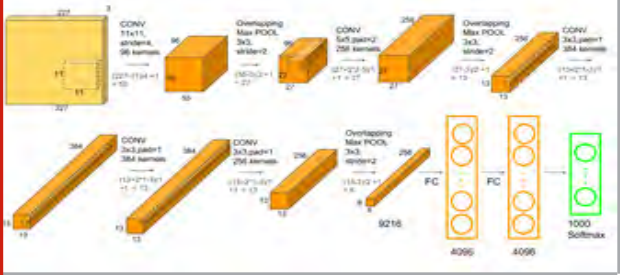
4. Fully Connected Layer: The output of the conventional base is flattened to give input to the fully connected layers of the network. The last layer of the fully connected layers is the output layer. The number of neurones in the output layer is equal to the number of classes in the training data.

2.2 Feature Extraction from pre-trained Convolutional Neural Network: As mentioned above, the output of the convolutional base is converted into one dimensional vector. This one dimensional vector can be used as a feature vector. There are two approaches for using this feature vector [A. Mollahosseini, 2015]. The first approach is to input this feature vector to fully connected layers of convolutional neural network. The only change to be made is to change the size of the output layer. The size of the output layer must be equal to number of classes in our classification problem [Jyh-Yeong Chang, 2001]. In our case there are 6 classes one for each facial expression. Softmax is used as an activation function for the output layer. The second approach is to use this feature vector as an input to some robust classifier like SVM, and train that classifier with this feature vectors as a input and the corresponding class as a target output. We have used SVM as a classifier for facial expression recognition [R. R. Selvaraju, 2017].

2.2.1 AlexNet Architecture: The size of the input layer of AlexNet is 227x227x3.The RGB images of size 227x 227 are presented as input to the network. There are a total 8 layers in a network; out of which 5 are convolutional layers and remaining 3 are fully connected layers. On the input images, 96 filters of size 11x11 with stride equal to 4 are applied and get a tensor of size 55x55x96. Max pooling of size 3x3 is applied on this tensor and gets a tensor of size 27x27 x 96. After that 256 filters of size 5x5 with same convolution are applied and get a tensor of size 27x27x256.Then max pooling is applied on this tensor and gets a tensor of size 13x13x256. After that 384, 384 and 256 filters of size 3x3 with same convolution are applied one after another without applying any pooling operation. So we get a tensor of size 13x13x256.After that max-pooling is applied on this tensor and get a tensor of size 6x6x256. This tensor is now converted into one dimensional vector 0f size 9216. Finally 3 layers of size 4096, 4096 and 1000 neutrons are added as fully connected layers.

2.2.2 VGG19 Architecture: The size of the input layer of VGG19 is 224x224x3.The RGB images of size 224x 224 are presented as input to the network. There are a total 19 layers in a network; out of which 12 are convolutional layers and 5 are max pooling layers and remaining 2 are fully connected layers.

Figure 1: AlexNet Architecture



3. Facial Expression Database: The Japanese female facial expression (JAFFE) is the data set for facial expression recognition [Sunny Bagga, 2013]. There are a total 213 images in which 10 female subjects are expressing their

faces in 6 universal emotions like anger, disgust, fear, happiness, sadness and surprise. The seventh expression is neutral [Ankita Vyas, 2014]. These are 8 bit gray scale images with resolution of 256 X 256.

Figure 2: VGG19 Architecture

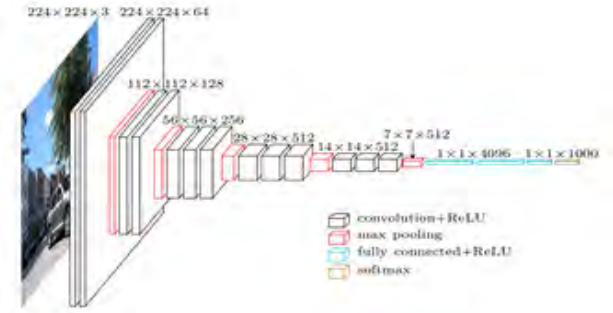
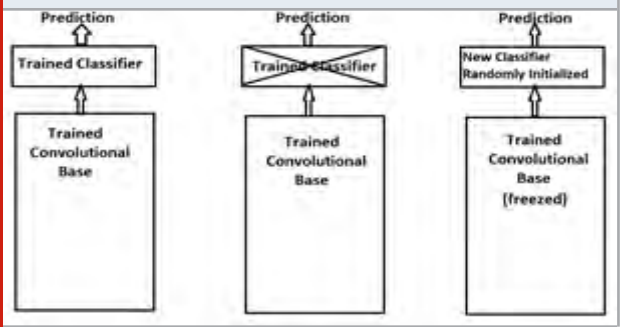


Figure 3: JAFFE dataset

Figure 4: Transfer Learning

Figure 5: Feature extraction with new classifier



4. Proposed Method: In the proposed system, transfer learning and feature extractions are used to classify one out of 6 possible classes. Two approaches transfer learning and feature extraction with SVM classifier, have been applied onto pre-trained networks AlexNet and VGG19. In the first approach, the size of output layer in fully connected layers is changed to 6, one for each facial expression. The convolutional base is freeze, and weights of fully connected layers are trained by using JAFFE dataset. In the second approach, the output of conventional base is converted into one dimensional feature vector, this feature vector and target values are used to train SVM classifier.

5. Experiments and Results: The last three layers of pre-trained network of AlexNet and VGG19 are configured for 1000 classes however; we performed fine-tuning of these classes since we wanted to detect 6 classes for facial expressions. For our classification, output layer of fully connected network was changed to 6 and we also retrained the subsequent two softmax and classification output layers. In our second approach, features were extracted from the fully connected layer FC7 of AlexNet and VGG19. Based on this, the feature vector with training labels were formed and fed them to the SVM Classifier. Since AlexNet only accepts the image with input size of 227x227x3,(VGG19 accept images with input size of 224x224x3), so we replicated the channel three times to converted our single channel gray scale images of JAFFE to three channels. Also, the input image size was different so, we resized the image.

Table 1. Confusion Matrix for Transfer Learning with AlexNet

Expressions	Fear	Surprise	Sad	Angry	Disgust	Happy
Fear	6	0	0	0	1	0
Surprise	0	6	1	0	1	0
Sad	0	0	5	0	0	0
Angry	0	0	0	6	2	0
Disgust	0	0	0	0	2	0
Happy	0	0	0	0	0	6

Table 2. Confusion Matrix for AlexNet-SVM cascade

Expressions	Fear	Surprise	Sad	Angry	Disgust	Happy
Fear	6	1	0	0	0	0
Surprise	0	5	0	0	0	0
Sad	0	0	5	0	0	0
Angry	0	0	0	6	0	0
Disgust	0	0	0	0	6	0
Happy	0	0	1	0	0	6

Random splitting with 80-20 ratios was done for the train and test images, which lead to different accuracy for each split. We achieved 86.11% and 94.44% accuracy for transfer learning and feature extraction-SVM approach respectively for AlexNet. The mini Batch size of 2 and 20 epoch gives optimal results for transfer learning. We achieved 94.44% and 86.11% accuracy for

transfer learning and feature extraction-SVM approach respectively for VGG19.

Table 3. Confusion Matrix for Transfer Learning with VGG19

Expressions	Fear	Surprise	Sad	Angry	Disgust	Happy
Fear	5	1	0	0	0	0
Surprise	0	5	0	0	0	0
Sad	1	0	6	0	0	0
Angry	0	0	0	0	6	0
Disgust	0	0	0	0	6	0
Happy	0	0	0	0	0	6

CONCLUSION

In proposed system, we have implemented transfer learning and classification using SVM on extracted features from convolution base of pre-trained models. We have used AlexNet and VGG19 as pre-trained CNN models. We have applied proposed methods on JAFFE dataset. Proposed system has achieved the accuracy of 94.44% which is comparable to best existing system.

The main conclusions of our proposed work are:

1. For small dataset transfer learning Deep CNN is a better option.
2. SVM is a powerful classifier, it can be trained using features extracted from pre-trained Deep CNN.

We will extend our work for Cohen Kanade dataset for facial Expressions, and real time images.

Table 4. Confusion Matrix for VGG19-SVM cascade

Expressions	Fear	Surprise	Sad	Angry	Disgust	Happy
Fear	5	1	0	0	0	0
Surprise	0	3	0	0	0	0
Sad	0	0	5	0	0	0
Angry	0	0	0	6	0	0
Disgust	1	2	0	0	6	0
Happy	0	0	1	0	0	6

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Predicting reduction of COVID-19 cases in India Using Machine Learning Algorithm

[1]Rashmi Welekar, [2]Sharvari Tapase, [3]Shubhi Bajaj, [4]Isha Pande, [5]Abhishek Verma, [6]Ashutosh Katpatal, [7]Vaibhav Mishra

[1]Shri Ramdeobaba College of Engineering Katol Rd, Gittikhadan, Nagpur 440010, Maharashtra, India.

[2,3,4,5,6,7]Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering Katol Rd, Gittikhadan, Nagpur 440010, Maharashtra, India.

ABSTRACT

The coronavirus disease (later renamed as COVID-19) originated in Wuhan, China and now has spread throughout the world. Many methods have been implemented so as to bring the condition under control, however it has been a difficult task to predict when the number of cases will start decreasing. Hence, we are trying to predict, using the Susceptible-Exposed-Infectious-Removed (SEIR) model, when the number of cases in India will start decreasing. The implementation will start on district/city level, then to the state level and then the country level. We are going to develop a WebApp, which will maintain a dashboard of the active cases, cured cases, and the death cases daily of India. We are trying to train the model on the data from a city/country where there was a significant decrease in the cases, to check our model's accuracy. We are expecting to get a probable period of time when the cases will decrease on an average all across India.

KEY WORDS: SEIR MODEL, COVID-19, PREDICTION, REDUCTION, COVID-19 CASES IN INDIA, MACHINE LEARNING ALGORITHM

INTRODUCTION

In the month of December 2019, we found the sudden outbreak of the Coronavirus, later renamed as COVID-19, in the city of Wuhan, China. This virus then rapidly started to spread to other parts of China, as well as to other many countries of the world. The condition in India is also at par with the world. Currently, as of mid-August 2020, there have been about 22,63,951 confirmed cases, out of which 6,38,368 are currently active and 15,80,231 are recovered, with the death toll at 45,352. Because of the asymptotic nature of the virus, it is difficult to predict its behaviour, and thus, it is difficult to predict its spread. However, it is essential for every citizen to know when the number of cases will start reducing.

The problem we are trying to solve is to predict when the number of cases will start reducing. For that, we have decided to use the SEIR model. Initially, we will try to predict the reduction in some particular cities/districts, where the number of cases has significantly decreased, so that we can test our model's accuracy on historical data. If the model is accurate, we will try to expand our scope from districts to states, and then to the entire country. The reason why the decrease in the number of cases is important to the entire population is because the daily lives of each individual has come to a standstill. This model's results will be beneficial to the government, so that it can concentrate on the areas where the reduction

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*****Corresponding Author: welekarr@rknec.edu

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will take place slowly, and apply the resources efficiently, rather than using them in places where the reduction in cases is going to be rapid. Similarly, the companies which have started producing sanitizers, masks, and other such sanitary products will know when to stop the production so as to save themselves from heavy losses. It will be easier for the ministries to decide when to uplift a lockdown, or when to start the schools, colleges, shops, etc. in a particular area. In short, it will be easier to predict when we can have the condition a little closer to normal.

Literature Review: Lots of research papers indicate that the research for the prediction, reduction and detection of COVID-19 is going on all over the world. The excess mortality in England [Peckham, R., 2020] was analyzed, to see the difference between the number of deaths in the presence of COVID-19 and its absence. We can see from the paper on "Outbreak and Analysis of COVID-19" [Hamzah, F.B., 2020] that a corona tracker is being developed, so that the cases around China can be tracked, and they are also working on the sentiment analysis of people to know the effect of this virus on the mental health of the people. They are using the SEIR model for prediction. Whereas from the "Journal of Thoracic Disease" we can see that [Yang, Z., 2020] they have integrated population migration data before and after January 23 and most updated COVID-19 epidemiological data into the Susceptible-Exposed-Infectious-Removed (SEIR) model to derive the epidemic curve. They have also used an artificial intelligence (AI) approach, trained on the 2003 SARS data, to predict the epidemic. A machine learning forecasting model for COVID-19 pandemic in India [Sujath, R., 2020] was created, to detect the number of cases in India. They have used the Linear Regression model with FANN for the prediction.

Why the prediction of COVID-19 cases so difficult, is addressed in the [Roda, W.C., 2020] paper. They have taken into account that the SIR model works better, and have implied that using more complex models will not guarantee reliability, as compared to simpler models. One more study [Gupta, R., 2020] on the outbreak situation in India can be seen. They have suggested that only the essential services and goods should be made available and a national lockdown should be observed for at least a month. Their study will be helpful to the Government of India and the states in India, and also the doctors, health workers, scientists and researchers. A study in Barcelona [Baena-Díez, J.M., 2020] was made where they had two parameters: age of the patient and the socio-economic status. They have observed that the impact of the virus has hit the hardest in the lower income section of the society. Lower the income, more the impact. They have concluded that not only the people who already have ailments should be prioritized, but also a healthcare strategy should be implemented for the whole population, especially the economically deprived regions.

We can also find similarities between the coronavirus and SARS virus that was identified in the year 2003, and [Raju, N.V., 2020] we can find the Indian publications on SARS-CoV-2 in the WHO database on COVID-19. There has been a rise in the publications related to COVID-19 in the past few months, with authors belonging to the Indian institutes like AIIMS and ICMR. In a similar paper [Di Girolamo, N., 2020], we can find the study of characteristics of the articles or reports published during the first 3 months of the coronavirus pandemic. Their search strategy was that they searched articles having "COVID" or "COVID-19" as the keywords, and found a lot of articles during the initial 3 months of the pandemic.

In the paper [Ali, I., 2020] the highlights were that it contains detailed information on the coronavirus, advanced methods of management and prevention of the spread, treatment strategies and this article can be helped to create awareness amongst the public. In one more paper related to study in India [Anirban Ghataka, 2020], they have implemented the compartment based epidemiological model, which incorporates social distancing and lockdown strategies for the top 15 affected states in India, upto May 2020. They have also implemented how to have post lockdown relaxation measures to prevent further spread of the disease using the eSIR model.

This study [Remuzzi, A., 2020] came out when there was a surge in the number of cases in Italy, after the surge in the number of cases in China. Also, the exponential growth in the number in Italy could not be properly predicted and managed due to the difference in the social distancing measures and the capacity to arrange facilities, as compared to that of China. Coming to the part, as to how coronavirus affects people already suffering from an ailment, we can see that [Zheng, Y.Y., 2020] SARS-CoV-2 infects the host cells through the AC2E receptors, leading to the COVID-19 related pneumonia and causing a chronic damage to the patient's cardiovascular system. Also, whether the patients suffering from diabetes and certain cardiovascular diseases are at an increased rate of infection [Fang, L., 2020] is studied. Summarizing this [Fang, L., 2020] paper, we can see that the understanding of the clinical chest CT features of the COVID patients will help to detect the traces of the virus in the early stages and access the treatment earlier. They have concluded that the chest CT scans show the high possibility of presence of COVID-19 pneumonia if the person has come in contact with a COVID affected person.

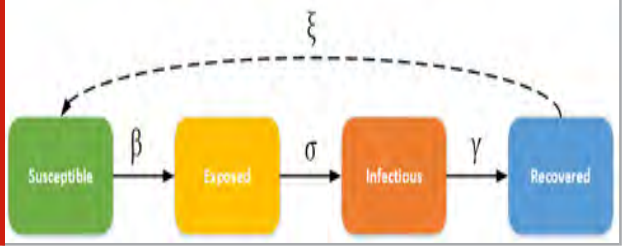
In [Jakhar, M., 2020] the paper, we can observe that the prediction on increase in cases of COVID-19 in different states of India is done using the SIR model. They came up with the results that the most affected state, having the maximum number of positive cases, was recorded in the state of Maharashtra. We can see from [Hoque, M.M., 2020] this paper, that the misconceptions about the effect of weather on the virus should be cleared up, especially in largely affected regions like the USA. Using the prediction model on the US, similar conclusions were drawn regarding India too. The relationship between weather conditions and the virus will help to identify the high-risk zones in India.

Using SIR model [Cooper, I., 2020], the effect of the coronavirus on different communities like South Korea, USA, India, etc. has been observed. Also, the data is from January to June 2020, where the difference in the number of cases is observed before and after the implementation of strict control measures. Our project is going to detect the reduction in the number of cases in India, using the SEIR model. We will try to predict the cases first on a district level, and then increase the range to the entire country.

Principles of the Proposed Method: SEIR stands for Susceptible, Exposed, Infectious, and Removed or Recovered, respectively. SIR model forms the base for the SEIR model, but SEIR adds the Exposed part as an added variable. The SEIR model then may become an SEIRS (Susceptible - Exposed - Infectious - Recovered - Susceptible) model, where already recovered people may become susceptible again.

The rate of infection, β controls the rate of spread which represents the probability of transmitting disease from a susceptible person to an infectious individual. The incubation rate, denoted by σ, is the rate of latent individuals becoming infectious (where the average duration of incubation is 1/Γς). Recovery rate, = 1/D, is determined by the average duration D of infection. For the SEIRS model, is the rate at which recovered individuals return to the susceptible status due to reasons like loss of immunity, etc.

Figure 1: SEIR Model Flowchart



The base SEIR model is as follow:

$$\frac{dS(t)}{dt} = -\frac{\beta S(t) I(t)}{N}$$
$$\frac{dE(t)}{dt} = \frac{\beta S(t) I(t)}{N} - \sigma E(t)$$
$$\frac{dI(t)}{dt} = \sigma E(t) - \gamma I(t)$$
$$\frac{dR(t)}{dt} = \gamma I(t)$$

Figure 2: The calculations for the SEIR model

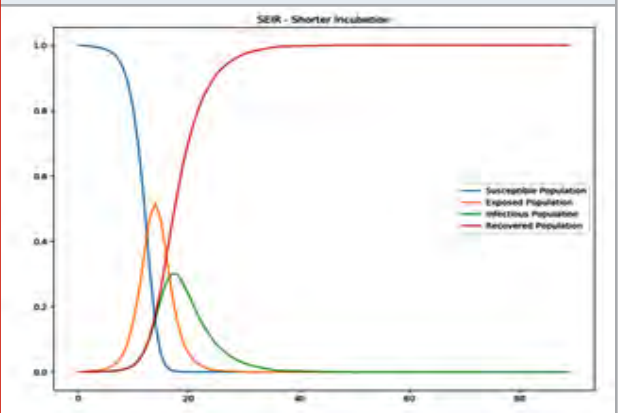
where

$$N = S + E + I + R$$

Figure 3: Total population equation

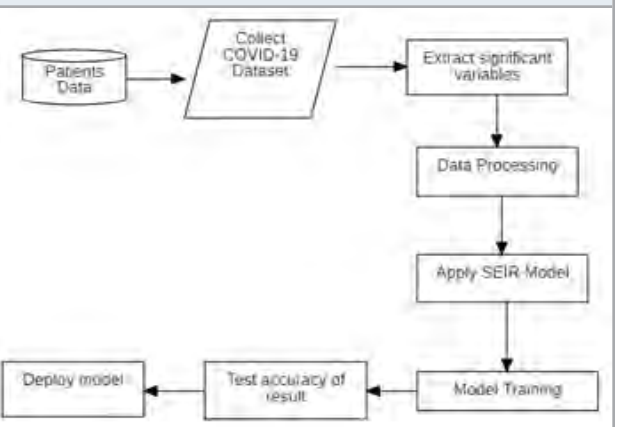
is the total population. Here, it is assumed that the latent population [E] is asymptomatic but infectious, and [I] refers to the symptomatic as well as the infectious population. The incubation rate, σ is defined as the rate by which the exposed individual develops symptoms.

Figure 4: The graphs plotted between different populations number of people vs infected



Research can be further done on: The high risk zones classified according to population density, age group, comorbidity, metabolic conditions patients, residential infrastructure, availability of medical aid; The variation in spread of disease if a person travels from high-risk zone to low risk zone and vice versa; To monitor if at a given time a person has gone from high-risk zone to low risk zone and vice versa; and group monitoring

Figure 5: Flow Diagram of the project



METHODOLOGY

Step1: Collect the dataset from sources. We are planning to use the dataset provided by John Hopkins University on COVID-19 and the dataset provided by Kaggle.

Step 2: Classify the data, select the data to be uploaded on the dashboard which shows the number of cases tested positive, death cases, recovered cases, etc.

Step 3: We will then classify the data required for the actual prediction and the train the data using the SEIR model.

Step 4: We will test the accuracy of the model using data from places where there has already been a significant reduction in the number of cases.

Step 5: Based on the accuracy of the model, we will decide whether to continue using the same model, and also the accuracy given by other models.

Step 6: The prediction will be carried out on a district level, first, then on the state level and then on the entire country.

Step 7: We will repeat the process of prediction every week to see the accuracy of the model as well as the change in the time period as to when the cases will actually start to decrease.

Proposed Result: We are aiming for 80-90% accuracy in prediction of the reduction in number of cases using the SEIR model. Also, we are hoping to find a near probable date, rather than a time period as to when there will be a reduction in the number of cases.

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Development of a Smart System for COVID-19 Guideline Compliance Verification

Rashmi Welekar[1], Manjiri Vairagade[2], Mohit Sawal[3], Shreya Rathi[4], Shrijeet Shivdekar[5], Siddhi Belgamwar[6]
Department of Computer Science & Engineering, Shri Ramdeobaba College of Engineering and Management, Katol Road, Gittikhadan, Nagpur, 440013, Maharashtra, India

ABSTRACT

The important reasons for the rapid spread of the novel coronavirus (2019-nCoV) was the lack of awareness of infected individuals about their health due to the 14 day incubation period of the virus and the subsequent un-intentional transmission, large scale ignorance of social distancing guidelines, and improper sanitary precautions and health. In this paper, we describe the development process of a system based solution for individuals to do Covid-19 susceptibility test using the SpO2 oxygen level detection test, to detect symptoms with higher levels of accuracy. We also discuss various other implementation features to prevent the unaware spread of the virus including providing details to the user regarding government guidelines related to containing transmission of the virus, alerts to the user about periodic maintenance of sanitary guidelines, social distancing, and notifying the user on non-compliance of above features. Finally, we discuss possible future extensions to stricter the measures taken up by the user to prevent any mistakes- like a front-camera based mask authentication approach, and alerting the user on entering crowded areas based on Bluetooth crowd sensing. Also, this system will be further developed into a mobile application.

KEY WORDS: COVID-19, COMPLIANCE, SPO2 OXYGEN LEVEL MEASUREMENT, GOVERNMENT GUIDELINES, ALERTS FOR SANITARY GUIDELINES, SOCIAL DISTANCING, AND FACE MASK.

INTRODUCTION

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has triggered a worldwide phenomenon which led to large scale repercussions in health and economy. The WHO declared the coronavirus as a pandemic on 11th march, especially that of the category known as Public Health Emergency of International Concern (PHEIC).[Mahalmani VM,2020] As of 14th August 2020, the number of cases recorded in India were approximately 2.46 million and the number of deaths were 48,040. The widespread influence of the coronavirus pandemic has resulted in proactive steps taken by the Government to contain the spread in order to prevent further swathes of the population from getting infected, because of the case fatality rate to be 2% as of April 2020[Fauci ,2020], and 3.02% as of September 2020. One of the most important steps taken by the government to control the transmission is comprehensive testing. Testing vulnerable hordes of the population through various measures like RT-PCR, serologic testing, lateral flow assay, etc. have proven to effectively identify Covid-19 positive and negative audiences. The further clamping down on spread is ensured through contact tracing.

However, the crucial factor which has led to an increase in the number of cases is the incubation period of the virus, which is 14 days[Jantien A Backer,2020]. This incubation period signifies the approximate time required

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for the emergence of symptoms in a COVID-19 positive individual. In these 14 days, ignorance and not paying attention to symptoms may lead to the persons in contact with the COVID-19 positive individual being susceptible to infection, which is known as the asymptomatic transmission of the virus.

[Bai Y,2020][Gao M,2020] Special care has to be taken to monitor the health conditions and oxygen levels of patients with hypertension and diabetes mellitus because of their increased susceptibility to the disease [Fang L,2020]. The RT-PCR testing method, despite its high accuracy, leans towards the non-feasible side for economically poor households. We can leverage the wide smartphone base and internet connectivity in India, even in poorer households, to come up with a solution to determine the susceptibility of an individual towards COVID-19 through oxygen level detection in the blood. [Xie,2020] Thus, in times of COVID-19, oxygen level monitoring has become especially important, because of low oxygen levels being an important indicator of the severe cases of COVID-19, with the individuals not being immediately aware of it.

A lot of asymptomatic patients also suffer from extraordinarily low blood-oxygen levels, or hypoxia without even realizing, which has made the prognosis of the infected individuals difficult. This is because low oxygen levels do not necessarily point towards any visible respiratory problems. This silent depletion of oxygen levels in the body of asymptomatic patients may ultimately lead to cardiac arrest. Since most asymptomatic patients don't prohibit any obvious symptoms of low concentration of oxygen levels, it becomes all the more essential to closely monitor the oxygen saturation, in the early stages of the disease. Patients are unaware of the depletion of oxygen as they are able to breathe comfortably[Tobin,2020].

However, they may experience confusion, impaired psychomotor performance, and even euphoria, none of which can be clearly linked to oxygen deprivation in the body. The slow drop in oxygen levels has shed light on the importance of a device to measure the percentage of oxygen in the blood and the heart rate. Normally, a person's oxygen saturation (SpO2) is around 94-96 percent and becomes a cause for concern when it starts dropping below 92 percent. Apart from this, violation of certain preventive measures can lead to the transmission of the virus. We aim to develop a system that will help in keeping track of a user's health status and provide him with the ability to test himself against the virus along with other features to verify his compliance against the measures set. The system can then, in later stages, be developed into a mobile application for the ease of use and availability to every smartphone owner.

Literature Review: The overall understanding of the COVID-19 pandemic and its repercussions, fatality rate, incubation period and the mode of asymptotic transmission was comprehensively explained by Mahalmani et al(2020) in [Mahalmani VM,2020], Fauci, Anthony, Lane, and Redfield(2020) in [Fauci, 2020], Backer, Klinkenberg and Wallinga(2020) in [Jantien A Backer,2020] and Bai, Yao, Wei et al.(2020) in [Bai Y,2020] respectively. To get an idea about the feasibility and existing systems, the paper by Jhunjhunwala(2020) in [Jhunjhunwala A,2020] provided sufficient information about the Arogya Setu app and the possible ways to leverage the vast smartphone user base. Fang, Karakiulakis, and Roth(2020) in [Fang L,2020] conveyed the urgency to develop a system that could determine the susceptibility of high risk patients (diabetes and hypertension), considering the high case fatality rate. The SpO2 level detection module was motivated by the importance of monitoring SpO2 levels in COVID-19 patients as suggested by Xie, Jiang, et al.(2020) in p8[and the fact that levels above 90% statistically pointed to a reduced mortality rate.

Another motivation to develop the module was the baffling phenomenon of "happy hypoxia", by virtue of which a high risk patient may seemingly be unaware of his low oxygen concentration and subsequently, low SpO2 levels, and may be at risk according to Tobin, Martin, Franco et al.(2020) in [Tobin,2020]. To develop this module of determining blood oxygen saturation using smartphones, Lamonaca, Carni, Grimaldi et al.(2015) in [F. Lamonaca,2015] provided useful insights on processing of change of light intensity in the video frames at the fingertips of the patient.Kanva, A.K., Sharma, C.J., & Deb, S. (2014) in [Kanva,2014], narrowed down on the extraction of data of recorded variations in colour signals on a fingertip placed in contact with the optical sensor and Bui, Nguyen, Nguyen et al.(2020) in [Nam Bui,2020] gave systematic insights about measuring SpO2 by exploiting wavelength separation and chromophore compensation. The motivation and feasibility for development of the bluetooth proximity sensing module and its importance to return to normalcy in times of pandemic was conveyed by Xia, Ye and Lee(2020) in [Xia,2020]. Finally, the understanding of the phenomenon of mass immunization and how use of AI, digital monitoring and repurposing of existing other resources with IoT, NFC and GPS protocols will optimize and handle the major challenges was succinctly conveyed by Indani et al.(2020) in [Ashish Indani,2020]

Existing System: The Arogya Setu app, leverages the large smartphone base and the expansive coverage of telecom network services and internet facilities, to augment the efforts taken by administrators and coordinators to better manage the pandemic at a local level[Jhunjhunwala A,2020]. The individuals who are suspected COVID 19 positive based on the assessment quiz are asked about location geographically through GPS and bluetooth, and users of the app around this suspected individual are given alerts and notification, citing their risk category on basis of proximity to that individual. The App provides various other features as well, by virtue of its augmentation with government initiatives to reduce the workload and risks of physical presence, like issuing e-passes. The convenient user interface makes the app very handy to use. The app does

not provide any sort of symptom detection test, which could benefit the large user base of this app. Also, the app does not periodically remind the user about maintaining sanitary precautions or social distancing guidelines or giving the user an idea about the individuals who come in contact with him during any outdoor activity, thus rendering him less aware of the degree of safety of any place visited by the user.

Proposed System: Our system primarily relies on SpO2 based oxygen saturation detection test to classify the susceptibility of users as risk-averse, or risk-negative. The result obtained would be supported by predicting the susceptibility depending upon the symptoms observed in the user. Periodic alerts will be given to remind the user to comply with the preventive measures. In case of a user stepping out of his home, he would be prompted to take a photo of himself so as to check whether the user is wearing a mask or not. If not, he will be asked again and again until the mask is detected by the system. When in crowded areas, social distancing will be monitored with the help of bluetooth by checking the nearest devices in an area of some radius. Government guidelines will be displayed to the user so as to comply with them. If the user is found violating the preventive measures, he will be notified immediately. A dashboard will be maintained for the user to check his health parameters and other details.

Since the patients may gradually become used to the slow concentration of oxygen level in the body, a pulse oximeter or a device which measures the oxygen concentration levels can come handy in spotting when the oxygen concentration level starts dropping. This may help in providing the patient with timely oxygen supply before things become critical and even help in early detection of COVID pneumonia when there are minor symptoms.

METHODOLOGY

To develop the above mentioned system and incorporate different features, we make use of the SpO2 concept that measures the oxygen saturation level in the blood. This will help in detecting the presence of virus in the human body. Monitoring social distancing in crowded areas with the help of bluetooth, detection of face masks before stepping out of the house, dashboard to keep track of health parameters are some of the other features that will be supported by the system.

- **SpO2 Level Measurment**

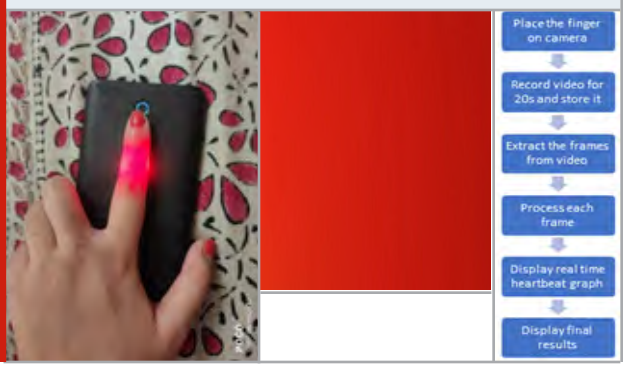
We primarily rely on the pulse oximetry measurement using smartphones to determine the SpO2 levels present in the blood.[F. Lamonaca,2015]The oximeter produces two wavelengths of light which pass through the finger/palm and the unabsorbed light is measured by a photo detector. Pulse oximetry relies on the principle that the blood absorbance of red light changes with variance in degree of oxygenation. The receiver end esignal is divided into DC and AC components. The DC component is due to tissue background, venous blood and constant part of arterial blood flow. The DC component is subtracted while the AC component is amplified. The DC and AC parts can be used to calculate the SpO2 level in the blood, according to the formula given in Fig. 1.

$$S_pO_2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}$$

Figure 1: SpO2 based oxygen saturation detection test

Where, A and B are parameters that can be obtained by matching the SpO2 graph obtained by a standard pulse oximeter.[Ding,2018] The user has to keep his finger/palm on his smartphone's camera as shown in Fig. 2. This is the first step of the algorithm involving the recording of a small video clip of around 20 seconds. Around 20 seconds is essential for the calculated values to stabilize. For this particular implementation of the algorithm to work, the white light will fall on the finger/palm and then the image of the finger/palm will be received by the phone's camera lens. After placing a finger/palm on the lens, the user has to make sure that the image produced on the screen is sufficiently bright. He will then press the Start button to start recording the clip. Second Step: When around 20 seconds will pass, the recording will automatically stop. Once this happens, a new screen will be launched in the app. The first 600 frames from the clip (corresponding to around 20 seconds of video) are extracted.The retracted frames shall look like the one shown in Fig. 3

Figure 2: Position of the finger while
Figure 3: Frame extracted from video
Figure 4: SpO2 capturing video Methodology



Third Step: After the extraction of the frames, they will be parsed into an image holder where they will be processed one by one. Each frame will be resized for reduced computation time. Each frame will be separated into its red and blue constituents. The following parameters will be calculated for each image: mean of red color component (mr), mean of blue color component (mb), standard deviation of red color component (sdr) and the standard deviation of blue color component (sdb). Here, mr corresponds to the red DC value, mb to the blue DC value, sdr to the red AC value and sdb to the blue AC value. These values will be used to calculate the SpO2

level. The calculated average SpO2 value of all the 600 frames will be then displayed and an average value obtained from SpO2 graph will be saved for further use.

Final Step: When all the required parameters will be obtained, the following suggested actions will be shown to the user:
1. SpO2 calculated between 96 and 99 Result: Healthy
2. SpO2 calculated <92 Result: The user should try again, if values persist, he should cross-check his values with standard equipment.

If the value also persists on standard equipment, then the user should seek medical attention, because these levels indicate low levels of oxygen concentration in the blood. [Nam Bui,2020] This methodology is diagrammatically explained in Fig. 4.

To support the above mentioned results, a machine learning model will be trained to apprise the user of his health status. Inputs such as fever, cough, sore throat, tiredness, etc would be taken from the user and applied against the model. Depending upon the output obtained, the final result will be shown to the user as whether he is safe or if he needs to seek medical aid.

- **Mask Detection**

1. Access location of the user.
2. If the location is other than the home location, prompt the user to capture his image.
3. This image will undergo a series of techniques of image processing.
4. Based on the processed image, the app will output whether the user has worn any mask or not.
5. If the user has not worn a mask, then an alert will be given to the user to wear the mask and retake his photo until the mask is detected to ensure his safety and will be good to go after wearing the mask.

- **Social Distancing Using Bluetooth**

1. The user grants the necessary permissions to the app like bluetooth, location, etc
2. We create a BluetoothServerSocket to listen for connection requests from other devices.
3. Compute the number of contacts every 30 seconds. This compensates for things like differences in bluetooth advertising rate.
4. Serialize these contacts into a Gson file with the appropriate name, signal strength and device address for each contact.
5. We can convert this Gson file to Json and send it to our server to store user information
6. count the number of space-separated addresses in the contact list and display in today's score.[Xia,2020]

CONCLUSION

We aim to develop a system that will have features like detection of virus in the human body using SpO2 and other visible symptoms like fever,cough,sore throat,tiredness,etc., verification of user compliance against preventive measures like social distancing when moving through public places or crowded areas and use of face masks while stepping out of the house. This system will be further developed into a mobile application for the ease of use and availability to every smartphone owner. This system shall help mankind technologically while such dire situations demanding medical aid prevails.

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Feature Set Reduction for Source Camera Identification Using Demosaicing and Wavelet-based Features

Rishabh Sanghvi[1*], Laksh Hariyani[2] and Richa. R. Khandelwal[3]

[1],[2]Research Intern, Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management

[3]Associate Professor, Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India.

ABSTRACT

Recent research work done in Camera Forensic Techniques have exhibited excellent results by merging several modern methods of Source Camera Identification, thereby creating a large feature set. Increasing the feature set can also contribute to higher computational time, complexity and error rates due to use of redundant features. The work exhibited in this paper shows that it is possible to optimize the feature set size to 16, while maintaining the results as those obtained by state-of-the-art techniques. The statistical features extracted from images are based on demosaicing algorithm and wavelet transform. First, the proposed statistical equations were used to formulate 4 features based on periodic characteristics shown by demosaicing. Then, the image matrices were transformed by 1-Level wavelet decomposition and 16 features were extracted from obtained co-occurrence matrices. After further optimization, it was found that classification model trained using 16 features had the highest average accuracy of 99.2%. Thus, the final optimized feature set size was reduced to 16 features from 20 features for identifying images from 10 camera models.

KEY WORDS: SOURCE CAMERA IDENTIFICATION (SCI), DEMOSAICING ALGORITHM, WAVELET FEATURES, HAAR AND SYMLET WAVELET, SUPPORT VECTOR MACHINE (SVM).

INTRODUCTION

Images are visual representation of information which is used for forensic, educational, entertainment and research purposes. Some individuals post fake information by manipulating images for gaining popularity or money. Source Camera Identification (SCI) is one such technique which will help us to identify the source of such suspected images and to quantify the fake and real information. [Kaur. H. Jindal, 2020] briefly explains the scope and applications of image and video forensics. The proposed methodology is a step towards providing desired solution to the existing problem. Several approaches are available for SCI like study of Color Features, Demosaicing Algorithm, Gray-Level Co-occurrence Matrix (GLCM), Wavelet transform, Image Quality Metrics (IQM), Noise-based techniques and many others, shown by [M. Kharrazi, 2004]. Such methods are constructed after studying the unique features of camera itself (proprietary hardware and software). Such techniques are broadly classified as Image Feature Extraction Techniques.

One important camera hardware is the Color Filter Array (CFA) or Bayer Filter, shown in Fig. 1. It captures all color components simultaneously, thus we need demosaicing algorithm for calculating missing color intensities to form a color image. The process of demosaicing approximates pixel intensity for all color channels based on the neighbouring pixels. There are several different algorithms for demosaicing which take under

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*Corresponding Author: sanghvirh@rknec.edu

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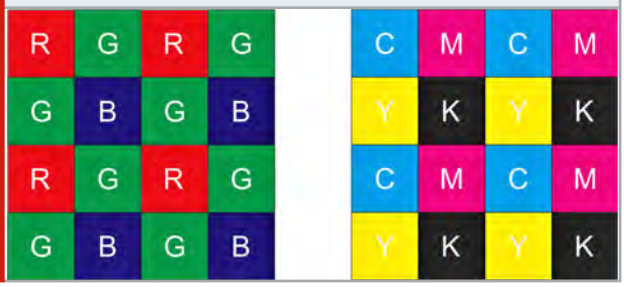
consideration various sizes of kernel for approximation of pixel intensities. Many such algorithms are briefly explained by [Y. Long, 2006].

Figure 1: Bayer Pattern (Color Filter Array)



Several approaches have been shown in different research works for using Demosaicing Algorithm as SCI technique. [A. C. Gallagher, 2005], proposed the use of second order differential equation to identify traces of interpolation occurring in images due to demosaicing. An improvement to Gallaghar's method was proposed by [S. Bayram, 2005], [S. Bayram, 2006]. First, they segmented the image based on smoothness, then the second order differential equation method was applied to smooth parts and Expectation- Maximization (EM) algorithm to less smooth parts of the image. [J. S. Ho, 2010] constructed a method to extract the correlations from the images, for constant hue interpolation based demosaicing algorithm. A novel framework was proposed by [Chen Chen, 2015], which calculates distribution of demosaicing errors over the entire image, which is represented as a co-occurrence matrix. Another framework developed by [H. Cao, 2009], accurately detects demosaicing regularities in images. First the framework reverse classifies images to several categories and then estimates the Demosaicing Formula based on partial second order differential equation. All these techniques finally extract features from the matrices obtained and then identify source of the images using Machine Learning (ML) Algorithms.

The images can also be transformed and depicted into different domains using Fourier, Wavelet, Cosine and many other transforms. Transformations ease the process of feature extraction as different transforms reveal different characteristics of camera's processing steps that are hidden in the images. Hence, Wavelet Transform are widely used for SCI and also Image Processing. Also, Wavelet transform is found to compliment many techniques, for e.g. noise-based techniques and Gray Level Co-occurrence Matrix (GLCM) based features, and ends up enhancing the performance of classification model. [B. Wang, 2009] suggested use of 4-Scale wavelet decomposition for extracting 216 higher order wavelet features and 135 wavelet co-occurrence features.

An extension of the above work was done by [A. Jeyalakshmi, 2018], where the effectiveness of using different types of wavelet transform for feature extraction was compared. An approach carried out by [K. R. Akshatha, 2016] used Higher Order Wavelet Statistics (HOWS) for extracting PRNU noise. The wavelet denoising techniques were utilized for extracting noise from the images. The rest of the paper is distributed as follows: Section 2 contains Proposed Methodology and a novel approach of using available techniques with optimum number of features will be discussed. Section 3 defines the Experimental Setup, the number of camera models used for testing proposed methodology. Section 4 contains the Experimental Results obtained. In Section 5 the advantages, limitations of proposed methodology and future work are discussed.

2. Proposed Methodology: Improvements and modifications to currently available methods for demosaicing and wavelet-based techniques are discussed. These improvements helped to reduce the number of features in comparison to available techniques, while maintaining a low error rate of classification accuracy.

2.1. Proposed Statistical Features based on Demosaicing methods: Gallaghar's method has certain limitations, its performance reduces significantly after image compression (e.g. standard JPEG compression). It becomes difficult to identify peaks, as for some observations they are indifferentiable from false peaks occurring due to JPEG compression at defined intervals. Also, the highest peak tends to shift around in the spectrum for images taken from same camera model, due to which false classification of images to other source camera model increases. The above techniques concentrate on a single peak (the highest peak which reveals the interpolation factor) from the entire frequency response of pseudo-variance signal. Another approach is to formulate features after studying the entire signal, which would give an insight about the shape of the signal and distribution of peaks. Hence, we propose two statistical features accompanied by skewness and kurtosis features, that would be able to extract more information from the entire spectrum of pseudo-variance signal. This in turn would provide a desired classification accuracy comparable with state-of-the-art methods and optimize the overall feature set.

The proposed method can be applied on any one of the color channel of the image (either Red, Blue or Green Color Channel). We selected the Red Color Channel, but the result can be replicated if one uses any of the color's matrix (which contains pixel intensity of selected color). First, we calculated the second order differential for each row of the image (from the equation provided by Gallaghar et al), added the result column-wise and averaged over the total number of columns. Then we converted the signal into its frequency equivalent using Discrete Fourier Transform (DFT). The methodology is exactly similar to Gallaghar et al's till this point. Then proposed statistical formulae are employed to extract the following features:

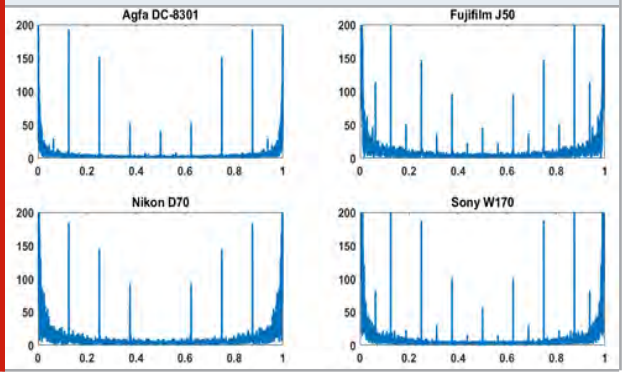
a. Coefficient Periodicity Analysis Feature (CPAF)

$$CPAF = \frac{1}{C}\sum_{i=1}^{C} F(1,i)$$

b. Peak Distribution Analysis Feature (PDAF)

$$PDAF = \frac{1}{C}\sum_{i=1}^{C} i * F(1,i)$$

Figure 2: The differences in peak magnitudes, their distribution and shape of signal are shown for 4 camera models. All camera models captured exactly the same scenery.



C represents the no. of columns in the image matrix and F(1,i) is the magnitude at ith column of the frequency signal.(The value of C is used to reduce the numerical values of the features, it doesn't affect the performance, as the features extracted without using C yield the same results). As every camera uses a different demosaicing algorithm, the distribution and values of the weighted coefficients will be different. Therefore, the peaks will have different magnitudes(as depicted in Fig. 2.) as periodicity of the coefficients will also differ. The feature-1 calculates a value by adding all the peak magnitudes. The sum will thus depend on the value of the coefficients and their periodicity in the variance signal, (hence, referred as CPAF) which will be similar for images from same camera model taken into consideration, as the coefficient is mainly affected by the type of demosaicing algorithm or size of kernel used.

Another important data to be extracted, for efficiently using the CPAF is distribution of peaks in the variance signal. As CPAF is a sum of magnitudes, the results obtained for some images from different cameras can be same, but the distribution of peaks will be different. The distribution of the peak values can then help us to determine the camera model (hence, referred as PDAF). The PDAF is a sum of product of peak magnitudes and their respective position. The sum will vary depending upon the position at which the peak magnitudes occur.

2.2. Skewness and Kurtosis: These statistical features were used to further analyze the shape and distribution of data with respect to the mean of the signal. These 2 features were added to further improve the performance. The results observed validated there use, as the error rates reduced significantly.

3. Wavelet-based Feature Extraction: The proposed methodology uses 1-Scale Wavelet decomposition and then obtain Energy, Entropy, Homogeneity and Contrast features from the co-occurrence matrices. The 1-level wavelet transformation can provide a set of uncorrelated features with minimum decomposition of the signal. Hence, we propose the use of 1-Scale Wavelet decomposition in addition to the proposed statistical features for classifying images from multiple cameras and to improve the results obtained from latter technique. These features were extracted using 3 different wavelet types, for comparing their individual performance and to incorporate the best performing wavelet's features with demosaicing based features. The three families of wavelet included Haar, Coiflet & Symlet wavelet.

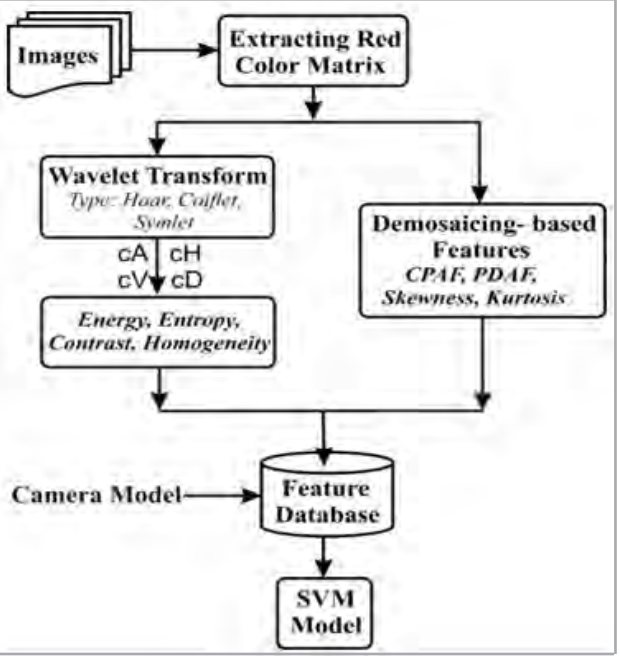
Table 1. Camera Parameters

Camera Model	Sensor Specification	Max. Image Resolution	Format	Label
Agfa 530s	5.0 Megapixel CMOS Sensor	2560 x 1920	JPEG	C1
Agfa DC-830i	8.0 Megapixel CCD Sensor	3264 x 2448	JPEG	C2
Canon Ixus-55	5.0 Megapixel CCD Sensor	2592 x 1944	JPEG	C3
Canon Ixus-70	7.1 Megapixel CCD Sensor	3072 x 2304	JPEG	C4
Fujifilm J50	8.2 Megapixel CCD Sensor	3264 x 2448	JPEG	C5
Kodak M1063	10.3 Megapixel CCD Sensor	3648 x 2736	JPEG	C6
Nikon D200	10.2 Megapixel CCD Sensor	3872 x 2952	JPEG	C7
Nikon D70	6.1 Megapixel CCD Sensor	3008x2000	JPEG	C8
Samsung L74 Wide	7.1 Megapixel CCD Sensor	3072 x 2304	JPEG	C9
Sony W170	10.1 Megapixel CCD Sensor	3648 x 2736	JPEG	C10

4. Experimental Setup: To observe the effectiveness and performance of proposed features to identify source camera model, 2924 images were collected from 10 camera models (300 images from 9 camera and 224 from Cannon Ixus-55 camera, this is maximum images available for this camera) from Dresden Image Database [Gloe, T., & Böhme, 2010], which is a standard database used for benchmarking of camera-based forensic techniques.

The specifications of the source camera models used for training and testing purposes are given in Table I. Hence, the database contains images that are from different brands, same camera brand but different model and some having the same image resolution.

Figure 3: Feature Set Extraction Setup



The 4(statistical features from demosaicing) + [4(cA, cV, cH, cD) x 4(Energy, Entropy, Homogeneity, Contrast)] = 20 features were calculated for a single image. This process of full feature set extraction from images is depicted in Fig. 3. For measuring the performance of the classification learner, the camera model name associated with each image is fed into the classifier along with the feature set. After collecting features from each image, a SVM classifier was used for training. We tested the model by applying 5-fold Cross-Validation. The results were verified by applying Holdout Validation, in which we split the data into 80% - 20%, training - test set. The process is repeated for Haar, Coiflet & Symlet wavelet.

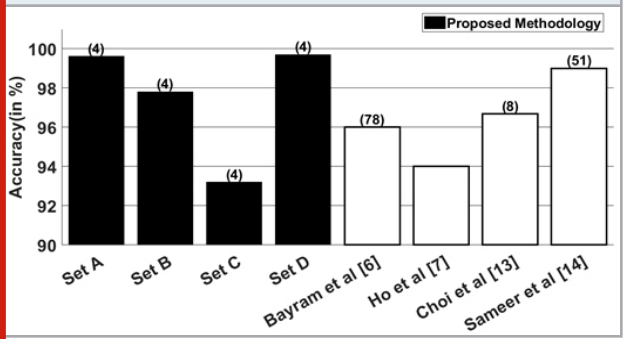
EXPERIMENTAL RESULTS

The experiments mentioned below were performed on MATLAB.

5.1. Performance of Demosaicing based Features: The features were tested on different pairs of camera models mentioned in Table III. The camera models included in 3 sets contain camera models of same brand, as many techniques of SCI show poor performance when camera from same brands are incorporated in the sets. The results obtained are then compared with other feature based techniques on the basis of feature set size used and obtained accuracy in Fig. 4. The proposed methodology achieved higher classification accuracy by using the least amount of features among all given methods. The accuracy does vary depending upon the similarity in demosaicing algorithm used in the cameras, shown in Fig. 4.

The set C has a lower accuracy and this indicates that the cameras use similar demosaicing methods. As the extracted features are dependent on demosaicing algorithm, such instances can be avoided by adding features based on other methodologies to the feature set. When further tested on 10 cameras, results showed that the confusion was most evident for camera pairs using similar demosaicing algorithms, as also indicated by Bayram et al. Thus, it can be concluded that other methods are required, different from those based on demosaicing algorithm, to achieve better results for multiple source camera models. Thus, we selected wavelet-based features to differentiate between such camera models.

Figure 4: The accuracy obtained by proposed and referenced methodologies are depicted and compared. The brackets contain the feature set size of respective methodologies.



5.2. Performance of Full Feature Set (Demosaicing and Wavelet Features): The feature set initially consisted of 4 features from demosaicing, then features like Entropy and Contrast (as Energy and Homogeneity were found to have similar values for images with same resolution. Hence, to remove the dependency of feature set on original size of image, these features were removed) extracted using Haar and Symlet were added successively to build a set of 20 features as discussed earlier. Initially, the set of 4 demosaicing features was tested on 10 camera models, its performance was analyzed and then 4 features obtained from wavelet features(i,e, Entropy and Contrast) were added successively. The accuracy obtained after each iteration is depicted in Fig. 5. This experiment clearly shows how the wavelet features improved the overall performance of the system (see transition from 4 to 12 features) and the contribution of each wavelet type in maximizing the performance (see transition from 12 to 16 features).

The important observation made was, the SVM model has the highest accuracy among the 4 training models for 16 features. As, the performance of the model is same for 16 and 20 feature set size, evident from the straight line between them in Fig. 5, we kept 16 features in the final set. The final feature set thus consisted of 4(statistical features from demosaicing) + [2(entropy +

contrast) x 4(cA, cH, cV, cD)] from Haar + [1(entropy) x 4(cA, cH, cV, cD)] from Symlet = 16 features, that are applied to 2924 images collected from 10 camera models. In another test, the optimized feature set was first used to classify images from 2 camera models and then a new camera model was introduced in every iteration. The average accuracy obtained for every set is shown in Fig. 6. This experiment allowed proper comparison of proposed methodology with research studies done for SCI, which use different number of camera models. It was also observed that the error rates rose utmost by 0.2%, every time a new camera was added. The figure also shows that the proposed methodology has better or on par classification accuracy when compared with referenced methodologies, after using the least amount of features. The average accuracy of SVM classifier was 99.2%

Figure 6: Comparing performance of proposed methodology with available SCI techniques based on camera models used vs. accuracy obtained. The brackets indicate full feature set size.

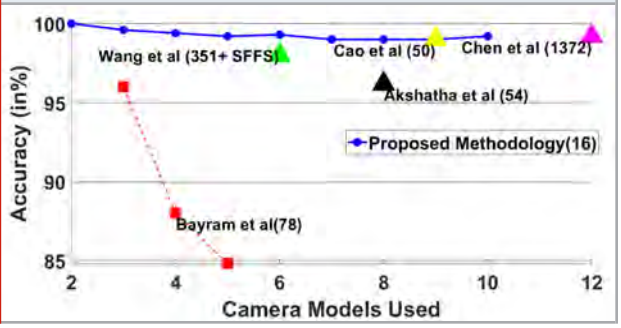


Figure 5: Comparing classification accuracy of different training algorithms.

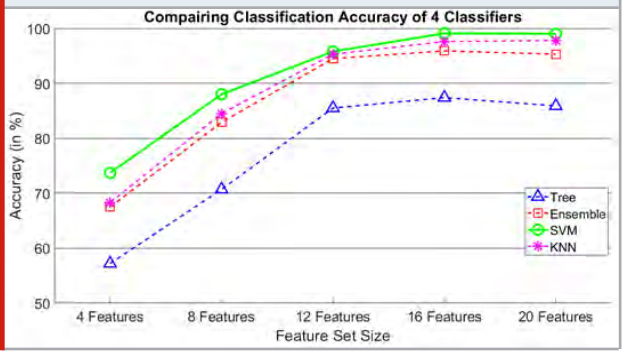


Table 3. Camera Set Contents

Set	Camera Models included
Set A	Canon Ixus-70, Kodak M1063, Nikon D70
Set B	Agfa DC-530s, Agfa DC-8301, Canon Ixus-70
Set C	Nikon D70, Nikon D200, Samsung L74
Set D	Nikon D200, Canon Ixus-70, Sony W170, Canon Ixus-55 (similar set used by Ho et al)

Figure 3: UV-VIS Spectra of the compound, PA-B-ester

Actual Class	Predicted Class										Accuracy
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
C1	298						1	1			99%
C2		297		1		1			1		99%
C3			223	1							99%
C4		1		299							99%
C5					300						100%
C6						296				4	99%
C7		1			1	1	297				99%
C8	6							294			98%
C9				3					297		99%
C10										300	100%

(Cross-Validation accuracy), shown in Table IV. Also, the Holdout Validation accuracy was 99.7% for the test set, obtained after 80% training set - 20% test set division of the entire database of 2924 images. Thus, the number of features was reduced to 16, without affecting the classifier's accuracy.

CONCLUSION AND FUTURE WORK

The proposed methodology can successfully identify camera models with high precision using only 16 features which is less than many methodologies available at present. The features were extracted based on periodic characteristics of demosaicing and by transforming

images by wavelet transform. The classification model maintains a low error rate when a new source camera is introduced, but the error rates will rise if multiple camera models (e.g. 10 cameras) are added, as the probability of false classification would increase. Thus, we need adaptive algorithms (like SFFS) that would be able to detect rise in false classification and then add uncorrelated features extracted from other wavelet families like Daubechies, Morlet, Shannon and many more to the feature set. The testing of these wavelet families is necessary before incorporating them with proposed methodology. In our future work, we would like to compare the effectiveness of using different wavelet families in addition with our proposed feature set.

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Tiny Face Detection And Recognition: A Review

Roshni Jambhulakar[1] and Shailendra S. Aote[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Face recognition is the method is most highly useful component for security surveillance with numerous biometrics and other surveillance systems, including several others states of art methods.Now a days have been made the object recognition one of the remaining open challenges in detecting small objects. Deep learning is used for tiny face recognitions.We explore so many aspects of the problem in this a finding a small faces. The role of small face is identifying by the small pixels of that image from the tiny faces. When we trying to find out the tiny faces, from lots of crowd. We need that image has the so many face objects. It means that image containing the large amount of data,while most recognition approaches in to be scale-invariant. The cues for recognizing 4 pixel tall faces are fundamentally different than, those for recognizing400 pixels tall face.As we take out different approaches and train a separate detectors, for a different skills to maintain the efficiency detectors, are trained in multitask.Here is the deep learning week we used to make the features extracted from the multiple layers of a single feature hierarchy. While training a detected from large objects is strength forward the challenge, remaining train detectors for a small objects. We show that the context is a crucial and define templates that make us use of the massively large repetitive fields.We use the deep networks for preview the scale.

KEY WORDS: FACE RECOGNITION, TINY FACES, BIOMETRIC IDENTIFICATION, METHODS, APPLICATIONS, IMAGE PROCESSING, INDEPENDENT COMPONENT ANALYSIS, PRINCIPAL COMPONENT ANALYSIS, LINEAR DISCRIMINANT ANALYSIS, LINEAR REGRESSION ANALYSIS.

INTRODUCTION

In this world every person has his unique Identity, unique face features,and human identification process before differentiate from one person to other person by identifying their features.It has different facial characteristics nose, ears, forehead, eyes, lips etc.So face recognition method is used to identifying the people in images or in videos throughdetection, and then match within the independent components features.Facial recognition and other existing methods are used to identification procedure. But the problem occurs when we are trying to identify of thousands of tiny faces at a time. Now a day the tiny face identification, this topic is very popular in research area in worldwide from past few years.

Identifying the tiny faces from lots of crowd, sent work has done in object detection makes use of scale normalized classifierneed and reason classifiers. Run on the image which has the less scale pixels features. When resizing the reasons, we need to look for the size of the templates; we need to look for the size of the pixels of that image. So we can identify the tiny objects from that image itself. On other hand we need small templates so that can detect small faces also. While we're talking about the tiny face recognitions, we got so much of data so much of tiny faces. So we need to collect that large amount of data. Traininglarge collectionsof a scale specific detector, means suffer from lack of training data, for individual scale and inefficiency from running a number of large of detectives at test time.

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*****Corresponding Author: janbhulkarrv@rknec.edu
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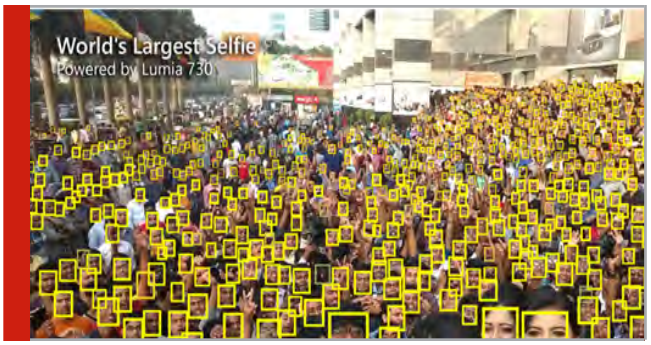


Facial recognition technology is becoming ubiquitous across the industries. It is considered as one of the fastest methods for image analysis, for human verification and image recognition through facial features and expressions. It involves extracting information, such as landmark, pose, expressions, gender, age, identity and etc.It has several applications including face biometrics for payments, security companies are using the facial recognition to secure their premises, immigration checkpoint use facial recognition to enforce smarter border control, fleet management companies can use face recognition to secure their vehicles, ride sharing companies can use facial recognition to ensure the right passengers are picked up by the right drivers, Iot benefits form facial recognition by allowing enhancement security measures and automatic access control at home, law enforcement can use facial recognition technologies as one part of their driven surveillance system, retailers can use facial recognition to customize offline offerings and to theoretical map online purchasing habits with their online ones.To identify a small object is a very challenge now days. We explore there more aspects of this problemin the context of face detection.The role is to find out the tiny faces from thousands of crowd and the task is when the object is of small scale but still it can be identified.

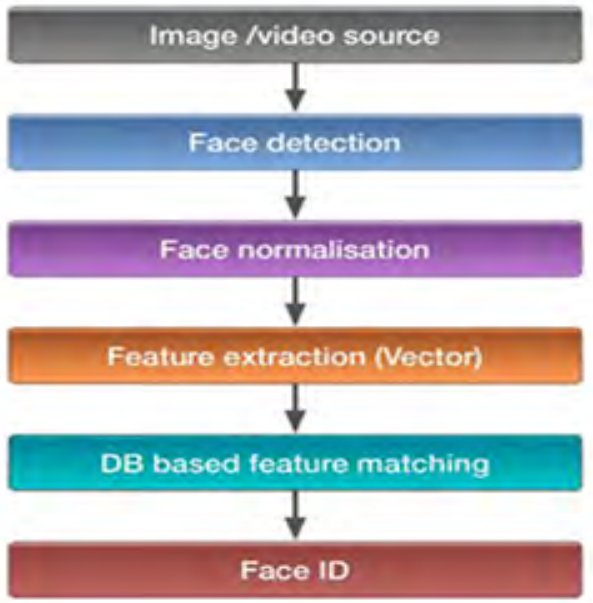
Literature Review: We give a brief overview of a recent works on different models of a face identification and recognition verification we discuss the recent face detection methods and applications and examples.

Previous Methods: Face Recognitions Methods: In the last decades there has been rapidly development of the reliable face recognition algorithms. The traditional face recognition algorithm can be categorized intovarious categories, holistic matching method, hybrid methods and feature based methods and that the holistic method group can be additional differentiate into a linear method and nonlinear projection methods.

Holistic matching methods: The holistic matching method is a complete all face feature is taken intoas an, input into a face features catching system.Holistic methods are Eigen facesapplications have given avarious good result of nonlinear projections method, appearance is based method search is a independent component analysis (ICA) and linear regression classifier (LRC), linear discriminant analysis (LDA) and principal component analysis(PCA).

In the starting stage of 1970, The face recognition method was called as a 2D pattern Face recognition method problem. The distance of between in precious points isa used to recognized known feature of faces; example calculating thegiven distance between the face features like eyes,head, nose or other important points for measuring various angles of various facial components of faces. But it is verynecessary that the face identification and face recognition method systems to be automatic face recognition on features are such a challenging job now days. It important problem that is has attracted for research towards face recognition, If they have various background psychology patterns recognition, neural network as computer visions and different computer graphics security biometrics etc.

Figure 2: Face Recognition System



Due to large variations in conditions facial expressions and other factors this method may fail to adequately represent the faces. The main reason is that the face white and lie on a complex nonlinear and non-convex main fold in the high dimensional spaces. In this order to delay with such a case is known in linear extensions, have been propose like a kernel PCA(KPCA), kernel LDE (KLDE). Do most nonlinear methods using the Kernel techniques, the general idea consists of Mac paying the input face images into a higher dimensional space. In which the main food of the face is linear and simplified so the traditional linear methods can be applied.

In the example of the iron faces the flowchart contain stages to classify the problem in given figure, the different stages are illustrates; in the beginning stage are to add different set of the images into a given database. These different input images are named asainput training sets of face recognition and this is because they will be used when we used to be compared thedifferent images and when we create the Eigen faces as an input. II stage is to

create the Eigen faces of the other input image. It meansis extracting characteristics face features from ainput image. The two different input imageare differently normalized to each line of a nose, eyes, forehead those are then resize, so that those features have the same distanceof Eigen faces, so can that extracted from the input image various dataas using the arithmetical tools it is principal component analysis(PCA). When input image Eigen faceshas been created input image will be elected by as vector of weighted objects.

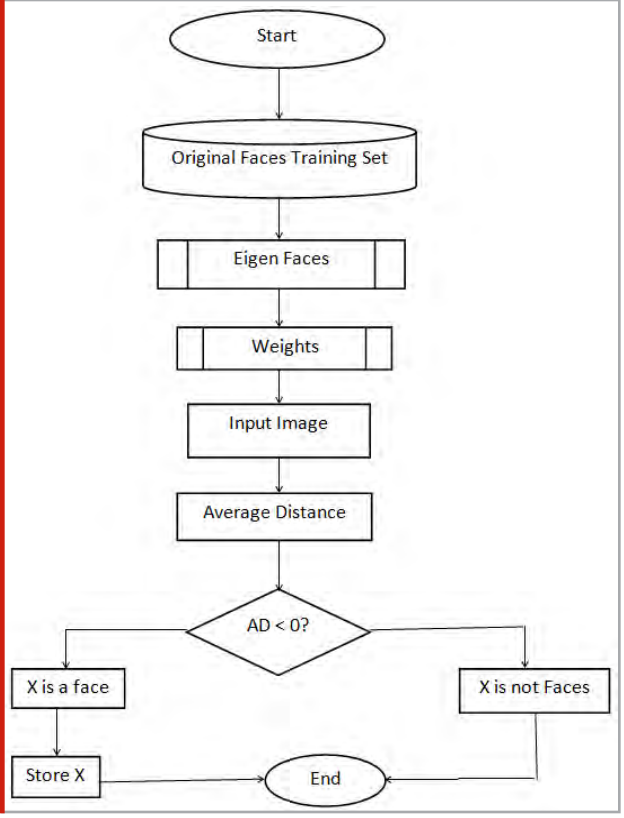
So now those systems are ready to accept the entire query is the input object weight of that incomingother input image is presented and then compared that with two different images to the weighted objects of those are sorted alreadyis given in the system. If the image weights are given as 4 solved for comparison. It is used to be considered as an identified the identification of the input image is done at the stage identification by the finding the various images in the database,which is weight, are very nearest tothe input image in identifications. In the given database of input images with the clauses will be prepared as a heat to the current user of the face recognition system as the sorted image.

Eigen Faces Feature based Methods: In Eigen faces feature based methods, the basic features of face such as forehead, eyes, nose, ears, chicks etc. are the first of all extracted from the input image and their locations of features and local statistics of face recognition are feed into a structural classifier of features. Now a day'schallenges for feature extraction method are a given features Restoration. This method is when the face recognition system tries to retrieve different features from the input imagethose are differently invisible due to a large different variations of image e.g. When we match the frontal view of image with the given profile image. We found out the similar features sometime. General dimensionality reduction techniques are used such as independent component analysis, ISO map, kernel PCA, latent semantic analysis, partial least squares, principal component analysis, multifactor dimensionality reduction, nonlinear dimensionality reduction, multilinear principal component analysis, multilinear subspace learning, Semidefinite embedding ,auto encoder, generic methods which is based on edges of image, shape , size, line and curve features of different views template are based methods of structural view matching method takes into a considered ofsymmetricalconstructions on the different features on input images.

Hybrid Methods: Do hybrids faces recognition methods,used the various combination ofholistic method and different feature extraction methods. Generally when we include the hybrid we use the 3D images in the hybrid method generally, the image is the form of the 3D the object in that image is that object looks like as and 3Dthis system is trying to understand the curves the position of that object. Suppose if the four head of that object is tilted towards to the left so that system, will detect of image that object by their particular shape. Even a various faces in system wouldgives because, these system use death as an existence on measurements of given images which gave that detailed information to construct a over all facefeatures extracted in the 3D system proceed does Measurement,Detections, Representation, PositionsMatching of face features.

Measurements – Given the measurement to that the object like the object is having the template of specific faces on the particular object inside in that image,like if we want to focuses on face so it gives the template of that the shape and size of the eyes and the angle of nose.Detection - Image scanning and capturing the exact object from that real time image. Representation - In the image convert that image into a code, we convert that image into a numerical representation of that prescribe object. Position- Considering the location of the damage, the angle of that image the size of the image and the curve which occur in that image for the real time object. Matching- Comparing the existing image of object which the received image of object from the database.

Figure 3: Flow Chart of the Eigen faces



CONCLUSION

In recent days so many researchers are doing research in Tinny face recognition and now on from many years, in face recognition area is the one of the challenging area for the research. In this paper we have the concept of the face recognition methods given and existing work which has done it in the face recognition method. In this paper the review information and the understanding about Tinny face recognition methods are provide for

readers for better understand. In the future research large scale Tinny face recognition applications such as the E-Commerce, student id in colleges for identifying the tiny faces or even personal identityit is a challenging task now days in the face recognitions methods and in recent years this topic is having high probability for future research.

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Peiyun Hu, Deva Ramanan, "Finding Tiny Faces" Robotics InstituteCarnegie Mellon Universityfpeiyunh,devag@cs.cmu.edu.

RajeevRanjan, Ankan Bansal, Jingxiao Zheng, Hongyu Xu, Joshua Gleason, Boyu Lu, AnirudhNanduri,Jun-Cheng Chen, Carlos D. Castillo, Rama Chellappa, "JOURNAL OF LATEX CLASS FILES, VOL. 14, NO. 8, AUGUST 2015 1 A Fast and Accurate System for Face Detection,Identification, and Verification

SHI LUO , XIONGFEI LI , (Member, IEEE), RUI ZHU , AND XIAOLI ZHANG, "Small Faces Attention Face Detector" Key Laboratory of Symbolic Computation and Knowledge Engineering of Ministry of Education, Jilin University, Changchun 130012, ChinaCollege of Computer Science and Technology, Jilin University, Changchun 130012, ChinaCorresponding author: Xiaoli Zhang (xiaolizhang@jlu.edu.cn)

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Xiangyu Zhu, Zhen Lei, Xiaoming Liu, Hailin Shi, Stan Z. Li, "Face Alignment Across Large Poses: A 3D Solution 1Institute of Automation, Chinese Academy of Sciences2Department of Computer Science and Engineering, Michigan State Universityfxiangyu.zhu,zlei,hailin.shi,szlig@nlpr.ia.ac.cnliuxm@msu.edu

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Exploradar: User-Centric Intelligent Document Retrieval System.

Samip Kalyani[1*], Sanjay Nayak[2], and Kriti Srivastava[3]
[1, 2]*Dwarkadas J. Sanghvi College of Engineering,*
[3]*Dwarkadas J. Sanghvi College of Engineering*

ABSTRACT

Finding a document is one of the most time consuming and laborious task for a user and could affect the overall productivity of an individual in a workforce. Even if the user finds a document by himself/herself, it is still cumbersome to remember the file location of every document present in the computer system considering their volatile nature. For instance, files may be moved from one location to another, deleted, renamed, etc. Over time, it is also probable that the user forgets the actual name of the document and the content related to the document. The abstractive text summarizer implemented in Exploradar provides a summary of user documents. Using the user query, Exploradar provides the best results of the documents present in the user system that includes the file system and databases. Further, to simplify the problem of remembering the contents in a document, Exploradar classifies documents into different domains/tags that help the user in faster document retrieval.

KEY WORDS: QUERY, DOCUMENT RETRIEVAL, DATABASE, CLASSIFICATION, ABSTRACTIVE SUMMARY, SEARCH, NLP.

INTRODUCTION

Despite the advancements in cloud technologies and internet storage-based services, users still function on documents, which are stored on his/her local machine. And while operating on these documents, the user may forget the exact location and the contained information of every document in the computer system. Further, a survey conducted by International Data Corporation, White Paper in 2012 on 1200 IT professionals and workers, concluded that individuals spent approximately five hours searching/looking for their document [Melissa Webster, 2012]. Individuals working in a particular field deal with documents that are related to certain domains and could be clustered together for accessing quickly. Moreover, from the advent of databases, users that operate on documents regularly prefer to store documents in large databases on their machines.

In this paper, we propose a web application to provide users with a common platform that fulfills the above requirements. The user would input a search query that could be based on the content of the document or what he/she assumes is related to the document, and Exploradar would provide the relevant documents to the user. For example, the search query of the user could be "presentation on thermonuclear rate estimation." It could be possible that the same user, instead of querying the system for documents, selects the domains in which he/she thinks the document might be related. In either scenario, the user expects retrieval of relevant documents that could be present in the file system or the database.

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There are five primary goals of the Exploradar. They are

1. Fetching the documents based on the query.
2. Classify the documents into several types and use these classes for querying.
3. Faster preprocessing and querying to retrieve documents quickly.
4. Enabling search on files present in databases as well as in the file system.
5. Providing an abstractive summary of each document.

In addition to the above main features, Exploradar is also implemented to be independent of the operating system on which it is installed, cross-browser compatible i.e. having the same functionality irrespective of the web browser being used. Exploradar opens the document in the native application used by the user for that document. Exploradar also takes into consideration the "human-factor" and thus provides a feature wherein the user can add a class for a document that could be used for querying the document.

Related Works: In the domain of searching a particular document from many documents, the system must rank the documents in order of their relevance to the user query. The ranking implemented by the system can be of two types: query dependent and query independent. As the name suggests, in query dependent ranking, ranking depends on the user given query whereas, in query independent ranking, ranking is based on the anchor text present in the document discounting the user given query. One of the widely used implementations in the realm of query independent ranking systems is the PageRank algorithm [Lawrence Page, 1999]. This algorithm considers a document to be important if it has many numbers of document links pointing to it. The algorithm considers PageRank of the linking documents as well as the number of outgoing links from the document. Link-based ranking approaches are the basis of many web-based search engines today but may not be relevant for user documents because users do not have documents with links pointing to other documents. Support vector machines with modified hinge loss function are also used for information retrieval [Ramesh Nallapati, 2004]. This approach views the information retrieval as a binary classification wherein a document could either be relevant or not relevant. Hence, we consider query dependent approaches for document retrieval.

A semantic search engine is also implemented based on inverse document frequency [TS Jayalakshmi, 2016]. In this approach, an index consists of pointers to each word in the documents. However, this approach would not consider the scenarios in which words, when combined, have an interpretable meaning. For instance, in The White House, individually, "white" and "house" would have a different meaning. But when combined, they form an entity of single interpretation. An SVM-based one-class document classifier is implemented on the standard Reuters data set [Larry Manevitz, 2010]. Many machine learning methodologies have been dependent on SVMs for multi-class classification. However, the performance of SVMs decreases as the number of labels and documents increases. A naïve Bayes classifier for document classification and achieves quality results among the other contemporary classifiers like neural networks, SVMs, and decision trees [S.L. Ting, 2011]. However, this implementation demands to identify features from the important document. A hierarchical attention network-based model that imitates the hierarchical structure of the document, as well as an attention mechanism that is applied on word and sentence level, is also used for document classification [Zichao Yang, 2016].

Various methods have been implemented for extracting text from the document to provide an overall summary. Supervised as well as unsupervised approaches have been used for extractive summarization. In unsupervised approaches, a graph-based method that understands the structure of the text in the document and then ranks important sentences selected from the document is used for document summarization [Jon Kleinberg, 1999]. Next, a fuzzy logic-based method wherein features like sentence length, sentence position, sentence similarity is considered, but the expressions which depend on other expressions are not considered is implemented for document summarization [L Suanmali, 2009].

Further, in unsupervised approaches, we have concept-based summarization wherein important concepts are extracted from an external knowledge base. A concept model that uses Wikipedia as an external knowledge base is used for summarization [Krishnan Ramanathan, 2009]. Lastly, in unsupervised approaches, we have Latent Semantic Analysis, which extracts the hidden semantic structure of sentences. In supervised learning approaches, a Bayesian methodology for automatic text summarization instead of using the conventional heuristic function [JL Neto, 2002]. RankNet algorithm proposed trains labeled data on a two-layer neural network and then extracts features from the test set as well as the training set [Krysta Svore, 2007]. Conditional random fields are used for feature extraction of each sentence and text summarization as a sequence labeling task [Dou Shen, 2007]. In the above two approaches under extractive text summarization, sentences are extracted from the text in the document rather than being generated.

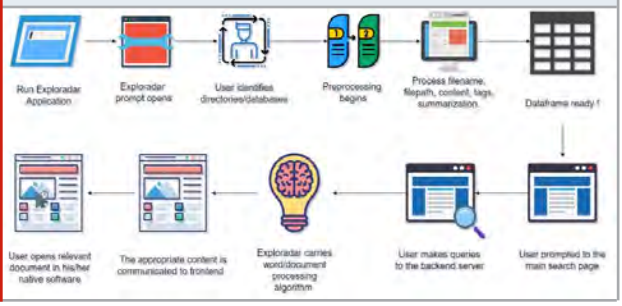
Various structured based and semantic-based approaches are implemented for abstractive text summarization. A multi-document summary is generated using extraction templates [Sanda Harabagiu, 2002]. A syntax-based summarization approach is also proposed wherein for a sentence, common phrases are identified, which are then substituted and inserted by different phrases in such a way that the syntactic meaning of the sentence does not change [H Tanaka, 2009]. Again, such an approach uses a predefined corpus of words for substitution. A novel method of abstractive summarization is also proposed wherein, instead of generating a summary from sentences, it converts the document to an abstract

representation that is based on the concept of information items (INIT) [Pierre-Etienne Genest, 2011]. However, most INIT systems do not generate full sentences. Thus, an NLP based sequence to sequence encoder-decoder network is implemented to provide a qualitative summary.

MATERIAL AND METHODS

The process of searching starts with exploring every file present in the directories chosen by the user. An overview of the flow of Exploradar is shown in figure 1. First, when the user opens Exploradar, a prompt is shown wherein the user can enter the directories where the Exploradar should look for documents. Next, Exploradar begins preprocessing every file in the database and generates tags, summaries, indexes that are stored in the data frame. This is a one-time process after which Exploradar looks only for the updated files and directories. Then, the user is prompted with the main search page where he/she can enter his/her query. Exploradar takes this user query and processes it's searching algorithm (discussed later). The documents are then shown to the user on the screen where he/she opens the document in his/her native application.

Fig 1: Process flow for searching



A. Data collection and preprocessing: The contents of all the files across the selected directories/subdirectories as well as databases are read and then cleaned using multiple text-processing paradigms which include but are not limited to stemming of complex and non-singular forms of words to their basic (root) form, lemmatization of rarely used words to their simple synonyms. Punctuations and all less-meaningful words, also known as stopwords, are removed to enrich the quality cum meaning of the collected content.

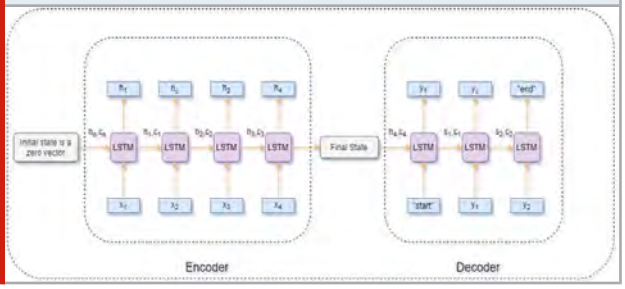
A mix of indexing and phrasing is used to structurally store the collected data and enhance the process of searching in the later stages. For every file that has been processed, a set of all unique words and their frequencies are noted. The words are used as keys and their values are maintained as a list of all the files having their presence and their corresponding frequencies. The idea is to calculate the term frequency of each word and its corresponding inverse document frequency. Term frequency is the number of times a word occurs in a document. Inverse Document Frequency is the mathematical inverse of the number of documents that a word is present in. The value obtained is then normalized to reduce the calculation time and complexity. To improve the results on phrase-based searches, the concept of n-grams is used, which is a continuous chain of 'n' words from a given piece of text. Mending all these calculations, a file vector is created, which is the vector space representation for that file.

B. Automatic Document Tagging: An unsupervised approach is used to assign relevant tags to every document based on its content. The first step is to parse and assign a POS tag (noun, verb, adjective, etc.) to every word by using a statistical model. Words having strictly 'nouns' as their POS tag are taken forward and if the condition (number of word cross threshold) arises, then all general and abstract nouns are discarded. The process of tagging now becomes a competitive process wherein, after every round of processing, words get eliminated. At a higher level of abstraction, this competitive process is simply a counter of their occurrences along with their uniqueness in the processed chunk of text. The terms that can cross these barriers i.e. the last few remaining words become the actual tags for that file.

C. Abstractive Summarization: A summary (basically a one-liner) of the contents from the file is shown to the user to help him choose the correct file without opening the file. Summarizing of the text-content is abstractive, unlike generic summarizers (extractive), which just pick high weighted sentences from the file. One of the concepts from deep learning is used to build the model required for summary creation. A Seq2Seq (Recurrent Neural Network) model is used to preserve the order in which the contents are stored in the file (sequential information). It is to be noted that gated recurrent neural networks provided commendable results on files of shorter lengths, but when large files were fed as input, Gated RNNs underperformed as they were unable to memorize long term dependencies.

Hence, the Long-Short Term Memory model, which takes into consideration the long-term dependencies overcoming the generic problem of vanishing gradient, is used for the seq2seq model; this involves the use of LSTMs in both the encoder and decoder of the model. The input to this model is the cleaned content of the file and the output is a short and meaningful summary for that file. The abstractive text summarization model has been trained on the amazon fine food reviews dataset that consisted of 568,454 mixed reviews given by 256,059 users. The technical architecture of the abstractive summarization model is shown in figure 2. The series of words from each document is given as input to this seq2seq model. Every word from the document is given as input to the encoder. The output of the LSTM unit is a hidden state, which is then given as input to the next LSTM unit. This individual LSTM unit at each time stamp processes the text and understands the conceptual information. The final state of the encoder is given as input to the decoder, which then predicts the next word in the summary based on the previous words.

Figure 2: Seq2Seq Model



D. Text-based Querying: A text input (generally a free text query) is taken from the user and this query text vectorized on similar grounds is used for creating file vectors in the preprocessing step. For ranking the documents, a similarity measure called cosine similarity is used, which is predominantly seen in text-based and NLP-related operations. This involves matching the query vector with each file vector and ranking them based on their metric-values in non-increasing order.

Algorithm retriever_and_summarizer
(input: query, output: ranked files)

1. Read the contents of the file and apply cleaning algorithms
2. Use lemmatization, stemming, etc., to extract meaningful words and store them in a data frame.
3. Compute the TF-IDF score for every document that is present locally.
4. Form N-grams with the threshold 'n' set as 3.
5. Create file/document vectors and store them in the data frame, which is used later.
6. Parse and identify POS tags for every word in the document.
7. Except for proper and general nouns, remove all other words, & calculate their frequency.
8. Compete amongst available tags and finalize the top words as tags.
9. Store these tags in the data frame.
10. Feed the content of every file to a sequence to sequence model (with LSTMs as encoders and decoders).
11. Store the obtained summary in the data frame.
12. Accept user input as free text and create query vectors as done for the creation of file vectors.
13. Rank the documents by calculating the cosine similarity between the query vector and the document vectors.
14. Display the results to the user.

The above algorithm gives the flow of the processing done by Exploradar. Beginning with preprocessing, to building vectors, generating tags, summarizing the file content, identifying the most pertinent tags, and finally, servicing the user query with the most relevant documents.

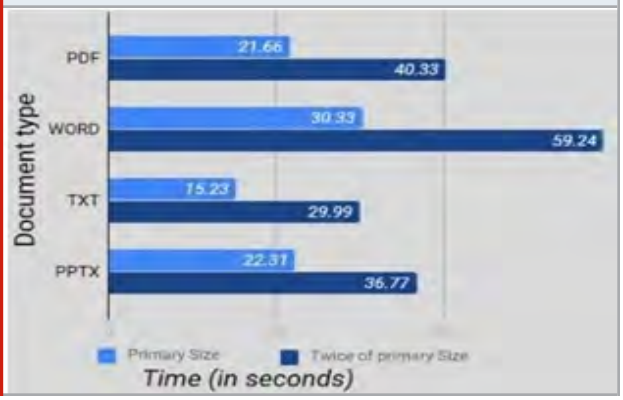
Table 1. Comparison of processing time by document type and size

Exploradar	Primary size (Time in sec)	Twice primary size (Time in sec)
PDF	21.66	40.33
WORD	30.33	59.24
TXT	15.23	29.99
PPTX	22.31	36.77

RESULTS AND DISCUSSION

A windows-based computer was used to test Exploradar across files of various types and sizes. This process was repeated on Ubuntu OS and similar results were obtained on both the systems. The algorithm took around a minute to read the sample set of files, following which testing was done with smaller sized files and the time was calculated for a few sets e.g. PDFs of size 12.6 MB took around 21 seconds whereas PDFs of double the same size took around 40 seconds, a similar result was seen when it came to processing WORD files wherein 3.2 MB of files took 30 seconds for preprocessing whereas 7 MB of files took around a minute. Text files were the fastest to get processed; 10 MB of files took around 15 seconds and 20 MB of files took half a minute.

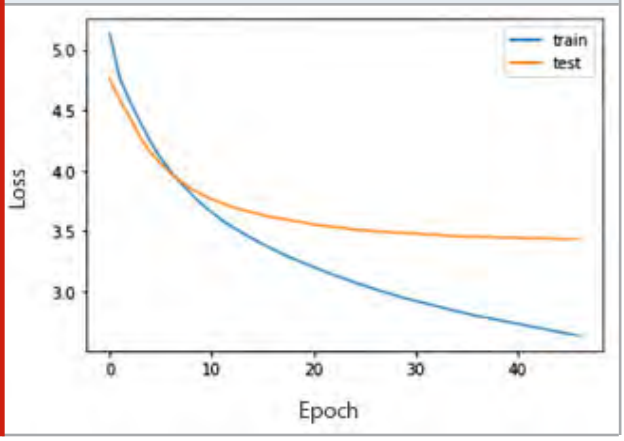
Figure 4: Loss vs epoch for Seq2Seq Model



Similar tests were carried on with ppt files and odt files, following which it can be deduced that the time for processing the files increased linearly with their size.

These results are summarized in figure 3 and table 1. It should be noted that the mentioned processing time is only valid for the first appearance of any file, successive running of the server wouldn't need the processing time as the content is already processed and stored in a pickle file. With an early stopping criterion of 10 epochs, good results were obtained from the summarization model, the training curve of which is shown in figure 4. The mentioned early stopping criteria were finalized after observing the curve crossover on datasets of various sizes. The summarizer produced commendable results for pdfs, word files, and text documents.

Figure 4: Loss vs epoch for Seq2Seq Model



CONCLUSION

Exploradar can be used by anyone and everyone who uses a computer to store his/her documents. Exploradar allows flexible search based on keywords and/or tags along with a summary of the contents present inside the file. It can be used as an offline search engine for local documents stored in directories and/or databases. Thus, Exploradar plans to improve and enhance the user experience when it comes to finding the document. In the future, the scope of Exploradar can be expanded to perform a search on the documents stored on the cloud and display results on a client software (web-based or android/ios or standalone). A personalized touch can be added to Exploradar by tracking the user queries and suggesting related files (content-based recommendation). Support for image files can be provided; this is possible with the help of a computer vision model for recognizing objects in an image that can be labeled to be used as tags for a particular image, thus expanding the reach of Exploradar.

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Online Healthcare Consultation System for Deaf & Dumb During Pandemic Situation

Sampada Wazalwar[1*] and Urmila Shrawankar[2]
[1]*Research Scholar,* [1,2]*Computer Science & Engineering*
[1,2]*G H Raisoni College of Engineering, Nagpur, India*

ABSTRACT

Pandemic situations knocks at the door without information. In such situation healthcare is a major concern. Increased count of patients in any adverse condition leads to scarcity of healthcare services. In such situation telemedicine has played a very important role to overcome health problems of patient & to promote the remote healthcare monitoring of patients by physician in online mode. This proved to be very helpful for normal people but physically challenged could not take its advantage because of disabilities. We have implemented a system to reduce the communication barrier. System include many modules most importantly sign recognition & sign interpretation module in combination with ISL database of medical terms. For sign recognition we are using HMM model with Haar cascade classifier. Interpretation system fully uses the language technology including POS tagging, parsing etc. The overall system proved to improve the accuracy & efficiency of online consultation system for Deaf & Dumb people.

KEY WORDS: TELEMEDICINE, HEALTHCARE, CONSULTATION, SIGN RECOGNITION, SIGN INTERPRETATION, SIGN LANGUAGE, SPOKEN LANGUAGE, COVID19

INTRODUCTION

Telemedicine is now becoming an important part of everyone's life. It is gaining more and more importance due to its advantages, time scarcity with people. Remote health monitoring is also a part of it. We have experienced its benefits during this today's world pandemic as well. As it has helped to monitor the patient's condition remotely during isolation period. Otherwise also when people are scared of going in hospitals because of pandemic condition, this technology helps a lot to the patients as well as physician for continuous health monitoring. Thanks to the technology today which is growing rapidly to increase comfort of human life. But, there are still some community in society which are still not using or unable to use such technology for health monitoring. Here we are specially talking about the physically challenged people like Deaf & Dumb. Deaf & dumb cannot take the advantage of remote healthcare monitoring services because of communication problem. Telemedicine also involves direct online appointment booking & video communication with physicians where a patient can show & explain his problem to physician directly. Deaf & dumb cannot do this because of communication language as sign language is not known to all & even there is also restrictions for medical terms in sign language dictionary.

Use of assistive technology is increasing day by day. There are many assistive technologies in terms of hearing aid, speech to text, text to speech, image to text, smart blind sticks, smart goggles for blind & many other android applications [Emad, 2016] etc for helping disabled in day to day life. Our system includes sign language interpretation in meaningful phrase. It also makes the

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things understandable to the physicians as well. There is a possibility that people can communicate the things to physicians by writing but, explaining so many things in writing also becomes difficult after a period of time. Verbal communication is always easy in comparison with written communication. But, in case of Deaf & Dumb, other person should also have a knowledge of Sign language which is basically a challenge. Implemented health monitoring or consultation system for Deaf & Dumb includes a sign interpretation module as well. This proves very much helpful in pandemic situations like COVID19, we all eye witnessed.

Current Scenario: Telemedicine for healthcare is gaining more and more importance because of technological advances & its benefits for the patients. Benefits of telemedicine includes that patient need not to visit hospital repeatedly which reduces travelling time & cost. Patient need not to remain bedside for small problems. 24*7 physician's consultation is available. There are many current applications which are helpful for remote monitoring. Some applications are for medicine supplies as well. COVID19 pandemic has increased the use of such applications amongst people at great level. Many applications are used for different purposes like appointment booking, online consultation, home delivery of medicine service & pathological services etc. Various applications includes Physicianlink , Netmeds, Mfine, Practo, Medlife & Ayushman Bharat.

These systems proved to be very useful during COVID19 pandemic situation where people preferred to be at their home. Many hospitals are also having their own online consultation services. But, here we are specially talking about the facilities available for Deaf & Dumb for assistance in healthcare for remote monitoring, there are no such applications available. Sign language is a visual language, which is difficult to understand without any knowledge. Thus, there is always a need of sign recognition & interpretation system which will translate sign language to spoken language in understandable phrases. So, during pandemic situation though the world is taking help of telemedicine applications, Deaf & Dumb community could not found solution. Physician's consultation can also be taken telephonically for normal people. But, for deaf & dumb it becomes necessary to have a video communication.

Remote Health Monitoring system for Deaf & Dumb

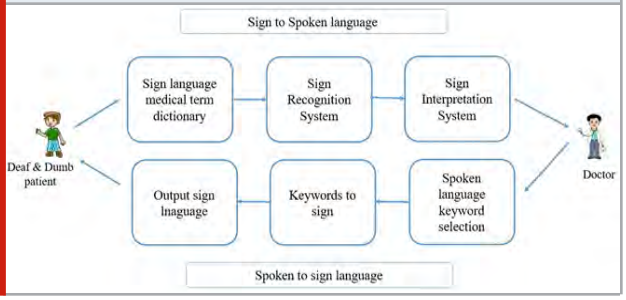
METHODOLOGY

Deaf & Dumb community uses sign language for communication. It is difficult for any normal to directly communicate to Deaf & Dumb and vice versa because of language barrier & the thoughts remains unshared. Healthcare is a sector where it is the right of every person to take advantage of all facilities. Using today's technological advances and smart algorithms we made a system for Deaf & Dumb. We added some modules to existing system which are used for sign interpretation. Implementation of such system has following challenges

- Physicians knowledge about sign language
- Patients (who is Deaf & dumb) understanding of spoken language
- Sign language medical term dictionary
- Sign recognition accuracy
- Interpretation system in between
- Continued internet connection with good resolution camera

In this system both ways interpretation is very essential. The prior need is physician should understand the symptoms which are communicated by Deaf & Dumb patient and in return patient should understand the consultation given by physician. In some cases physician may send the advice by writing if deaf & dumb is well aware of spoken language, but if it is not the case then reverse translation from spoken to sign also become essential, especially when that Deaf & Dumb person do not have anyone to assist or he is in isolation condition. Proposed system model is shown in the fig 1 below. We are proposing fully software system which will be user friendly. The system may also be included dictionary separately where a patient can learn the sign for medical term if he is not having knowledge of it. There still many terms in medical which do not have any sign in such cases fingerspelling or character by character representation can be done to spell the word.

Figure 1: System model for remote healthcare monitoring for Deaf & Dumb



The model for remote healthcare monitoring application for Deaf & Dumb includes two way conversions. Start from Sign language to spoken language for patient to physician communication & other from spoken language to sign language for physician to patient communication. There are many different proposed sign recognition systems. Some are hardware based written here [S. Mitra, 2007] & some are software based written here [Masrur Sobhan, 2019]. Of course wearing hardware for this is not comfortable so a software system can only help in this model. The overall performance of model depends on the accuracy of translation system which depends on training dataset. As here we are basically talking about healthcare, system needs to be trained for some standard signs for medical terms.

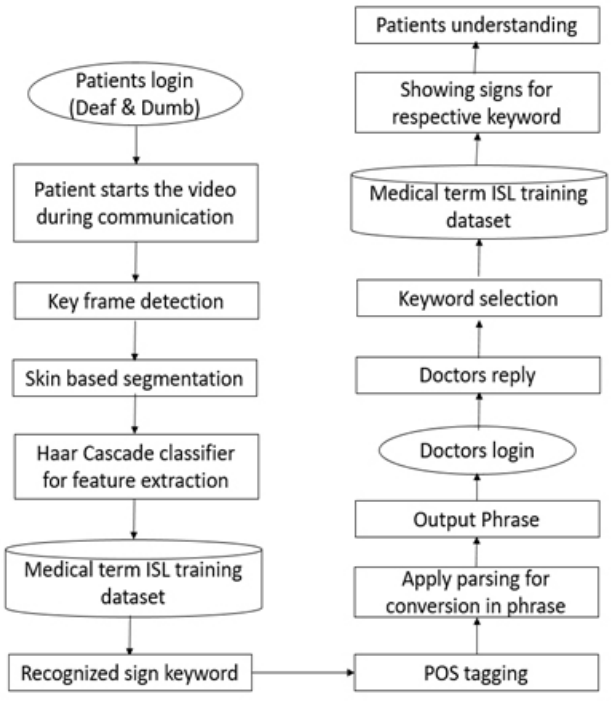
Now the question comes for the data set. Indian Sign Language Research & Training Centre (ISLRTC) has released ISL dictionary of 3000 words in March 2018. The second edition also released in February 2029. It includes

6000 words under the categories of academic, legal, medical, technical and everyday terms. So the overall dictionary includes approximately 500 medical terms which includes standard signs for basic medical terms which are needed to communicate medical problems. The examples of medical terms included in dictionary are listed below.

Table 1. Sample keywords in medical dictionary of ISL

Example of Medical terms in ISL			
headache	fever	cough	Cold
swallow	stomach	pain	itching
Crack	bones	vomit	loss
Blood	mouth	teeth	Joint
Nose	Eyes	Tongue	Hands
Blood	vein	Brain	Spinal cord
Memory	Skin	faint	Injection
Blood Pressure	Pulse	Heart rate	Thermometer
Oximeter	ventilator	Heart attack	cancer

Figure 2: System Flow Diagram



In addition to above many other terms including each body part are also there in ISL dictionary. The application needs the knowledge of both the corpus for translation. Spoken language like English corpus is easily available & the ISL corpus which is quite difficult. Medical term database is available online in terms of videos. So the overall system includes following steps to complete the conversation.

Implementation Details

Step 1: Patient & physician login to system
Step 2: Patient & physician needs to start video communication
Step 3: Application will capture the gesture of patient & apply sign recognition using feature extraction, key frame identification, gesture identification and assigning the sign keyword for that gesture by system training.
Step 4: Recognized sign keywords will be given as input to sign interpretation system which will apply POS tag on it and after applying parsing system will output phrase.
Step 5: Output will be understandable phrase for physician

The detail implementation of system is given in flowchart below. Flowchart shown in figure 2 represents the detail steps in system. The system mainly concentrates on understanding the problem of Deaf & Dumb. This will make consultation easy for physicians.

Table 2. Input keywords for recognized patient gesture and output phrase

Input identified keywords	Output phrase
Me fever	I am having fever / I have fever
Experience headache	I am experiencing headache
Pain toes	I have pain in toes
Me recover	I am recovered
Need rest	You need rest
Tell symptoms	Tell me the symptoms
How you now	How are you now?
Tell history	Tell me your history
What name	What is your name?
Where pain	Where do you experience pain

RESULTS AND DISCUSSION

The system helps to translate the sign language into spoken language to ease the communication between physician & Deaf & Dumb patient for remote consultation during pandemic situations. Sign language do not have the standard grammar & it has many limitations as compared to spoken language. Thus, we expect the results in following form considering selected sign keywords will be interpreted in the form of understandable meaningful phrase. Following table shows the input & system generated output sentences. Table 2 below shows some list of input keywords & system interpreted output. It helps physician to understand what patient wants to say & it also avoid the misinterpretation which is very important point of consideration in healthcare consultation.

CONCLUSION

Implemented system gives 85% accurate results. Accuracy is calculated by comparing output of system with actual human interpreter. The system proved to be helpful for physician & patient in emergency situation. Similar system can also be used for many other purpose like online or remote education for Deaf & Dumb. It will motivate them to share their thoughts & knowledge by recording their own video where it will

be automatically getting interpretation in English for others understanding.

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Role of Ethics in Information Technology During COVID-19 Pandemic: A Review

Sanay Jaju[1], Sunita Rawat[2] and Abhijeet R. Raipurkar[3]
[1,3]Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[2]Research Scholar, G. H. Raisoni College of Engineering, Nagpur, India

ABSTRACT

Ethical principle consists of ethics. Ethics plays an important role and have impact on individual and their lives. Whistle blowing is an important situation which has direct impact on ethics in IT. The problem raises moral queries and has social and economic implications. Organizations implement codes of ethics within their policies that highlight the moral responsibilities of users in the use of knowledge technology. Company's name can be shielded and increase worker engagement by making a work wherever moral conduct is that the norm. COVID-19 has incontestable the impotency of current technologies. The COVID-19 pandemic has raised a bunch of moral challenges; however key among these has been the chance that health care systems may have to be compelled to ration scarce essential care resources. World Health Organization (WHO) has established a global unit on Ethics and COVID-19 so as to develop recommendation on key moral queries that Member States have to be compelled to address.

KEY WORDS: ETHICS, INFORMATION TECHNOLOGY, CHALLENGES POSED BY COVID-19.

INTRODUCTION

In simple words, ethics can be said as a system of moral principles. It affects people's decision making and the way they lead their lives. It concerns with what is good and necessary for an individual and even a society and can also be described as moral philosophy. The term "Ethics" originates from the Greek word "ethos" meaning custom, character, habit or disposition.

It basically covers the following dilemmas:

- Way of living nice life
- The language of what is right and what is wrong.
- Moral decisions, i.e., what is good and bad.

The concept of ethics has basically been derived from various religions, different philosophies, and variety of cultures. These bring in to light the topics like human rights, abortion, and even professional conduct. It is also defined as the code of morals practiced by an individual or an institution. A simple example of ethics can be taken as the- code of conduct set by a business. The field of ethics (also known as moral philosophy involves the process of systematizing, defending, and recommendation of concepts on right and wrong behaviour. In today's world, philosophers usually divide theories of ethics into three general subjects as- metaethics, normative ethics, and applied ethics.

Role of Ethics in IT: With contingent workers (people who do contingent work, i.e., a type of job in which the person neither has an implicit nor explicit contracts for long-term employment), whistle-blowing is an important topic that is taken up in any discussion of ethics in IT [Alex Dubov & Steven Shoptaw]. Both, contingent work

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and whistle-blowing raise ethical questions and they have economic and social implications. The way in which these issues are taken up and addressed leaves a long-lasting impact not only on the individual and the employers involved, but also on the entire IT industry [2]. As previously noted, it is a way of attracting masses attention to an illegal, negligent, unethical, dangerous, and abusive act performed by an institution or any other company or organization. In some of the cases, whistle-blowers are those people or employees of an organization who send, sell, and reveal information about their organization in order to gain revenge for a perceived wrong. In most of the cases they act in an ethical way to correct what according to them is wrongdoing of the company, at times on a great personal risk.

Importance of Ethics in IT: Ethics in IT (Information Technology) is important as it creates a culture of responsibility, integrity, trust, and excellence in the sense of use of resources [Wang, C. J., C. Y. Ng, and R. H. Brook]. It promotes a sense of privacy, confidentiality of information and an unauthorized access to the computer networks, which helps prevent conflict and dishonesty. Many organizations put in affect codes of ethics into their policies which highlight the ethical responsibilities of the users in the way they use information technology. The codes of ethics help ensure resources of IT are used in an authorized way and only for authorized works. They also help prevent the share of privilege access, like passwords, among the users. This ensures prevention of malicious attacks in computer systems. It also promotes respectful use of IT by preventing users to deny others the access to computer networks. It helps prevent unauthorized copying, deletion or modification of personal information, such as files and emails. Ethical code of conduct prevents users from adding software which are malicious, i.e., infected by virus, into the computer systems. Also it makes users resist from misusing or vandalizing resources of IT.

Role of Ethics in Reducing Problem in Information Technology: In order to increase the trust of the stake holders of your organization and gain popularity among masses, you can create a workplace such that the norm followed is the organization's ethical conduct. Ethical risk can be reduced by implementing following key points: -

- Assessing your resources and needs honestly.
- Try to establish a powerful foundation.
- Create a culture of integrity from top to bottom in your workplace.
- Keep a "values focus" in moments big and small.
- Re-evaluate and revise if required.

Assessing your resources and needs honestly: Whenever you start a program, beginning with an accurate picture of the available strengths and the vulnerable areas makes a difference. Assessing your risks in the beginning is a good starting point in your internal efforts, which should be followed by gap analysis which should be continued by assessment of program. An essential piece can be audit reports. Information (resources) can be gathered in various ways. Opinions and experiences of masses can help provide deep rich, deep "snapshot" of the ethics in your institution. Surveys can be conducted by third party, which could provide an opportunity for gathering data from masses (or within the institute from the employees). This can give comparative results and the data can be analyzed by relevant people.

Try to establish powerful foundation: Once you have the list of your needs, resources can be put together to establish a robust ethics and compliance program. This program can be used as a powerful tool to reduce pressure so that the standards which were being compromised and misconduct which was being observed were reduced. Also retaliation amongst whistle-blowers would decrease. When a company commits resources towards ethics, a difference is seen- major of the employees feel depressurized so they don't break rules and lesser misdeeds take place.

Create culture of integrity from top to bottom in your workplace: People have a basic feeling of getting along with the company. They try to fit in and conform to the norms. It is not pleasant to admit, but most of the people's standards of ethics are malleable. Many might retain a desire to "do the right thing", but how right is defined gets influenced significantly by the organization they keep. Also culture matters a lot.

Keep "Value focus" in moments big and small: Ethics is about choices-big and small. Institutions having integrity have their "values focus" at the front in both monotonous and extra ordinary moments. Corporate values of an institution should come into action and should be reflected in the tasks of everyday life of the institution like:

- Human resource policies and its implementation.
- Rewarding mechanism.
- Hiring and retention.
- Management of performance of the employees and their evaluation.
- And finally taking decisions on promotion.

Re-evaluate and revise if required: Situations, parameters, and even needs will change. You should always know what's working out for you and what's not, what new susceptibility have emerged, what advancements you have made and where incomplete work is. Be regular and disciplined about revisiting the state of ethics and compliance in the institution. Assessments of risks, follow-up surveys, and on-going focus groups allow your program to be relevant and its risk is minimized.

Challenges posed by COVID-19 pandemic for IT: COVID-19 showed the non-usefulness of presently available technologies. Major of the cities around the world have applications of digital informational and smart technology. Some of the cities especially Global South cities don't have this kind of applications [Abusaada, H., Elshater]. These applications provide

the help for detection of pandemic and the infected individuals, also they help in stopping hazards that can be potentially be caused by the virus. Also regarding the Information Technology and Communications, the cities in Global South can't compare with Western and European countries [Abusaada, H., Elshater]. During the COVID-19 pandemic, the cities which were dependent on technology, have failed in coping with the losses the COVID-19 pandemic brought with it [Wang, C. J., C. Y. Ng, and R. H. Brook]. This was seen due to the less effectiveness of the cities when it comes to smart digital technology.

Hence, contextualization of broader constraints over planning and management in the urban should be considered like:

- Improvement in the disclosure and transparency of information or data.
- Making people think in a different way, stopping people from getting information and rather make them accustomed to collect and make information and also create new ideas.
- A smart city uses smart technology-based applications and it also observes the competences of its citizens against the technology. A smart city can be said as a city of communications, traffic, network, knowledge. Also they analyse the collected big-data through suitable, strong, wireless network (network of sensors) for every condition, which are ubiquitous, sheltered, and accessible to each and every citizen at no extra cost. Smart technology includes:
- The physical structures like buildings, electronics and electrical components, software and ITCs infrastructure, renewable source of energy.
- Connectivity of network like fibre optics to home, Wi-Fi in the complete city, NFC (Near Field Communications), Cyber-physical systems (CPS) and Bluetooth, IoT (Internet of Things).
- Biometric sensors should be used in healthcare and E-governance.
- Robust urban environments should be made to antagonize the environmental emergence, or political or economic conditions.

Role of Ethics in solving current pandemic challenges: The current pandemic situation caused by COVID-19 gave rise to many challenges related to ethics; key challenges being the possibility that there would be scarce critical care resources for the health care systems [Elgesem, D]. Policies for rationing during this pandemic vary from healthcare systems to organization to constitutions (jurisprudence). Some of the states presently have uniform or unvarying policies for healthcare whereas some don't have a single policy. Where there are policies, the primary considerations for a patient are that s/he should get benefits of treatment. In some places there is a disagreement on factors that are appropriate for considerations in the ethical sense. This is where real ethical challenges arise [Elgesem, D]. The challenge for the healthcare systems is that how can they handle the inflow of so many patients during the COVID-19 pandemic. Since COVID-19 has spread to majority countries of the world, bioethicists and physicians have been working with healthcare professionals in order to create new or revise existing policies in order to create a suitable criterion of decisions for allocations.

Working Group on Ethics and COVID-19: The World Health Organization (WHO) formed an international "Working Group on Ethics and COVID-19" for developing advice on the main ethical problems that are needed to be addressed by the Member States. This expert group was formed in February, 2020 in order to advise the WHO's technical units about the COVID-related work and the ethical aspects regarding to that work. From the formation of this expert group, the activities in which it has been engaged are

- To give advice on the ethical aspects on the research related to COVID-19.
- To provide a practical guidance on the ethical values' application focusing research based on COVID-19 as per the journal published," Public Health Ethics".
- A brief on the policies regarding the allocations and setting priority for the care related to COVID-19.
- In-order to facilitate the reviewing of protocols during the pandemic due to COVID-19 rapidly, emergency standard operating procedures is to be developed for the committees of human research.

Community of global ethics responded to COVID-19 by coming together and working on the implications of ethics during the pandemic of COVID-19 [Lenca M, Vayena E]. Also for strengthening of communications between groups, collaborations of different ethical groups and the collaboration of different groups, is done by Global Health Ethics team of the World Health Organization.

Role of Cyber laws for challenges in IT from country to country: The challenges faced by the information technology field vary from country to country depending on how their cyber laws are designed. A new cyber security initiative was introduced in China which said that it would not collect any data in an illegal sense. Now this law was passed in China in the year, 2020 whereas in many other countries they existed like from the start of their digital era. This tells us that anyone whose data was on Chinese servers; it was easily accessible to the Chinese government. This was possible only due to a difference in the cyber laws of that particular country.

The possible challenges which can be found in IT are: -

- Digital Data Threat – Since transactions are increasingly being done online, cybercriminals get a bigger enticement. There are various establishments who look forward to mine data, for instance, the information of a customer in order to create a treasured IP (Intellectual Property).
- Hacking – It is the act of probing into another system in an illegal or unauthorized manner in order to steal some confidential information or even destroy the same. This has grown drastically in the

past few years. Internet, in today's world, has made information for performing a hack available at our fingertips making it easier for the people, who don't have a bit of knowledge, to perform a hack.

- Supply Chain Interconnection – Increasingly, supply chains are getting interconnected. Various companies (or organizations or institutions) are influencing customers and vendors to connect with them into their networks, which in turn is making the firewall (or security wall) of that company weak.

CONCLUSION

We saw that ethics is apprehensive for what is best for an individual or a group of individuals (or society). It is also known as moral philosophy. It helps prevent the wrongdoings of people like whistle-blowers. It is an important part of an organization so that a culture of trust, integrity and responsibility can be observed. It dispirits the user from misusing any resource of ITC (Information Technology and Communication). We can reduce the ethical risks by assessing needs honestly, establishing a robust foundation, inculcating beliefs of integrity, keeping "values focus", and revising if needed. Smart technologies help to resolve challenges posed by COVID-19 pandemic. Due to global spread of COVID-19, physicians, bioethicists and other healthcare professional have come together to see to it that we get back to our normal life by reducing the extent of it. WHO's expert team," Working Group on Ethics and COVID-19" is putting in all its efforts too. We also explored the different types of challenges like hacking, phishing, data mining, that IT faces. In all we can say that the role of Ethics in Information Technology in this challenging period of the pandemic of COVID-19 is finding a great importance.

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Efficient Multi-label Classification using Attribute and Instance Selection

Shirish S. Sane, and Vaishali S. Tidake[2*]
[1]*Dept. of Computer Engineering, K. K. Wagh Institute of Engineering Education and Research, Nashik, India Savitribai Phule Pune University*
[2]*Research Scholar, Matoshri College of Engineering and Research Center, Nashik, India*
Dept. of Computer Engineering, MVPS's KBT College of Engineering, Nashik, India Savitribai Phule Pune University

ABSTRACT
Both attribute and instance selection is proven to be beneficial to reduce the computational complexity of classifiers while improving their accuracy. Instances in multi-label data are associated with multiple labels. Hence the process of attribute selection from multi-label data is different as compared to single-label classification. Either transformation or adaptation approaches are used by various researchers while performing attribute selection. In this paper, attribute selection and sampling are performed on the multi-label data. This pre-processed multi-label data is then fed to the proposed algorithms, namely MLFLD and its extension MLFLD-MAXP. An empirical evaluation is carried out to study the behaviour of proposed multi-label classifiers. The methods used in this work are defined as algorithms MLFS, MLIS, and MLFSIS. Comparing proposed algorithms with and without MLFS, MLIS, and MLFSIS has shown the effectiveness of using only sampling, or attribute selection followed by sampling on multi-label data. Attribute and instance selection together are noticed to be very useful for the performance enhancement of proposed algorithms over only attribute or instance selection.

KEY WORDS: MULTI-LABEL CLASSIFICATION, SAMPLING, ATTRIBUTE SELECTION, SAMPLE SIZE

INTRODUCTION

Many objects in the real world may reflect multiple semantic meanings. For instance, an old building may have importance from historical as well as architectural point of view. A video that describes the sorting algorithm is useful to study subjects like Data Structure as well as Design and Analysis of Algorithms. A drug may be useful for preparing medicine for multiple diseases. Thus in multi-label classification, an object is assigned a set of predefined class labels based on its characteristics.

Transformation and adaptation are two approaches used by many researchers for designing multi-label algorithms. The ensemble of the existing methods is the third approach for the same (Tsoumakas et al. 2009) (Zhang et al. 2014) (Tidake et al. 2018). BR (Wever et al., 2020), MLkNN (Zhang et al. 2007), and RAkEL (Tsoumakas et al. 2009) follow these approaches, respectively. Adaptation of k nearest neighbors is also used in the literature where feature similarity is used to find neighbors (Zhang et al. 2007) (Spyromitros et al. 2008). As multi-label data are associated with more than one label, dissimilarity of labels should be taken into account during the neighbour search. Based on this assumption, the proposed algorithm MLFLD (Tidake et al. 2019) is designed. Generally, it is

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*****Corresponding Author: tidake.vaishali@kbtcoe.org
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assumed in MLC that a set of labels has at least one element (Godbole et al. 2004). With this assumption, an instance is considered useless if it is not associated with any label. Otherwise, an instance is related to any number of labels.

The proposed algorithm MLFLD discussed in the previous section does not predict any label for some test instances. For such cases, the MLFLD algorithm is extended to avoid no label prediction cases. Extended algorithm MLFLD-MAXP (Tidake et al. 2020) predicts that label, which is the most probable, among all the labels in the label set. Feature selection is used in the literature effectively as it reduces the number of features. It is useful for raising the classifier performance as well as speed up the process. Sampling also helps to speed up the process of classification by reducing the size of the input dataset (Han et al. 2012). As per survey of existing literature, the effect of sampling on multi-label classifiers is not studied by researchers, while sampling is found to be used for preparing folds required for cross-validation. Section 2 contains a pseudo code and a brief description of the proposed algorithms. Section 4 lists concluding remarks based on the empirical evaluation described in section 3.

Proposed Methods: The proposed algorithm for Multi-Label classification by exploring Feature Similarity and Label Dissimilarity (MLFLD) aims to improve the performance of the multi-label classifier through proper selection of neighbors. It uses labels of known instances along with their features while searching for the neighbors. Then information extracted from obtained neighbors is utilized for the estimation of labelwise likelihood probabilities. These probabilities and computed prior probabilities of the particular label, are further used to predict that label for an unlabelled instance. The pseudo-code for MLFLD (Tidake et al. 2019) is shown in Algorithm 1 (Fig 1). MLDB denotes a multi-label dataset hereafter. Let size of MLDB is q.

Figure 1: Pseudo-code for the proposed methods

Algorithm 1: MLFLD
Input: MLDB, *k*, *Th*, *Fdist*, *Ldist*
Output: Label prediction for unseen instance *t*
1: **for** each instance $X_i \in$ MLDB ($1 \le i \le q$) **do**
2: - MLDB' = MLDB - X_i
3: - NN_i = Compute *k* nearest neighbours from MLDB' using *fs(Fdist)* and *ld(Ldist)*
4: **for** each label *c* ∈ MLDB **do**
5: - Compute PR(t_c=1) and PR(t_c=0)
6: **for** each label *c* in *j* neighbours from NN_i ($0 \le j \le k$), ($1 \le i \le q$) **do**
7: - Estimate PL(j|t_c=1) and PL(j|t_c=0)
8: **for** each instance $X_i \in$ MLDB ($1 \le i \le q$) and Instance *t* **do**
9: - NN_t = Compute *k* nearest neighbours using fs(Fdist)
10: **for** each label *c* ∈ MLDB **do**
11: - Predict t_c for an instance *t* using PR_c and PL_c

Algorithm 2: MLFLD-MAXP
Input: *MLDB*, *k*, *Th*, *Fdist*, *Ldist*
Output: Label prediction for unseen instance *t*
1-9: Prediction of labels for instance t using Algorithm MLFLD
10: **if** $\forall_{c=1...l}\ t_c = 0$ **then**
11: - Set t_x = 1 with maximum probability

Algorithm 3: MLFSIS
Input: MLDB, attribute selection criteria Θ, Sampling strategy α, sample size β
Output: MLDB'
1: **for** each label *c* **do**
2: - $Q_c = \pi F_{1...f} L_c$
3: - Apply attribute selection criteria Θ on Q_c to get QF_c.
4: $QF = \cup_{c=1...l} QF_c$
5: $QFI = \sigma_{\alpha, \beta} QF$

MLFLD estimates probabilities for all labels. For an instance under consideration, if probabilities of all labels are less than threshold (Th), then no label is associated with that instance. This scenario is handled by the proposed algorithm MLFLD-MAXP (MLFLD with MAXimum Probability), shown in Algorithm 2 (Fig 1). Attribute or instance selection is proved useful to reduce the dimension of a dataset in a different direction. It helps to reduce computational complexity as well as enhance the accuracy of the classifier. Either transformation or adaptation approaches are used by various researchers while performing attribute selection (Trohidis et al. 2008) (Newton et al. 2013) (Li et al. 2014).

Both these operations were used separately as well as combined on multi-label datasets to see the impact on multi-label classifiers. In this work, these operations are defined using algorithms MLFS, MLIS, and MLFSIS, respectively. Because of space limitation, only algorithm MLFSIS (Algorithm 3 in Fig 1) is given here, as algorithms MLFS and MLIS are subsets of algorithm MLFSIS. In this work, algorithm MLFS is defined using problem transformation followed by attribute selection to find attributes from MLDB to which each label was related. It was done for each label independently. Once attributes were selected, they all were combined along with all the labels to form MLDB'. Algorithm MLFS consists of lines 1-4 only from Algorithm 3. It takes input: (a) MLDB Qfxl with f features, l labels, and q instances, (b) attribute selection criteria θ and generates output MLDB QFgxl with g features (g ≤ f), l labels, and q instances.

Algorithm MLIS takes input: (a) MLDB Qfxl with f features, l labels, and q instances, (b) Sampling strategy α (with or without replacement) and (c) sample size β and generates output MLDB QIfxl with f features, l labels, and r instances (r ≤ q). Parameter β denotes the percent of instances to be retained in MLDB. Algorithm MLIS consists of line 5 only from Algorithm 3. It performs sampling. Algorithm MLFSIS takes input: MLDB Qfxl with f features, l labels and q instances, θ, α, β and generates output MLDB QFIgxl with g features (g ≤ f), l labels, and r instances (r ≤ q). As shown in algorithm 3 (Lines 1-5), MLFSIS performs attribute selection using problem transformation. Then on the obtained MLDB, sampling is performed.

RESULTS AND DISCUSSION

Experiments were performed using five benchmark multi-label datasets, namely, Emotions, Scene, Image, Yeast, and CAL500 available from the sources (Tsoumakas et al. 2009) (Zhang et al. 2007, 2014). These datasets consist of 6, 6, 5, 14, and 174 labels, respectively. Ten folds cross-validation was used throughout the experiments. Java program written using Mulan, Meka and Weka libraries (Read et al. 2012) (Hall et al. 2009) (Tsoumakas et al. 2011) was executed on Intel® Core™ i5-6200 CPU@2.30GHz.

The performance was evaluated based on eight example-based measures, namely hamming loss, ranking loss, coverage, one error, average precision, accuracy, F1, subset accuracy, and two label-based measures, namely macro and micro F1 (Tsoumakas et al. 2009) (Zhang et al. 2014) (Tidake et al. 2018). For the first four measures, a smaller value is expected, denoted by (↓), whereas for the remaining, a higher value is desired, denoted by (↑). As expected value for measures was different, it was difficult to compare the performance. Hence for each

measure, performance of five datasets was averaged and rank of each algorithm was obtained. An algorithm getting minimum average rank and maximum number of wins was considered better. Experiments were performed in three stages, as described below.

3.1 Effect of attribute selection: MLFS was run with threshold one to select attributes relevant to at least one class label by selection criteria. Among five datasets used for experiments, attributes of Image were found relevant to more number of class labels. When MLFS was executed with a threshold of 25%, it retained attributes selected for at least 25% labels. Similarly, results for 50 and 75 % were also obtained. When attributes related to at least 25% of labels were used, then no growth was seen in the performance of MLFLD-MAXP and MLFLD. Hence the remaining thresholds were not used. Only multi-label datasets obtained using threshold one were used further.

Table 3.1 Effect of attribute selection on MLFLD and MLFLD-MAXP performance

Metric		MLFLD	MAXP	MLFS + MLFLD	MLFS + MAXP
HamLoss	(↓)	0.155	0.156	0.156	0.157
RankLoss	(↓)	0.145	0.145	0.150	0.150
OneError	(↓)	0.220	0.220	0.223	0.223
Coverage	(↓)	27.97	27.97	27.92	27.92
AvgPrec	(↑)	0.753	0.753	0.750	0.750
Accuracy	(↑)	0.506	0.531	0.507	0.530
SubAcc	(↑)	0.327	0.348	0.332	0.350
Ex-F1	(↑)	0.577	0.604	0.578	0.603
Macro-F1	(↑)	0.685	0.696	0.686	0.697
Micro-F1	(↑)	0.676	0.613	0.674	0.611
ExecTime		60	58	36	36
Avg. Rank	2.4	1.7	2.7	2.5	
#Wins	5	5	1	3	

Initially, attribute selection using the MLFS algorithm was performed on multi-label datasets, and they were fed to the proposed algorithms. From Table 3.1, MLFLD-MAXP has functioned well among four experiments carried out using two proposed algorithms with and without MLFS. MLFS was not able to enhance the overall performance of the proposed algorithms.

3.2 Effect of instance selection: Algorithm MLIS was executed for sampling with replacement with 60-100 size. Generated datasets were supplied to the proposed algorithms. Table 3.2 has shown that MLFLD-MAXP has defeated MLFLD for the same sample size. When the proposed algorithms were used on datasets pre-processed with 70, 80, and 90 percent sampled instances, increasing progress was noticed over proposed algorithms. 60% was not seen to help for enhancement, but still better than that of contesting algorithm.

MLFLD-MAXP with 90% size has outshined with the smallest average rank 1.8, and 7 wins out of 10. It is followed by MLFLD with size 90, showing an average rank of 2.2 and 6 wins. For accuracy, subset accuracy, and ex-F1, MLFLD-MAXP has shown more progress compared to MLFLD after instance selection comparatively. For one error, coverage, average precision, and rank loss, MLFLD-MAXP, and MLFLD are observed to work similarly for the same size of datasets. For macro-F1, no result was obtained for a few datasets; hence it was challenging to compare. But for micro-F1 and hamming loss, MLFLD-MAXP worked well than MLFLD for the same size.

3.3 Effect of attribute and instance selection: As seen earlier, only attribute selection using MLFS has not proven useful for performance improvement in this work. Also, only instance selection with 70, 80, and 90 sample sizes have proven to perform better than sample size 60 when followed by MLFLD and MLFLD-MAXP. This section combines both using the MLFSIS algorithm.

Table 3.2. Effect of instance selection on MLFLD and MLFLD-MAXP performance

Metric	MLIS + MLFLD					MLIS + MAXP				
	60	70	80	90	100	60	70	80	90	100
HamLoss (↓)	0.155	0.150	0.148	0.144	0.155	0.157	0.152	0.149	0.145	0.156
RankLoss (↓)	0.142	0.134	0.130	0.125	0.145	0.142	0.134	0.130	0.125	0.145
OneError (↓)	0.215	0.209	0.206	0.197	0.220	0.215	0.209	0.206	0.197	0.220
Coverage (↓)	25.29	24.43	24.51	23.68	27.97	25.29	24.43	24.51	23.68	27.97
AvgPrec (↑)	0.756	0.763	0.770	0.776	0.753	0.756	0.763	0.770	0.776	0.753
Accuracy (↑)	0.498	0.512	0.523	0.541	0.506	0.530	0.544	0.555	0.567	0.531
SubAcc (↑)	0.311	0.330	0.345	0.352	0.327	0.339	0.357	0.372	0.375	0.348
Ex-F1 (↑)	0.571	0.584	0.594	0.612	0.577	0.605	0.616	0.627	0.640	0.604
Macro F1 (↑)	0.605	0.627	0.638	0.652	0.685	0.617	0.637	0.650	0.661	0.696
Micro F1 (↑)	0.671	0.687	0.694	0.707	0.676	0.612	0.626	0.636	0.647	0.613
Avg. Rank	8.1	5.8	4.5	2.2	7.6	7.5	4.8	3.6	1.8	7.1
#Wins	0	0	0	6	0	0	0	0	7	1

From Table 3.3, attribute and instance selection together were noticed to be very useful for upgrading the performance of proposed algorithms instead of separately. Also, MLFLD-MAXP has beaten MLFLD when compared with each other for the same sample sizes. Experiment with a 90% sample size revealed to be the most appropriate among all, followed by 80%. MLFLD-MAXP with 90% size got minimum average rank two and maximum wins 6.

3.4 Comparison with the state-of-the-art multi-label algorithm: In the previous three sections, the effect of applying attribute selection, instance selection, and attribute selection followed by instance selection to multi-label datasets were observed separately for the proposed algorithms. In this section, the performance of MLFS, MLIS, and MLFSIS, followed by MLkNN, MLFLD, and MLFLD-MAXP, is examined and compared with each other. From Table 3.4, MLIS and MLFSIS with sample sizes 70, 80, and 90 have shown the better performance of proposed algorithms. Size 80 showing average performance, and the average time was continued for further experiments. Datasets were fed to the MLIS algorithm with two parameters, namely sampling with replacement and sample size 80. Obtained datasets were used for experimentation. Experiments done using sampling with replacement were found to give better performance than without replacement. As observed from empirical evaluation, MLkNN is a strong contestant among the remaining algorithms. Hence only MLkNN was used for performance comparison. When the performance of MLkNN, MLFLD, and MLFLD-MAXP on the pre-processed multi-label datasets is compared, experimentation has shown that

Table 3.3 Effect of attribute and instance selection on MLFLD and MLFLD-MAXP performance

Metric	MLIS + MLFLD					MLIS + MAXP				
	60	70	80	90	100	60	70	80	90	100
HamLoss (↓)	0.154	0.151	0.149	0.146	0.155	0.153	0.152	0.150	0.147	0.156
RankLoss (↓)	0.139	0.138	0.132	0.128	0.145	0.139	0.138	0.132	0.128	0.145
OneError (↓)	0.208	0.207	0.201	0.202	0.220	0.208	0.207	0.201	0.202	0.220
Coverage (↓)	25.29	24.32	24.41	23.59	27.97	25.29	24.32	24.41	23.59	27.97
AvgPrec (↑)	0.761	0.763	0.771	0.774	0.753	0.761	0.763	0.771	0.774	0.753
Accuracy (↑)	0.509	0.515	0.530	0.538	0.506	0.542	0.545	0.554	0.561	0.531
SubAcc (↑)	0.326	0.332	0.347	0.348	0.327	0.352	0.357	0.367	0.368	0.348
Ex-F1 (↑)	0.581	0.588	0.601	0.611	0.577	0.616	0.619	0.628	0.635	0.604
Macro F1 (↑)	0.615	0.626	0.644	0.650	0.685	0.632	0.639	0.653	0.667	0.696
Micro F1 (↑)	0.678	0.686	0.694	0.702	0.676	0.623	0.629	0.636	0.644	0.613
Avg. Rank	7.8	5.9	4.4	2.9	8.1	6.4	4.8	3.3	2.0	7.4
#Wins	0	0	1	5	0	0	0	1	6	1

(a) For only attribute selection: MLFLD-MAXP ranked better than MLFLD, which in turn, ranked above MLkNN. MLFLD-MAXP performed better than MLFLD for accuracy, subset accuracy, ex-F1, and macro-F1. Both outperformed MLkNN. MLFLD achieved the same average hamming loss as that of MLkNN that was not seen in other experiments. The performance of MLFLD-MAXP is slightly lesser than both algorithms for hamming loss.

(b) For only instance selection: The pattern observed was different than all the remaining experiments. MLFLD was better for hamming loss compared to MLkNN. Both algorithms defeated MLkNN, except for coverage.

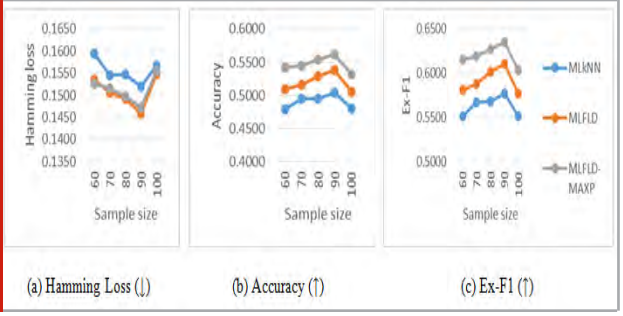
(c) For attribute selection followed by instance selection: Different sample sizes were used during execution like 60-100. Sizes 60 and 70 were suitable for some datasets only. 80 and 90 were always seen well on almost all datasets. Again, MLFLD-MAXP achieved a better average rank, whereas MLFLD stood second for average rank over MLkNN. Both proposed algorithms got the same number of wins. MLFLD-MAXP with MLIS has shown the same average rank as MLFLD with MLFSIS, the later showing more wins.

When all the experiments in the last three sections were examined, both MLFLD and MLFLD-MAXP were similar for one error, coverage, hamming and ranking loss. More enhancement was noticed in the accuracy, subset accuracy, ex-F1, macro, and micro-F1 compared to the remaining five measures. Overall performance rise due to attribute and instance selection together is maximum followed by an increase due to only instance selection, whereas performance rise due to only attribute selection is least among the three experiments.

Table 3.4. Performance comparison of MLFS, MLIS, and MLFSIS

Metric		MLFS			MLIS			MLFSIS		
		MLkNN	MLFLD	MAXP	MLkNN	MLFLD	MAXP	MLkNN	MLFLD	MAXP
HamLoss	(↓)	0.156	0.156	0.157	0.153	0.148	0.149	0.155	0.149	0.150
RankLoss	(↓)	0.152	0.150	0.150	0.141	0.130	0.130	0.139	0.132	0.132
OneError	(↓)	0.228	0.223	0.223	0.219	0.206	0.206	0.218	0.201	0.201
Coverage	(↓)	28.16	27.92	27.92	24.49	24.51	24.51	24.47	24.41	24.41
AvgPrec	(↑)	0.745	0.750	0.750	0.758	0.770	0.770	0.758	0.771	0.771
Accuracy	(↑)	0.485	0.507	0.530	0.499	0.523	0.555	0.496	0.530	0.554
SubAcc	(↑)	0.308	0.332	0.350	0.315	0.345	0.372	0.308	0.347	0.367
Ex-F1	(↑)	0.554	0.578	0.603	0.571	0.594	0.627	0.568	0.601	0.628
Macro F1	(↑)	0.501	0.686	0.697	0.532	0.638	0.650	0.527	0.644	0.653
Micro F1	(↑)	0.588	0.674	0.611	0.610	0.694	0.636	0.605	0.694	0.636
Avg. Rank		8.7	5.8	5.3	6.2	3.6	2.7	6.5	2.7	2.2
#Wins		0	0	1	0	2	3	0	4	4

Figure 2: Comparison of attribute and instance selection experiments for different sample sizes



CONCLUSION

The use of feature similarity and label dissimilarity has enhanced the performance of multi-label methods MLFLD and MLFLD-MAXP. The performance of MLFLD and MLFLD-MAXP on selected attributes and sampled data is studied. It is compared with the execution of algorithms on non-processed datasets. Attribute and instance selection are beneficial for upgrading proposed algorithms' performance over only attribute or instance selection. Also, MLFLD-MAXP has beaten MLFLD when compared with each other for the same sample sizes. Experiment with ninety percent sample size was revealed to be the most appropriate among all, followed by eighty. When all the experiments were examined, both MLFLD and MLFLD-MAXP were similar for one error, coverage, average precision, and ranking loss.

More enhancement was noticed in the accuracy, subset accuracy, ex-F1, macro, and micro-F1 compared to the remaining five measures. Performance rise due to attribute and instance selection is maximum, followed by an increase due to only instance selection, whereas performance rise due to only attribute selection is least among the three experiments. When the same pre-processed data was used in further investigations for comparison, MLFLD-MAXP achieved the first average rank with maximum wins, whereas MLFLD stood second over MLkNN. It will be interesting to modify the attribute selection method used and the use of a smaller sample size to study proposed algorithms' behaviour.

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Challenges and Innovations in Cybersecurity

Simran Baheti[1*], Nikhil Tiwari[2], Rushil Parikh[3], Paritosh Dandekar[4], Rajat Chandak[5] and Abhijeet R. Raipurkar[6*]

[1, 2, 3, 4, 5, 6]*Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

The World Wide Web or the internet today is a vast space. It contains information about everything one wants and is accessible at the tip of the finger. Billions of people use the internet every day and most of them at the same time. When we think about the activities taking place on the web, we are bound to think about all the crimes that happen throughout the web. People are exposed to crimes like identity theft, crypto-jacking, cyber extortion, etc. Therefore, their security becomes a serious question and the topmost priority of the creators. Here comes the need for cybersecurity. This paper focuses mainly on the threats faced and the innovations in technology to encounter those threats.

KEY WORDS: CYBERSECURITY, CYBERCRIME, CLOUD SECURITY, AI AND ML, BLOCKCHAIN.

INTRODUCTION

In the age of analytics and intelligence, nearly 5 billion people and 31 billion devices have access to the internet. The digital world has seen a drastic expansion in the recent time of COVID-19. From MNCs to governments, schools to universities all are functioning online. Almost all organizations use the internet to transfer data and cloud services to store it. This increases the concern of several organizations toward the protection of data and communication. Cybersecurity helps in the protection of this sensitive information and the system used to store the information. With the sudden increase in cybercrimes and cyber-attacks, companies and research organizations are embracing technologies and innovations to tackle them.

There are existing technologies for cybersecurity although due to the variations in cyber-attacks, the organizations need better technology for early detection of the attacks. The advancements in technology that we are seeing are blisteringly fast as compared to the past, which increases the number of cyberattacks with new challenging threats. With every passing year, thousands of new threats are created which are getting more and more dynamic which results in hazardous and challenging threats to the organizations. The pandemic has brought a workplace shift to work from home which has resulted in more cyberattacks. Nowadays cybersecurity is not only about protecting the system from known attacks but also preventing the system from new threats. Everyday threat actors are conceiving new strategies for attacks, this evokes the need for innovation in security measures for the integrity of data.

Cybersecurity; For any individual or an organization, the most important concern while working online is the safety of their data. Cybercriminals work with the exact opposite motif to hack into a system for financial gains or simply to create chaos. Here comes the need for cybersecurity to stop such people from achieving their goals. Cybersecurity is the practice of defending an electronic device from any kind of an external, malicious attack that breaches the safety software and can cause harm to the system or the person at whom the attack is aimed. Various security

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measures include protecting networks, applications, information, operations, disaster-related and business continuity and end-user education.

- Currently, over 98% of corporations have cybersecurity resources and over 50% of those are allotted for online privacy in Malaysia itself.
- It was predicted in 2017 that nearly 50% of the company's budget will go into cybersecurity by 2020
- The cost of a post-data breach is around 1.56 Million USD in the USA.
- Therefore, cybersecurity should be the topmost priority of every individual and organization.

Cybercrime or Computer Oriented Crime: Cybercrime is done by individuals who aim to get recognized or to spread fear. It is a type of crime that uses a computer as a source or target or both, meaning that cybercrime can be carried out through a computer, carried out on a computer, or both. These attacks are tough to identify but when identified, the punishments are extreme.

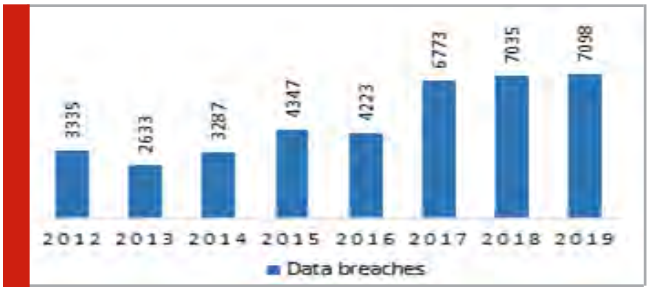
Different types of computer-oriented crimes include:

1. Cybercrime: - Aimed at an individual or an organization.
2. Cyberattack: - Crime with a political motive.
3. Cyber Terrorism: - Conducting violent acts resulting in damage, loss of life, or any kind of bodily harm.

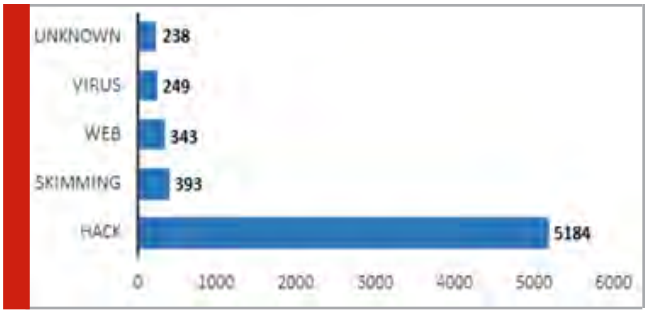
Email and internet fraud, Identity fraud/theft, Cyber Extortion (demanding money to stop the threatened attack), Cryptojacking (when hackers mine cryptocurrency using resources that they do not have any right on) are some common types of cybercrime.

Some statistics related to data breaches:

- In 2019, over 15.1 billion records were compromised with 7098 breaches reported.
- The chart below shows a comparison between data breaches in different years.



- The web itself contributed to 13.5 billion records while 1.5 billion records were hacked.
- In 2019 alone the % increase in records exposed was 284% as compared to 2018 and 91% as compared to 2017.
- The number of breaches per economic sector is topped by the Information Technology industry by 614. It is closely followed by the Healthcare industry at 512. Finance and Insurance come third at 435.
- The below chart shows breaches by breach type in 2019



Emerging Threats:

Cloud Vulnerabilities: Cloud computing is a way to offer storage services over the internet. The shortage of physical storage has led us to seek storage in virtual cloud domains thus cloud services are rapidly taking over the traditional physical storage. Many organizations find public cloud services to be safer than on-site data centres. With the COVID-19 pandemic on hand, the use of cloud-based services has seen an unprecedented demand. Due to this surge, it has led to the development of a hybrid cloud structure where enterprises combine their private cloud service with the public cloud service. This increased complexity in the cloud structure has made it prone to cyber-attacks.

Cloud security has been a major concern for a long time. Data breaches and leaks in the cloud have cost billions of dollars to the economy. They can lead to some sensitive data such as personal, financial, or health records in the wrong hands. Public cloud being used by millions of users has given attackers a sea of victims. Ransomware injection to one of the victim's local computers may get uploaded into the cloud thus corrupting the whole cloud. A major issue is the lack of awareness in the organizations regarding cloud security which may lead to a leak of credentials, system vulnerability, third-party misuse, distributed denial of service attacks, insider threats, etc.

The AI-based cyber attacks: Artificial intelligence (AI) has been there for more than a decade and there's still a ton of potential yet to be explored in this field. AI has been brought to use at numerous good places from traffic signals to cancer detection. But that unexplored potential is also being used for malicious purposes. There are various ways in which artificially intelligent cyber-attacks are helping attackers creating chaos. AI can help cybercriminals in blending their malware into the computer system and thus making detection harder which will lead to the creation of enhanced and intelligent malware. They can use AI to find their victims from social media or other platforms.

Cybercriminals can use machine learning to bypass CAPTCHA and can also create very convincing spam messages. IBM's Deeplocker is one of the examples where AI is being used to conceal in an unsuspicious application until it reaches a specific target. AI can be used to detect and exploit vulnerabilities before they are fixed in a patch. AI botnets scan the target systems for vulnerabilities and then inject the malware which steals data and remains undetected until the target has been attacked. Data poisoning is also an emerging threat and could cause significant damage to many organizations and businesses using AI systems. This happens when the data fed to machine learning or deep learning algorithms is corrupted thus misleading the algorithm. Though AI-based attacks have not made the news yet, they sure are a big threat if not looked after.

Deepfake: Deepfake is an emerging threat that could change our social life drastically. It is used to create fake still images, audio and videos that look and sound real. It uses Generative Adversarial Networks (GANs), which is widely available and could facilitate social engineering attacks. A user doesn't require any special skills to use deepfake. Also, free and paid software are available online that create deepfake content. This could be used for political agenda, blackmailing, defamation and frauds against politicians, celebrities, even the general public can be targeted. A rising concern is that the advancement in AI technologies is resulting in more and more undistinguishable fake content. Another potential threat deepfake could possess is deepfake ransomware. A threat actor could create deepfake videos and demand a ransom which failing to pay will lead to making the video public.

Smart Contract Hacking: Blockchain is an innovative technology that uses the concept of distributive and decentralized ledger. It helps in digitalization of the information being recorded and distributed but not edited. Though Blockchain is considered almost impossible to hack, the same cannot be said about smart contracts. A smart contract is nothing but a block of code as a part of a blockchain that defines a set of rules agreed by both the parties and are executed if both the parties follow these rules. If anyone of the parties fails to meet the defined rules, the output is not generated. This line of codes helps in automating the verification and enforcing of the agreement between both the parties. The concept of a smart contract is very new and thus it makes it very lucrative for cybercriminals to exploit bugs and vulnerabilities. These hacks can be converted into money very rapidly and there is no one to give a halt to these hacks. So, this field of the smart contract still requires research in its security and quality.

Fake news: Fake news has been a severe problem for a long time now since the advent of social media and has alarming concerns. The recent coronavirus pandemic has only exacerbated the situation. As people are becoming more dependent on social media for news, it is becoming more and more difficult to differentiate authenticated news from the fake ones. This makes it quite easy for agenda peddlers to spread misinformation about a political party and influence people's opinion in the wrong direction. This brainwashing may instigate violence or create differences among groups. Controlling fake news, hate speech and misinformation has become an obstacle for regulatory agencies.

Innovations in Cyber Security:

Cloud Security: Cloud Computing has become a necessity of every organization irrespective of its size. Cloud Security also known as Cloud Computing Security which involves some policies and technology which helps in securing the cloud computing data, environment and infrastructure from theft, deletion, alter and leakage. Predictive security in the cloud collects and examines the customer's data with the help of Machine Learning algorithms and AI which studies the pattern and determines the probability of future outcomes. Distributed Cloud provides more secure operations on the cloud. It is the distribution of cloud services to different geographical locations and each cloud service is autonomous in its governance, evolution and updates. Cloud services like Microsoft Azure, Amazon Web Services (AWS) and IBM Cloud are adopting Blockchain-as-a-Service (BaaS) which is the third-party cloud-based infrastructure for creating, maintaining and configuring cloud-based apps.

User Behaviour Analytics: User Behaviour Analytics is a process of tracking and assessing user data and then looking at the pattern of user's behaviour. It uses Big Data and Machine Learning algorithms to detect these abnormalities and when there is a deviation from a particular pattern then it might be a real threat to the organization. By using this on a large scale, organizations can find malignant movement and traded off endpoints. User Behaviour Analytics doesn't report all abnormalities as baleful, if it contains less sensitive data then it is given less impact score and if it contains risky information then it is given a high impact score. So that the predictions can be prioritized according to impact score. In this way, the organization can reach the illegitimate source before it can reach the organization.

Next Generation Breach Detection: From a security perspective, data breach is one of the critical problems in the past couple of decades in various industries. With an increase in cases of data breaches, companies need to have better detection systems for early detection and alerts. This problem is solved by next-generation Intrusion Detection Systems (IDS). In earlier times, signature-based IDS were used, they were only capable of

responding to breach once the has occurred. Signature-based IDS uses raw data and manual investigation. Whereas in current times, companies use next-generation breach detection systems like Legacy IDS technology. In this technology, activity or policy violations on a network is monitored by a device or software application. Unlike previous IDS, next-generation IDS uses intelligent data and Machine Learning features to implement full Network Traffic Analysis (NTA). A Security Information and Event Management (SIEM) system collects any malicious activity or security violation. SIEM generates alerts regarding malicious activity or security violation by combining all the inputs from all the security sources. Hence, next-generation breach detection systems will be helpful for early alerts and prevention of firms.

Virtual Dispersive Network (VDN): Virtual Dispersive Network (VDN) is a technology invented by Robert Twitchell Jr. and introduced by Dispersive Networks Inc. In this COVID-19 time, most of the companies are working on the public network rather than the private. This increases the chances of cyberattacks on any company as in any standard network the data sent from one device to another device using a single route or path. This single route data transmission increases the chances of Man-in-the-Middle (MitM) attack. The MitM attack is one of the major threats for several firms whose three-quarters of the employees are working from home. VDN is the technology that provides one of the finest solutions to this threat by protecting the network from MitM attacks. VDN takes the data from a sender, separates it into multiple smaller packets or pieces and adds encryption data to each packet. The encryption varies for each packet and depends on the transmission route of the packet. VDN compels those packets to take independent routes to the receiver. When data packets reach the receiver side, they are authenticated and then reassembled for use. If there is any MitM attack between transfers, the hacker will only access single packet of original data and that will be useless and unproductive for a hacker. VDN is a centenary software solution that can be installed on any firm's existing network.

Quantum Computing: Irrespective of any industry from Health to IT, all organizations focus on security of their digital data by encrypting them. Every encryption nowadays is done using the traditional Public Key Infrastructure (PKI) system. This PKI system can easily be deciphered using quantum machines in hours, certain minutes or even instantly while it takes several years to decrypt using classic machines. In this changing world, if this machine comes into the hands of cybercriminals, it might be a threat to the world. To overcome this threat, many companies and research institutions are working on the development of a new encryption system called "Quantum safe" which is based on quantum concepts. This encryption is done using Quantum Key Distribution (QKD). Rather than using hard mathematics, QKD uses quantum physics to build keys. QKD distributes and shares secret keys between the communicating parties. This is important for ensuring that their communication remains private and it is also necessary for cryptographic protocols.

CONCLUSION

Cyber threats are a global issue that needs to be given higher priority in any organization. With the rise in cyber threats, there has also been an emergence of new technologies to counter the threats. Cybersecurity should be practiced not only by organizations but also by every individual. Everyone needs to understand the prevailing threats and learn how to defend themselves from threats. The pandemic has opened a gate for a new era of cybersecurity as it has provided opportunities and also added more responsibilities to IT security professionals. They can enhance their existing technology and protect their data and system in which the data is stored from upcoming heightened cyber-attacks. It is high time that cybersecurity professionals look down the kaleidoscope of time and focus on developing more secure cyberspace. Cyber threats are incessant, so we need our cybersecurity techniques to be continuously evolving. Last but not least, the question isn't whether cyberattacks will happen or not, but how organizations can respond and recover faster when it happens.

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Automatic Number Plate Recognition (ANPR) With E-challan using Super Resolution Algorithm

Prof Supriya Thombre[1*], Rakshanda Tarekar[2], Sakshi Ramgirwar[3], Shivani Zulkanthiwar[4] and Shubhra Dubey[5]

[1]Assistant Professor, Dept. of Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India

[2,3,4,5]Students, Dept. of Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India

ABSTRACT

Number Plate Recognition is most efficient and intelligent system to find the location of the number plate by analyzing image/video data for automatic number plate recognition system (ANPR). Images /videos are captured by a camera placed at every intersection of the road. For identification, the super-resolution techniques are to be applied to the image so that the license plate will get easily identified with the help of OCR technique. The nature and texture of an image should be maintained during the super-resolution of an image. After getting vehicle number it will initiate the activity to generate challan and send the email to the vehicle owner.

KEY WORDS: AUTOMATIC NUMBER PLATE RECOGNITION, ANPR, E-CHALLAN, SUPER RESOLUTION, LICENSE PLATE DETECTION, RULE VIOLATION DETECTION.

INTRODUCTION

Nowadays, every city is converting into a smart city and people's demand for cars is growing and so are the problems, such as parking lot management, traffic rules violation, etc. The percentage of accidents are increasing now-a-days due to increasing vehicles on road and breaking the traffic rules by many vehicles. For reducing the traffic accidents and to avoid traffic violations for ensuring the safety the images from the installed cameras have been captured. In our country, we have fewer traffic cops and laws associated with traffic regulation are not as strict as in other countries. Sometimes, the rule violators are left unseen by the traffic police due to lack of concentration or they are not able to catch them due to which no challan is generated against them. We can solve this problem with the help of the Number Plate Recognition System by using the captured image.

Literature Survey: M. Chaitanya Sai, Deepesh Chandwani, and Saravana Bhava proposed a method that uses the Otsu Thresholding scheme. The image was firstly segmented by the proposed methodology and double binarized for object detection and license plate detection. The blurred or noisy image has been used during the implementation and the multi-object detection is used for license plate detection. The implementation has carried out using multiple stages like the acquisition of an image, gray processing, binarization of an image, recognition of number plate, and OCR is used for template matching. For checking the performance of an algorithm, the authors have used various real-time test images for extracting the number plates from an inputted image. The IoT can be used along with the proposed approach for enhancing the tracking systems [M Chaitanya Sai, 2019].

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*****Corresponding Author: supriyathombre@gmail.com

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The two approaches have been used by an Automated License Plate Recognition (ALPR) for performing license plate detection (LPD) and perform license plate recognition (LPR). The LPD uses character segmentation and optical character recognition (OCR) for identifying vehicle location and license plate detection. As an alternative of using a general object detector method like Faster-RCNN or SSD300, the authors have used segmentation free OCR evaluation approach for developing a precise system for detecting license plates. The detection in the feature map pyramid is performed by object detectors for detecting objects at different scales. As the deep network needs multiple samples, the new data augmentation technique has been developed which has the potential to train and evaluate [Jaskirat Singh, 2019].

The authors have identified the problems during image capturing. The vehicle license plate detection from an image is itself a complex problem as the image is captured can contain noise. For considering complex scenarios, the application demands robust and generalized license plate detection techniques. The new technique has been proposed by the authors which mainly focuses on the problems such as variations in illumination and color pattern of an image. They have used a static camera for capturing an image. The proposed method can be used for the detection of license plates in each frame of a video sequence, detecting license plates partially and the detection of license plates using moving cameras and vehicles. For object detection, region proposal (RCNN) with convolutional neural networks and its inheritors (Fast-RCNN and Faster-RCNN), and the exemplar-SVM have been used [R Naren Babu, 2019] [Haixiang Li, Ran Yang, 2018].

Yogiraj Kulkarni, Shubhangi Bodhke, et.el considers moving object for license plate detection. The proposed method uses a neural network with an improved Optical Character Recognition (OCR). This method uses K-Nearest Neighbors (KNN) for classifying the features retrieved from region properties in an image. This system uses a decision tree classifier with Ada-Boost for detecting a partial and complete helmet. For achieving accuracy, they have also used CNN for classification of the pre-trained model. For subtracting the background from a video for getting moving objects, various features of computer vision have been used like Hough transform, LBP, HOG, SIFT, etc. For identifying geometric shapes like circles, ellipses in an image Hough transform is used. The distribution of edge directions or intensity gradients is used for describing the shape and its appearance of a local object within an image. For describing the local texture structure and for capturing key-points in an image the LBP and SIFT have been used respectively. The author gets an accuracy of 98.72% for traffic videos which was earlier as 96.36% using Tesseract OCR on the test images [Yogiraj Kulkarni, 2018].

Praveen and Arihant have significantly shown the usage of deep learning techniques for simplifying the process of ALPR which also allows the inclusion of all the abnormal features present in the license plates. The proposed method uses a recursive training method for the character segmentation network and for detecting the license plate. The same data have been used for training the YOLO framework. This network has proven for fast object detection in a real-time scenario [Praveen Ravirathinam 2020]. A recursively region-growing procedure with some heuristic approach is used by Region Growing Algorithm (RGA). This also focuses on the symbols present on the license plate. The background of the license plate consists of region dimensions, and position, width, and height (aspect ratio), and color and typestyle size. The proposed algorithm is used for identifying the Region of Interest (ROI). This algorithm has been tested on 350 images containing light and heavy vehicles [Sarthak Babbar, 2018].

The license plate recognition (LPR) algorithm is based on license plate region extraction, plate character segmentation, and each character recognition. Image acquisition is a very challenging task due to a variety of number plates formats and the non-uniform lighting conditions. Taking this into consideration many approaches works for limited conditions such as vehicle speed limit, fixed lightning, selected routes, and stationary backgrounds. Immobile images or video sequences have been used in various techniques developed for LPR. The authors have carried out the work categorizing and assessing them by considering the time required for processing, the computational power, and recognition rate [Aishwarya Menon, 2018].

Proposed Methodology

A) Overview: Automatic Number Plate Recognition (ANPR) is a system which itself a capable for license plate detection without human intervention. It uses an image captured with supporting illumination.

Figure 1: Architecture of ANPR with E-challan

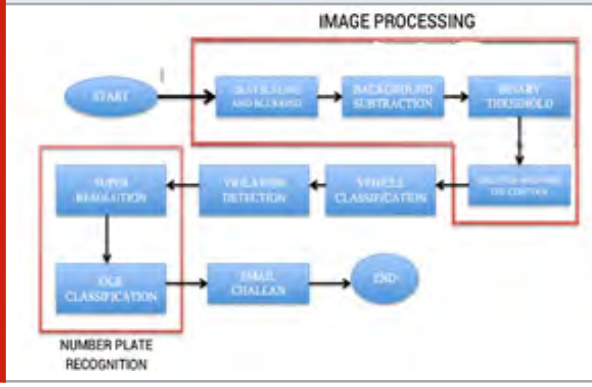


Figure 1 shows the flowchart of the process. When an image is considered for license plate detection it undergoes four factors, such as gray scaling and blurring, background subtraction, binary threshold, dilution, and find the contour. After which the vehicle classification and detection is done where the rule violating vehicles are classified. For Number plate recognition, Super-resolution and OCR classification is used. Once the license plate is detected for a particular vehicle, an

email is generated and sent using the SMTP service to the registered email-id.

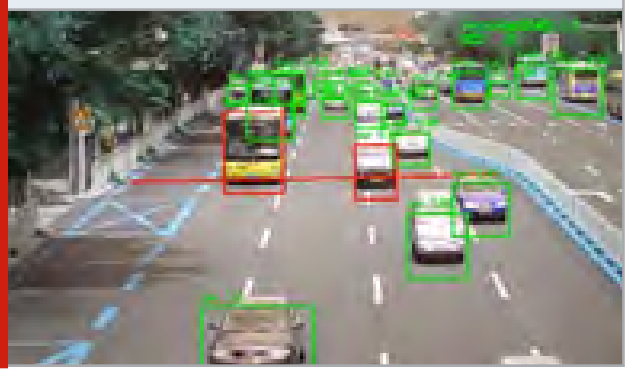
B) Image processing

1. **Grayscaling and Blurring:** As the part of preprocessing the input frame got from the CCTV footage, the image is grayscaled and blurred with the Gaussian Blur method.
2. **Background Subtraction:** The background subtraction method is used to subtract the current frame from the reference frame to get the desired object's area. The equation shows the method. dst(I) = saturate(|scr1(I) – scr2(I)|)
3. **Binary Threshold:** The binarization method is used to remove all the holes and noises from the frame and get the desired object area accurately.
4. **Dilation and find the contour:** After getting the thresholded image, it is dilated to fill the holes, and the contour is found from the image and it is denoted by the rectangle box.

C) Vehicle classification: From the preprocessed, image moving objects are extracted. A vehicle classification model, Mask RCNN is used to classify those moving objects into three class - Car, Motobike, and Non-vehicle. For solving segmentation problems in computer vision, Mask RCNN- a deep neural network can be used. The classifier model is built with MobileNet v1 Neural Network Architecture. In figure 2, the green squares are the bounding boxes.

D) Violation Detection: This is performed with the help of the comparison algorithm. With the help of Mask RCNN, the vehicle classification and a threshold line are made at the signal or parking lots. Whichever car crosses the line will be considered as the rule violator i.e. in figure 2, the red line indicates the threshold line, and the vehicles in red boxes are the ones who broke the signal.

Figure 2: Vehicle Classification and Violation Detection



E) Number plate recognition: The number plate recognition consists of the following steps:

1. Super-Resolution: Super resolution uses a combination of a low-resolution sequence of images of a scene for generating a high-resolution image. The high-resolution image can be reconstructed from the low-resolution images.

The Fast-Super-Resolution Convolutional Neural Network (FSRCNN) approach for super-resolution has been used. This approach has mainly 5 steps:

a. Feature Extraction: Adopts the original low-resolution image as input.
b. Shrinking
c. Mapping
d. Expanding
e. De-convolution: Gives the higher resolution image.

The proposed approach will generate a high-resolution image in a lesser time than the existing methods. This method can also be implemented in the real-time images.

2. Optical Character Recognition (OCR): It is a process in which an electronic device is used for checking the characters, shapes by detecting the color pattern present on the paper and translate it into machine-encoded text. This is generally used for converting the text image into a text. While generating a high-resolution image from its corresponding low-resolution image it may produce multiple errors due to a lack of high-frequency image details in low-resolution text images which may lead to incorrect information retrieval. For achieving the higher OCR accuracy, the super-resolution preprocessing on inputted text images should be carried out.

F) Email Challan: The challan will be generated based on violations by vehicles and an e-challan will be sent via email to the violator using SMTP service. To achieve this the Simple Mail Transfer Protocol (SMTP) Server can be used. By using this SMTP, the system can easily send or receive emails. It acts as a relay between the sender and receiver of the email.

Applications

1. Traffic controlling - This system can be used for controlling the traffic especially in those areas where chances of crimes are more.
2. Parking control – This will help in no parking areas, where sometimes people park their vehicles causing issues like traffic jams.
3. Paperwork reduction - This system is directly sending an e-challan on the registered mobile number as well as on the registered email address. So, the paperwork can be saved.

CONCLUSION

It has been observed that the images captured from the web cameras installed at every traffic signal provide the blurred and noisy image with poor quality due to the distance and the climate conditions. The proposed method improves the quality of an image using image super-resolution techniques and will also detect the license plate of the vehicle. The rule violator can be easily detected, and the e-challan will be sent on his registered phone no as well as on the email address.

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Review on Estimation of Road Quality using Mobile Sensors & Machine Learning Techniques

Trupti K Dange[1*], K.H.Walse[2] and V.M.Thakare[3]
[1]*Assistant Professor,Department of Computer Engineering, RMD Sinhgad School of Engineering,Pune,M.S,India*
[2]*Professor & Head, Department of Computer Engineering, Anuradha Engineering College, Chikhli,Buldhana, M.S, India*
[3]*Professor & Head, P.G Department of Computer Science,Sant Gadge Baba Amravati University, Amravati, M.S.,India*

ABSTRACT

Machine learning techniques have become an integral part of realizing smart transportation Machine learning learns the latent patterns of historical data to model the behaviour of a system and to respond accordingly in order to automate the analytical model building. Using AI based Machine Learning Algorithms can detect the road anomalies, analyse them, share this information to the users while driving and also repair them by sending the relevant information to the road maintenance authorities. The availability of increased computational power and collection of the massive amount of data have redefined the value of the machine learning-based approaches for addressing the emerging demands and needs in transportation systems. The overall objective of this work is to develop an efficient machine learning techniques for mobile sensor data. As road maintenance is costly and authorities cannot go on each and every road network, such applications will be useful to provide the data to the higher authorities so that they can take the valuable actions towards it.Machine learning for sensors and signal data is becoming easier than ever: hardware is becoming smaller and sensors are getting cheaper. The paper presents brief information about the smart phone sensors and techniques used in Machine Learning how they are used for the road anomaly detection and the work done up till now in that domain

KEY WORDS: ROAD MONITORING, ACCELEROMETER, GYROSCOPE, MACHINE LEARNING, ANDROID

INTRODUCTION

Road network is the key transport infrastructure for any country. They are paramount for country's economic growth and development and social benefits. According to statistics US has the world's largest road network size followed by India on 2nd rank and China on 3rd rank. But as the road network size is increasing in the developing countries than the developed countries road safety is also crucial. According to the WHO (World Health Organization) of 2020 approximately 1.35 million people die each year due to road crashes with highest death rate in the African region. Poor road infrastructure, distracted driving, pothole, uneven roads, etc. are also responsible for the death rates. These problems cannot get resolved by just adding a greater number of roads as the vehicle production and sales are increasing day-by-day.Above addressed road safety measures can get improved using the new technologies. As this is the digital era, technology makes crucial contribution to the society. Past few decades have given so many solutions to the transportation domain to increase its efficiency and effectiveness.

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*****Corresponding Author: trupti.dange@gmail.com
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Technologies that provided tremendous roles areMachine Learning (ML) Algorithm and IoT (Internet of Things) that provided various ways to overcome the problems of the transportation domain. The data that is collected for these technologies are mostly the Mobile sensors data collected continuously for analysis or the sensors designed to be used externally with the vehicles.

2. Data Sensing using Smartphone Sensors: In today's world, technology has made a drastic change to the society that has changed the standard of living of humans. Smartphone is one of the biggest examples of technology. Each and every human now days are able to get the smartphones at affordable rates. Using smartphones, we are able to collect a lot of data either related to person's lifestyle, surroundings or location. These smartphones play an important role for collecting the data related to the transportation that does help to resolve the issues faced by the transportation systems. This data is collected using the in-built sensors of the smartphones. As discussed in the previous sections, the road safety conditions problems can get resolved using the smartphone sensors. We can detect the potholes, bumps, uneven roads, etc. using these sensors.

To detect this problem, we have to continuously acquire the data from the smartphone sensors so that enough data can be processed to obtain the better results. Sensors that are used to acquire the data are accelerometer, gyroscope, magnetometer, GPS etc.To use these sensors the vehicle directions and smartphone directions must be same. That is, the smartphone should be mounted properly while driving the vehicle. If the smartphone is kept stable inside the vehicle it may lead to incorrect data collection. In AzzaAlloch,2017[Ravi Bhoraskar ,2012] [Aniket Kulkarni,2014][Gaurav Singal ,2018][Yun-chin Tai l ,2010][Arun Kumar ,2017] the smartphone and vehicle axes are made fixed so that the correct data should get obtained.

2.1Accelerometer: Accelerometer is an electromechanical device used for measuring acceleration forces. This sensor is used to sense the movement or vibration. It is the measurement of change of velocity or speed divided by time. In [AzzaAlloch,2017][Ravi Bhoraskar ,2012] [Aniket Kulkarni,2014][Gaurav Singal ,2018][Yun-chin Tai l ,2010][Arun Kumar ,2017] this sensor of smartphone (3-axes) is used to get the change in the driving speed of the vehicle. Using this sensor data, we can find out that whether the vehicle is driving on the smooth road surface or any bump, pothole or speed breaker has occurred on the road surface. The smartphone accelerometers are dynamic accelerometer which measures gravitational force also. This can be removed from the collected data by using many techniques.

2.2Gyroscope: Gyroscope is the sensor which is used to maintain a reference direction or provide a stability in navigation. The gyroscope in smartphone is used to check the orientation of the smartphone inside the vehicle. The orientation of smartphone can change the accelerometer data which may lead to wrong prediction for the road condition [AzzaAlloch,2017][Aniket Kulkarni,2014]. If the smartphone in the vehicle is not mounted properly there are many mathematical calculations that can be used to change the unstable smartphone directions data into stable direction data.which has been shown in Table 1

2.3GPS: GPS is a radio navigation system. It is used to find the longitude and latitude of a device if the device has a GPS tracker active on the smartphone. The GPS system plays an important role while detecting the location of the unwanted activity while driving a vehicle. While driving if it is detected that the accelerometer and gyroscope captured some unwanted activity while driving, then using GPS system of the smartphone [AzzaAlloch,2017][Ravi Bhoraskar ,2012] [Aniket Kulkarni,2014][Gaurav Singal ,2018][Yun-chin Tai l ,2010][Arun Kumar ,2017 we can see the location of the unwanted activity like pothole, bump, slope, speed breaker, etc. on the road surface.

2.4 Challenges of smartphone sensors:

2.4.1. Vibration pattern of sensor data: The sensor readings depend on the speed of the vehicle that is, how it approached and what was the orientation of the sensor therefore given pothole or any road anomaly not necessarily give the same pattern during each drive. If the vehicles suspension system is not the normal condition then large vibration may experience by the vehicle which may lead to more deviation.[Lei Kang,2017] [Arun Kumar ,2017]

2.4.2 Benign event: There are events like door slams, railroad crossing, any object under the tires must not be considered as the potholes or any other uneven road condition discussed above. [Lei Kang,2017][Arun Kumar ,2017

2.4.3 GPS error: GPS system has an error of 3 meters which may lead to incorrect identification of the longitude and latitude to detect the anomaly of the road. [Lei Kang,2017][Arun Kumar ,2017

2.4.4 Privacy: As we are going to use the GPS system to detect the location of the pothole or any anomaly on the road, we need the access to the user's smartphone which may lead to privacy breach of the user.[Lei Kang,2017] [Arun Kumar ,2017].

3.Estimation technique to detect road quality: Machine Learning is a part of Artificial Intelligence (AI) and is a data-driven solution that can cope with the new system requirements. IoT is a system of interrelated computing devices that transfers data over the network without human-to-human or human-to-computer interaction. Many authors used these technologies to analyse the road conditions in transportation.

3.1 XSense: Lei Kang and Suman Banerjee, proposed Practical Driving Analytics with Smartphone Sensors. This paper basically focuses on the several techniques which can be used to improve the accuracy and usability

of inertial sensors. The author discussed various problems and error that can arise due to the inertial sensors that may mislead the correct identification of the pothole on the road surfaces. The XSense application is designed by the author on the android platform. The application uses accelerometer, gyroscope and GPS sensors of the smartphone to collect the data. The author used novel techniques that can increase the accuracy of these sensors in more extent; the techniques like detecting orientation change, conducting slope-aware, coordinate alignment and linear acceleration estimation. Moving variance method and Intra-cluster variance method are used to detect the orientation change and estimate the mounting stability of the smartphone. The author also addressed the GPS data when used combined which machine learning techniques give high accuracy for detection. [Lei Kang,2017]

3.2 Road Quality Management System using Mobile Sensors: Arun Kumar G et. al. proposed a Road Quality Management System using Mobile Sensors. The author used the accelerometer and GPS sensors to identify the pothole and bumps and detect its location accordingly. The author has created such a system with four parts; sensing, storing, analysing and retrieving. Cloud computing concept is used by the author to store the information regarding the potholes to get easily accessible to the higher authorities. To identify the pothole, a threshold value is set, if the value changes then it is identified as the pothole or bump on the road surface. Data analysing is done using a web application in this system. The cloud is made public accessible so that smartphone users get the pothole located on their mobile phones. [Arun Kumar ,2017].

3.3 RoadSense: AzzaAlloch et. al designed a RoadSense Android application to estimate the road condition using accelerometer, gyroscope and GPS sensors. Potholle detection methodsThe proposed system is divided into two parts; training and prediction phases. . The data is labelled into two categories; soothed and potholed. Once the data is collected using the accelerometer and gyroscope sensors, they are passed to the training phase. In training phase, a low pass filter is applied on the collected data to remove the high frequencies and new accelerometer and gyroscope magnitude values are obtained. The feature extraction is done where a vector of Fourier coefficients is obtained. The author used the Correlation-based Feature Selection approach to select the features from the previously obtained vector. The author uses C4.5 Decision Tree Algorithm, SVM and Naïve Bayes for prediction from which the C4.5 Decision Tree algorithm gives the highest accuracy of 98.50% for correctly predicting the potholes. [AzzaAlloch,2017]

Table 1. Smartphone Sensors to detect Road Quality

Sr. NO	System	Smartphone Sensors			
		A	G	M	GPS
1	RoadSenseAzzaAlloch,2017	✓	✓		✓
2	Wolveriene[Ravi Bhoraskar ,2012]	✓		✓	
3	Encog[Aniket Kulkarni,2014]	✓			
4	Pothole Detection using Machine Learning [6][Ali Tizghadam ,2019][11][12]	✓	✓		✓
5	PitFree[Gaurav Singal ,2018]	✓	✓		✓
6	Xsense [Yun-chin Tai 1 ,2010]	✓			✓
7	ML using AI Mohammad Abbadi	✓	✓		✓
8	Streetcheck [15]	✓			✓
9	ML using IOT Sensors[JIn Ren Ng]				
Abbreviations:-A-Accelorometer,,G-Gyroscope,M-Magnetometer					

3.4 Pitfree: Gaurav Singal et. Al. propose a model Pitfree which detects the pothole on road using mobile sensors. The author has collected the data using accelerometer (3 - axes) to get the data regarding road condition and GPS system data to identify the longitude and latitude of the pothole on the road surface. The collected data is clustered using K-means clustering algorithm into two categories (smoothed and pothole). The author analyses the accelerometer for normal driving condition, pothole condition and speed breaker condition. According to author, when the graph first goes down and then goes up signifies that detection of the pothole. Total of 250 samples were used for classification. Three classifiers are used to identify the pothole, SVM, Random Forest and Logistic Regression from which the SVM classifier gives the highest frequency of 99.6% for correctly identifying the potholes. [Gaurav Singal ,2018].

Ali Tizghada et. al. enlightens about how machine learning approaches are being used in the transportation domain and how massive amount of data have redefined these approaches for emerging demands and needs in transportation. The paper briefly addresses the transportation issues that can be solved using machine learning approaches such as prediction of future traffic conditions, public transit commuter's travel

pattern, detect vehicle and track vehicle trajectories in traffic conditions, identity of the public transport driver, challenges in air travel like collision avoidance, automated decision support technologies, etc. The author also focuses on the aircraft transport issues and how Synthetic Minority Oversampling Technique (SMOTE) and Ensemble-Based Ordinal Classification approach can resolve these issues. [Ali Tizghadam ,2019].

3.5 Road Condition using IOT Sensors: Jin Ren Ng et. Al. proposed a research work for road surface condition identification using IoT sensors and Machine Learning approach. The author instead of relying on the smartphone sensors used IoT sensors accelerometer (3-axes) with Arduino microcontroller placed to the front wheels of the four-wheeler vehicle. The author collected total of 350 sets with seven different road surface conditions which includes smooth road, speed bump, pothole, rumble strip, uneven road, sudden.

stops and turns. The feature extraction and selection are done for both time and domain frequency with some statistical parameters. The author used Ranker, Greedy Algorithm and Particle Swarm Optimization (PSO) techniques for feature selection and K-Nearest Neighbour, Random Forest and SVM for classification. The performance of the classifiers is measured using Correctly Classified Rate (CCR). The system gave 99% of the accuracy for all the classifiers expect SVM (Polynomial) which gives the accuracy of 94%. [JIn Ren Ng].

Table 2. Assesment of Machine Learning Technique to estimate Road quality

Sr.No	System	Machine Learning Model						Accuracy
		DT	KNN	NN	RF	LR	NB	
1	RoadSenseAzzaAlloch,2017	✓					✓	98.60%
2	Wolveriene[Ravi Bhoraskar		✓					-
3	Encog[Aniket			✓				95%
4	Pothole [6][Ali Tizghadam ,2019][A. S. El-Wakeel]	✓					✓	More than 80%
5	PitFree[Gaurav Singal			✓	✓	✓	✓	99.60%
6	Xsense [Yun-chin Tai 1	✓		✓	✓	✓	✓	90%
7	ML using AI Mohammad Abbadi	✓		✓	✓	✓	✓	99.90%
8	Streetcheck [NunesandMot			✓	✓			97%
9	ML using		✓		✓			99%
DT-Decision Tree,RF-Random Forest,NB-Naïve Bias ,LR-Logistic Regression,NN-Neural Network,K-NN								

The various methods in Machine Learning with combined AI approach can also be used for the analysis as shown in Mohammad Abbadi to provide more accuracy to system.. Even though the presented work gives you correct prediction for road conditions but there are many ways to try to solve this problem to a bigger extent which will be useful for the higher authorities for road maintenance.

CONCLUSION & FUTURE WORK

This study highlights the use of smartphone sensors and machine learning algorithm using AI technique. Many authors have used various algorithms for the prediction of data. Each algorithm plays an important role in every presented work by different authors. Some authors also used some mathematical techniques to optimize the sensors data so that correct data must be captured and there should be no misleading outputs. The paper provides a good description of the various methods and its performance. fusing AIMohammad Abbadi procedures with Smartphone sensors .Using some techniques of Machine Learning (Neural network, KNN, Naïve Bayes and Random forest tree) to prepare and test information received from Smartphone sensors. All inspected AI calculations keep up high precision and recall in obtaining the vehicle's driving class; be that as it may, the neural network classifiers accomplish the most noteworthy precision value which is 90%.

Governments' representative architects and laborers are unable to alert about harm to streets, potholes, and so on. This is profoundly tedious and requires a great number of labourers. Consequently, it would fill in as a notice framework to all clients just as an information base of potholes with their areas to the experts for activity. Study analysis the exhibition of different AI models (Logistic Regression, Support Vector Machine (SVM)Mohammad Abbadi, K-Nearest Neighbours (KNN), Naive Bayes, Decision Tree, Random Forest and Ensemble Voting) in view of various output parameters (Accuracy, F-score, Precision and Recall) and distinguished that

Random Forest is the best model for pothole recognition & combination of two or more sensors provide better accuracy and scalability to system.

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PCOcare: PCOS Detection and Prediction using Machine Learning Algorithms

Vaidehi Thakre[1*], Shreyas Vedpathak[2], Kalpana Thakre[3] and Shilpa Sonawani[4]

[1,2] *Student (Third Year B.Tech. CSE), MIT – World Peace University Pune, India,*

[3]*Professor, Sinhgad College of Engineering Pune, India,*

[4]*Assistant Professor, MIT – World Peace University Pune, India*

ABSTRACT

Polycystic Ovary Syndrome (PCOS) is a medical condition which causes hormonal disorder in women in their childbearing years. The hormonal imbalance leads to a delayed or even absent menstrual cycle. Women with PCOS majorly suffer from excessive weight gain, facial hair growth, acne, hair loss, skin darkening and irregular periods leading to infertility in rare cases. The existing methodologies and treatments are insufficient for early-stage detection and prediction. To deal with this problem, we propose a system which can help in early detection and prediction of PCOS treatment from an optimal and minimal set of parameters. To detect whether a woman is suffering from PCOS, 5 different machine learning classifiers like Random Forest, SVM, Logistic Regression, Gaussian Naïve Bayes, K Neighbours have been used. Out of the 41 features from the dataset, top 30 features were identified using CHI SQUARE method and used in the feature vector. We also compared the results of each classifier and it has been observed that the accuracy of the Random Forest Classifier is the highest and the most reliable. The dataset used for training and testing is available on KAGGLE and owned by Prasoon Kottarathil.

KEY WORDS: MACHINE LEARNING, POLYCYSTIC OVARY SYNDROME, SUPPORT VECTOR MACHINE, LOGISTIC REGRESSION, RANDOM FOREST CLASSIFIER, GAUSSIAN NAIVE BAYES, CHI-SQUARE.

INTRODUCTION

In the past few decades, technology has revolutionized our universe and affected our lives, making them easier day by day. Emerging technologies are reshaping mankind in a lot of ways. These days, machine learning, a field of study that gives computers to learn without being explicitly programmed, is playing a key role in the healthcare sector. Machine learning can deal with obscenely huge datasets, convert analysed data into clinical insights and help in the diagnosis of various ailments. Polycystic Ovary Syndrome (PCOS) is a medical condition which causes hormonal disorder in women in their childbearing years. PCOS occurs as a result of hormonal imbalances. In this disorder, the ovaries develop small collections of fluids called follicles (cysts) and fail to release eggs, which is why women suffering from PCOS tend to have complications in conceiving [Zhang, 2018]. A lot of women have PCOS, but do not get diagnosed with it at an earlier stage. In a study, 69 to 70 percent of women did not have a pre-existing diagnosis [Dewailly, 2013].

While the actual causes of PCOS remain a mystery, studies say that it is generally inherited. It is a very unpredictable condition as the cure is uncertain since there is no observable trend for this medical condition. The time and cost of taking innumerable medical tests and scanning is a burden for the patients and the doctors too. Hence, early diagnosis and treatments are important as long-

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term health risks like type-2 diabetes, cardiovascular diseases can be avoided by simple changes in lifestyle. Common symptoms include irregular periods, excessive androgen levels (male hormones), polycystic ovaries. Hence, parameters such as Follicle-Stimulating Hormone (FSH), Luteinizing Hormone (LH), Human Chorionic Gonadotropin (HCG), number of follicles, Thyroid Stimulating Hormone (TSH), Age, cycle length, cycle regularity, etc. are taken into account to formulate the feature vector for our machine learning models. Early detection can help make necessary lifestyle changes beforehand and hence reduce risks of the condition as women with PCOS are three times more likely to undergo miscarriages in early stages of pregnancy, suffer from infertility and in rare cases, gynaecological cancer.

Literature Survey: From 1 in 10 women suffering from PCOS worldwide to currently 3-4 in 10 women, PCOS is now exponentially increasing among women due to an unhealthy lifestyle. The literature says that 1 in every 5 women in India suffers from PCOS. PCOS symptoms differ in every patient. The major diagnosis includes scanning for follicles, their number and sizes using Ultrasound imaging. In the existing literature, several various techniques have been used to analyse and detect PCOS. We need to refer to the categories of PCOS standards to gain complete understanding of what PCOS is. Even though it is called Polycystic Ovary Syndrome, it is not essentially described by ovarian cysts. It is defined by examining at least two of three diagnostic criteria. These criteria which are used for diagnosis have been evaluated multiple times separately by the National Institutes of Health (NIH, in 1990), by the European Society of Human Reproduction and Embryology (ESHRE) and the American Society for Reproductive Medicine (ASRM, in 2003) (popularly known as the Rotterdam criteria). In 2012, the 2003 Rotterdam criteria were endorsed by NIH for PCOS. Table 1 illustrates the criteria used for diagnosis of PCOS which have been set as a standard by NIH.

For an accurate PCOS diagnosis, disorders that have specific signs and symptoms that match with those of PCOS must be dismissed. Hyperprolactinemia, Cushing's syndrome and non-classic congenital adrenal hyperplasia are few examples. [Zhang, 2018] have used different machine learning algorithms like K-nearest neighbour (KNN), decision tree and SVM with different kernel functions to predict PCOS from the identification of new genes. [P. Mehrotra, 2011] have used machine learning algorithms like Bayes and Logistic Regression (LR) to develop an automated system that will act as an assisted tool for the doctor for saving considerable time in examining the patients and hence reducing the delay in diagnosing the risk of PCOS by using metabolic and clinical factors in a feature vector. [Norman, 2007], have done a comprehensive study on the disorder and its three diagnostic criteria in depth giving us insights on not just PCOS but also abnormalities of insulin, gonadotropin and folliculogenesis. [Essah, 2006], have discussed how there exists an overlap between the metabolic syndrome and the polycystic ovary syndrome (PCOS).

That article discusses the existing data regarding the familiarity, characteristics, and treatment of the metabolic syndrome in women with PCOS. [Amsy Denny, 2011], have proposed a system for the early detection and prediction of PCOS from an optimal and minimal but promising clinical and metabolic parameter, which act as an early marker for this disease. [Dewailly, 2013] have illustrated in their literature how the diagnosis of PCOS depends on biological, clinical and morphological criteria. As ultrasonography has technologically advanced, the excess follicle has become the primary criterion of polycystic ovarian morphology (PCOM). Since 2003, most investigators have used a threshold of 12 follicles (measuring 2–9 mm in diameter) per whole ovary, but that now seems obsolete [A. Saravanan, 2018]. The fluctuations in the quantity of ovarian volume or area may also be considered as accurate markers of PCOS Morphology, yet their utility compared with excess follicle remains a puzzle.

METHODOLOGY

The formulation of a good machine learning model is an important aspect of project design. Having the correct patient data is very important because one cannot afford mistakes while devising healthcare services. We have used multiple machine learning models to check which model gives us the most accurate results. To support our claims and results obtained, use of plots and evaluation metrics has been made. A basic workflow diagram to explain the proposed system is given in Figure 1. The following sections will give a detailed insight into the system:

Figure 1: Architecture of the Proposed System

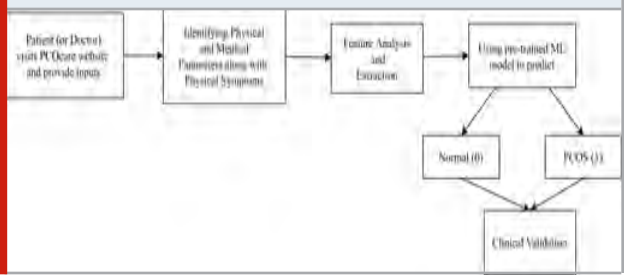
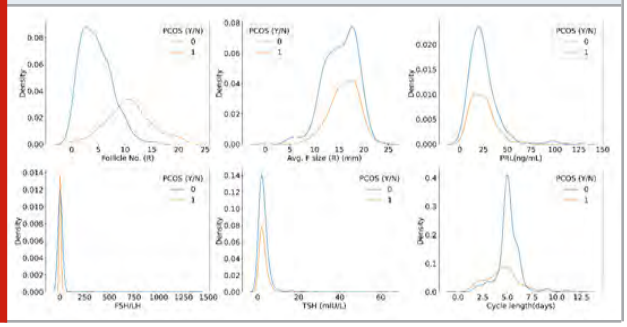


Figure 2: Kernel Density Estimation Plots



For the machine learning model implementation, Jupyter Notebook has been used. Our proposed web app PCOcare is intended to be developed in Python using Streamlit

Open Source Web App Framework. Data Pre-processing: The dataset found was cleaned. Hence, no data pre-processing was required. The dataset contains columns which have continuous as well as discrete observations. So, let us see if we can derive any useful insights from the columns which have continuous values.

These Kernel Density Estimation Plots demonstrate that patients who had PCOS have similar trends as the patients without PCOS. These distributions are not useful from the point of view of finding features that can help us differentiate between a patient who is diagnosed with PCOS and a patient who is not. So, in order to find important features, statistical help has been taken (Chi-Square Method). Feature Selection and Importance: Feature selection is performed to divide the set of features into a subset of significant features so that the classifier efficiency can be done. From 41 features present in the dataset, Top 30 features were selected using CHI Square method. A chi-square test is a test used in statistics to test the independence of two events. Essentially, what chi-square is doing is that it will calculate scores based on a formula:

$$(X_c)^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (1)$$

Where, c= degrees of freedom, O= Observed Value and E= Expected Outcome. Once a score is calculated, we can form a conclusion about a particular feature by saying: The higher is the chi-square value for a feature, it is more dependent on the response and can be selected for model training.

Table 2. Chi-Square Score for Top 30 Features (Generated in Jupyter Notebook)

Rank	Feature	Score	Rank	Feature	Score
1	PRL(ng/mL)	9600.594	16	Vit D3 (ng/mL)	25.00828
2	No. of abortions	6899.359	17	Hair loss(Y/N)	23.56211
3	FSH(mIU/mL)	2572.754	18	Cycle length(days)	19.71094
4	II beta-HCG(mIU/mL)	1592.273	19	Height(Cm)	15.10558
5	I beta-HCG(mIU/mL)	1012.629	20	Skin darkening (Y/N)	8.910647
6	Follicle No. (L)	673.1438	21	Cycle(R/I)	8.230296
7	BP _Diastolic (mmHg)	564.5952	22	Follicle No. (R)	7.460844
8	TSH (mIU/L)	221.8157	23	FSH/LH	5.426396
9	LH(mIU/mL)	96.23587	24	Hip(inch)	5.219221
10	hair growth(Y/N)	85.66499	25	PRG(ng/mL)	4.779813
11	Weight gain(Y/N)	84.0381	26	Avg. F size (L) (mm)	3.352904
12	RBS(mg/dl)	65.01353	27	Avg. F size (R) (mm)	3.144839
13	Age (yrs)	50.85829	28	Pregnant(Y/N)	2.824165
14	Pimples(Y/N)	37.43732	29	Fast food (Y/N)	1.856357
15	Hb(g/dl)	27.7938	30	Blood Group	1.235629

Random Forest Classifier: Random Forest Algorithm is another example of Ensembling methods. It combines result from many decision trees to derive a conclusion. Used for solving problems based on both Regression and Classification.

Support Vector Classifier: Support Vector Machine algorithms are supervised machine learning algorithms which are used for regression, classification and outlier detection problems. In SVM, it basically plots the data as points in an n-dimensional space, where n is the number of features. The algorithm tries to find a hyperplane which can separate the plotted points into the required or identified number of classes. Logistic Regression: Logistic Regression is a classification algorithm. It is a supervised machine learning algorithm. It uses sigmoid function to perform its hypothesis. The outcome of the hypothesis is the estimated probability. It is in terms of binary i.e. will it happen or not basically 1 or 0 respectively.

Gaussian Naive Bayes: Naive Bayes are algorithms that use the Bayes' theorem to calculate the probability and decide to which class does the given data would belong. We have used Gaussian Naive Bayes for our hypothesis. It follows Gaussian Normal Distribution which means there will not be covariance between the features, and it supports continuous data. KNeighbours Classifier: The KNN algorithm assumes that similar data if plotted would exist nearby. We first load the data and choose how many classes we want the algorithm to classify the data into. The algorithm first calculates the distance of K number of neighbours using distance formula, then it takes the K nearest neighbours according to the distance we calculated. Among these classes, it counts the number of data items for each class. It then allocates the new data points to that class, where it has the greatest number of neighbours.

Comparison of Models: After implementing the machine learning algorithms, the following observations and

results were obtained - Table 3 and 4. These have been generated in Jupyter Notebook using Scikit Learn Library. Table 3 describes the K Fold cross-validation scores of each algorithm on training data and Table 4 describes the precision, recall and Fscore for each model on testing data. From the tables 3 and 4, Random forest Classifier is seen to perform better than the respective others. Hence, Random Forest Classifier is used for our final hypothesis which will predict results using test data. The given ROC curve is plotted using test data and is 89.0% accurate (Given by area under the curve). The train data accuracy of the same is 90.9% (Refer to Table 3).

Table 3. K Fold Cross Validation Scores

	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Mean Accuracy
Random Forest Classifier	0.895349	0.930233	0.872093	0.918605	0.929412	0.909138
Logistic Regression	0.918605	0.918605	0.872093	0.872093	0.917647	0.899808
Linear SVM	0.895349	0.883721	0.872093	0.848837	0.905882	0.881176
Radial SVM	0.941860	0.883721	0.813953	0.883721	0.882353	0.881122
KNeighbors Classifier	0.883721	0.883721	0.837209	0.883721	0.894118	0.876498
Gaussian Naive Bayes	0.895349	0.906977	0.779070	0.848837	0.917647	0.869576

Table 4. Classification Report

	Precision (Class 1, Class 2)	Recall (Class 1, Class 2)	Fscore (Class 1, Class 2)
Linear SVM	(0.911, 0.850)	(0.911, 0.850)	(0.911, 0.850)
Radial SVM	(0.855, 0.906)	(0.955, 0.725)	(0.902, 0.805)
Logistic Regression	(0.888, 0.888)	(0.941, 0.800)	(0.914, 0.842)
Random Forest Classifier	(0.891, 0.941)	(0.970, 0.800)	(0.929, 0.864)
KNeighbors Classifier	(0.820, 0.866)	(0.941, 0.650)	(0.876, 0.742)
Gaussian Naive Bayes	(0.923, 0.813)	(0.882, 0.875)	(0.902, 0.843)

RESULTS

Figure 3: Confusion Matrix for Random Forest Classifier

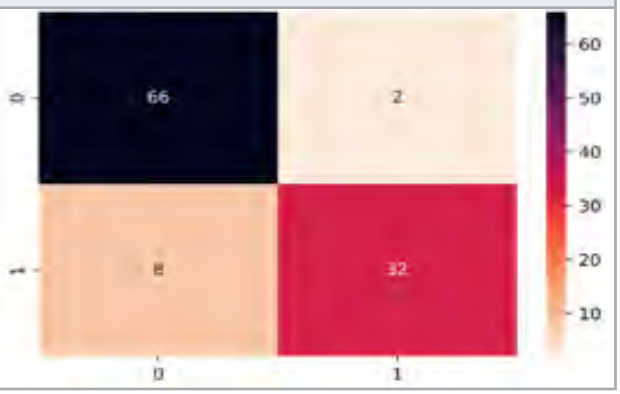
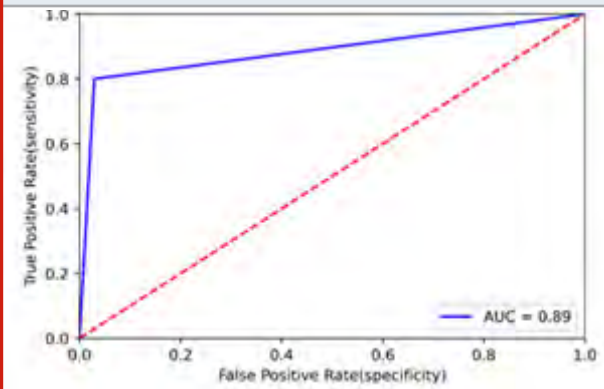


Figure 4: ROC Curve for Random Forest Classifier



CONCLUSION

Polycystic Ovary Syndrome (PCOS) is a medical condition which causes hormonal disorder in women in their childbearing years. The hormonal imbalance leads to a delayed or even absent menstrual cycle. Women with PCOS majorly suffer from excessive weight gain, facial hair growth, acne, hair loss, skin darkening and irregular periods leading to infertility in rare cases. Our proposed system helps in early detection and prediction of PCOS treatment from an optimal and minimal set of parameters which have been statistically analysed using the chi-square method. The Random Forest Classifier was found to be the most reliable and most accurate among 4 others with accuracy being 90.9%. The proposed system can be used by both patients and by doctors too, as a doctor can filter new patients with basic information and give priority to treat patients with PCOS first and then meet patients who do not have PCOS.

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A Detailed Review on Decision Tree and Random Forest

Bhushan Talekar[1] and Sachin Agrawal[2]
[1]*Senior Hr, L&T Infotech,*
[2]*Assistant Professor, College of Engineering and Technology, Nagpur India*

ABSTRACT

The decision tree method works by repeatedly dividing the location of features into imaginary limb regions so that each imaginary location provides a basis for making a different approximation. The decision tree system in existence so far applies to various future tasks such as classification and regression. These methods are popular in the field of data science with various benefits. This is due to limitations such as instability of predictions before slight changes in data, and this leads to a major change in the structure of the decision-making tree and has detrimental effects in terms of forecasting. On the other hand, to improve the prediction accuracy of a single base classifier or regressor, multiple decision trees are given parallel training for forecasting purposes and are known as random forests. The random forest technique is an ensemble methods, it comprises of several decision tree which are trained on the subset of data or with the feature subspace, once all the tree are trained, their results are combined together for the purpose of prediction. As random forest is more stable than a decision tree it become more popular in the field of data science and machine learning. In this paper, we had provided an detailed introduction of the decision tree methods and random forest method. Also, how they works and for which type of problem they are suitable.

KEY WORDS: SUPERVISED LEARNING, DECISION TREE, RANDOM FOREST, CLASSIFICATION, REGRESSION

INTRODUCTION

The decision tree actually derived from the statistics field and then it is improved by a various researchers for the prediction purpose in the field of data mining, pattern recognition and machine learning. As decision tree comes up with several benefits like human readability but it is having several drawbacks like it suffers a lot when there is a little change in the data i.e. instability. To overcome the drawback of decision tree and to fully utilise its capability one can build random forest for this purpose. As per the name, Random Forest, consist of 'n', number of decision trees which are trained using the subspace of the training data and the result of all decision tree is collectively used for the final prediction of the 'y' label.

Due to large number of tree used for the prediction of s 'y', the error of a single tree get overcome or compensated by other decision tree, available in the forest. In recent study, comparison of all the present classifier is done on 121 dataset and it is found that the result for random forest is far much more better than the other forecasting methods. The reason for this great prediction performance is the presence of the base classifier in the random forest. The performance of the random forest is completely dependent upon its base classifier and its training. Also, if subspace is provided in a more structured way to a individual decision tree, it gives more accurate result compare to the random training techniques. The complexity of Random Forest is comparatively low even though it comprises of several decision tree which are trained in parallel.

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**Corresponding Author: bhushan.talekar@live.com*
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As far as literature is concerned, several studies discussed about the ensemble learning and its performance, but these studies are generalised and had little focused on Random Forest methods. Also, these studies given an superb feedback on various ensemble learning methods, but they are not that much sufficient. Apart from the previous studies, several researchers proposed a study which completely emphasised on the performance of random forest method and its related methods. The popularity of random forest in the field of machine learning, pattern recognition and data science is due to its superior performance compared to its peers, while there are methods which are present for the construction of random forests. In the recent book publication by criminisi and shotton, they pitched a aggregate model of random forest for handling various prediction learning jobs. In this book, they presented detailed theoretical description of random forest algorithm and its implementation in various prediction tasks. Nevertheless, they failed to explain the various issues related to random forest like pruning methods for handling big data and various processing methods.

The goal of this research paper is to provide an reader to give an introduction to Random Forest algorithm and its variants. In this paper, the detailed working of decision tree is presented and its advantages and disadvantages is discussed. Also, detailed study on construction of Random Forest algorithm is mentioned along with is advantages and disadvantages and suitability of the algorithm with respect to the data is discussed. The article is organised as follows: Section 2 gives an introduction of decision tree which plays a important role in the construction of random forest and its prediction accuracy. In this, we discussed in detail how the accuracy of single base classifier impacts the final accuracy of an ensemble algorithm. In section 3, detailed description of Random Forest algorithm is presented in terms of it working and its applicability to various domains and gives an overview of the Random Forest construction methods. Section 5, gives an general description on the fusing technique and detailed study of present popular techniques related to Random Forest algorithm is shown and finally in the section 6 conclusion is made.

2. The Decision Tree – The Building Block of RandomForest: The decision tree method works by repeatedly dividing the location of features into imaginary limb regions so that each imaginary location provides a basis for making a different approximation. It consist of nodes and edges. The decision tree building process starts from the root node and it is also known as first split point. This split decides the divisions of the entire dataset. The split is done on the basis of calculation of entropy and information gain or gini index. The splitting process continues from top to bottom until no longer partitioning is required. The leaves present at the end of the decision tree represent the last partitions. In the decision tree, the root node do not contain any incoming edge but the test nodes must contain one edges coming from the upper node and it may have one or more outgoing edges. The decision is made by the decision node also known as leaves node which contains the predicted output.

A tree which consist of only root node (also known as parent node) and leaves and do not contain any test node in it then it is called as decision stump. For the classification type of problems, decision tree is widely used and the goal is to predict the object on the basis of their features. For the purpose of demonstration of working of decision tree we took an dataset sample of Iris flowers. Here, the goal is to predict the Iris flower species based on the the features of the Iris flower like petal length, petal width, sepal length and sepal width. This problem belongs to classification category, here the goal is to predict the type of iris flower. Here the tree will be called as classification tree and the child node will hold the predicted object.

The figure1 represent the classification tree for the Iris flower dataset, in this, the test node consist of 'n' number of object. The first split is based on petal length, which shows the importance of petal length parameter in identification of species, and this split is calculated on the basis of highest value of information gain or gini index. The petal length is called as root node. The petal width node and petal lengths are the internal node or test node, whereas node 2, node 5, node 6 and node7 are the leaves node. Decision trees divided the covariate space into unequal parts. One way to better understand the decision tree is to envisage the covariate space with selected partition boundaries. The below figure presents a two-dimensional projection skeleton that uses selected features to examine the tree. Indivisible decision-making tree divide the space by axis- parallel hyperplanes. The scatterplot shows the corresponding partition of the feature space by adding the boundary of the partition. In this case, the plot consists of four hyperplanes (boxes). Each box classification corresponds to one leaf of a tree. Based on the examples in it, we can visualise the square distribution of each frame.

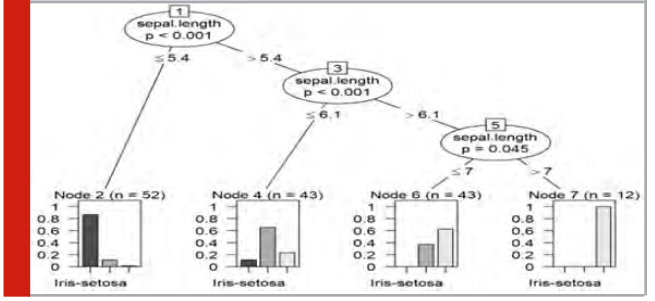


Figure 1: A decision tree also known as classification tree for Iris_Flower dataset

Benefits of the Decision Tree Method: The reason behind the popularity of decision tree technique is due to the many benefits it offers which are stated below:

a) The structure of decision tree is clear and easy to understand when compared to the other present classifier. That is, if the decision tree has the correct

number of test nodes, it can be easily understood by non-commercial users. In addition, decision trees can be easily transformed into a set of post-rules, so this type of representation is considered understandable. In addition, it provides a selection of built-in functions which makes it more attractive than the rest.

b) Decisions will be made in a way other than parametric, i.e. there is no predefined hypothesis regarding the feature space and its distributions. Also, the decision tree can work with numeric data, data presented in text format and nominal data. The decision tree is capable enough to handle large data and it is scalable. It can provide a fast result with respect to the other classification technique and gives high prediction performance. Due to its popularity among the researcher, it is available in various open source platforms.

Drawbacks of the Decision Tree Method: The decision trees also have many shortcomings. As we will see later, some of these deficiencies can be mitigated with a decision to grow the forest. Here are the main disadvantages:

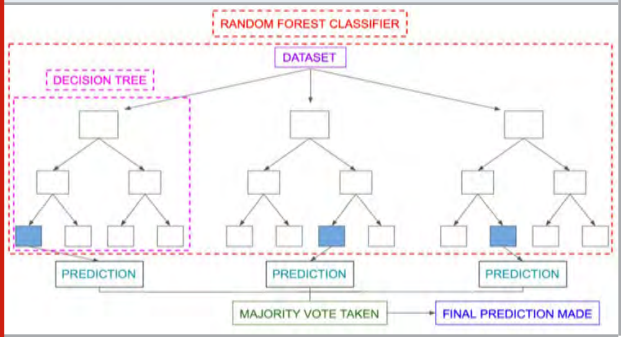
a) The decision tree suffers from the replication issue i.e. the performance of the tree degrades when it comes to intricate interactions between the features. As this technique uses the divide and conquer approach in the training phase, it gives superior performance but when it comes to dealing with highly co-relate feature the performance of the model decreases gradually.

b) It suffers a lot with the change in the data and shows myopic behaviour. Also, during the fragmentation process the overall insight on view of the data get decreases. It also suffers from the dimensionality i.e. if the data is getting fragmented on equal part on every split then the testing of the data on the features is getting reduced.

The Random Forest and Ensemble Learning Methods: The researcher proposed an ensemble's methods to overcome the drawbacks of a single prediction model. The ensemble comprises of more than one model which are trained by the subset of the data belong to the same datasets. The objective is to achieve higher accuracy compare to the single prediction model. The reason for getting better accuracy, is because of multiple models are involved in decision making. The origin of ensemble was done on seventies when several researchers, proposed an concept of forecasting model where they combined several models together for the better prediction. The first ensemble which was built by Tukey, comprises of two regression models. Later, the authors, proposed an idea of fragmenting the input with two or more model. The author proposed an algorithm Adaptive Boosting in the year 1990, since then random forest received an attention from the data scientist and machine learning experts.

The number of times people proved that the combination of models gives better prediction than that of a single model. The ensemble approach gives superior performance when we combine several decision tree model works together as a base model. The amalgamation of decision tree methods along with the concept of ensemble learning generates a model known as Random Forests. The random forest models was applied to various domains like pattern matching, information retrieval, forecasting of stock indices and medicine because of superior performance. The authors, given an several reasons in the favour of random forest with respect to its performance which are as follows: a) The random forest works very well even though the size of the dataset is very low for the training purpose and also the hypothesis space increases which gives a better fit for the decision tree.b) The construction of the decision tree model is termed as Np-Hard problem, and problem with the decision tree model is that it get stuck in local minima, so to avoid local minima, combination of more than one tree, reduces the risk.

Figure 2: A Random Forest comprises of several decision tree for the perfect classification



Construction of Random Forest Algorithm: The following steps need to be followed for the generation of Random Forests model, first, diversity plays a vital role for better prediction of the model. If diversity present in the dataset is more than each decision tree classifier will get mixture of the dataset and this results in good training of the base classifier. The performance of individual trees matters a lot for the overall accuracy of the Random Forest model. In order to improve the accuracy of the RF model, we need to make sure that each base learner get trained on the subset of data with better diversity. The holistic approach for the manipulation of input data, is to use the data required for the purpose of training with replacement. For the manipulation purpose, the random forest algorithm get trained with different subset of features rather than selecting best feature present in the dataset. This leads to randomness which helps in achieving the good accuracy.

Also, several researcher proposed the concept for increasing the performance of RF algorithm with the help of alteration in parameters. It is found that algorithm tends to give better accuracy when there is a change in the algorithm parameters. Splitting is the initial division that applies to a small teaching process. Another tree was created on each subdivision. There are two obvious ways to split original data: partitioning and partitioning. In

the horizontal section - the original dataset is divided into several datasets with identifiable information from the original dataset, each with a list of original examples [26] In the vertical section, the vertical dataset is divided into several databases containing the same content as the original dataset, each with a primary identifier [27]. The author, proposed an method for the creation of subspace of attributes by doing the combination of larger base classifier.

CONCLUSION

In this paper, we discussed various ways of construction of decision tree and random forest model and how base classifier accuracy is important for the ensemble model performance. The random forest is to improve the generalization capacity of a single decision tree by combining the production of multiple trees. This overview article highlights the main decisions and techniques used in random forests, in particular the three main factors involved in the use of random forests was explored in detail.

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A Brief Overview of DJVU Ransomware Family

Chaitanya Kapre
[1]*Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

In today's world the use of internet and computer are not just restricted to sending emails and retrieve information. Instead all large and small enterprises, health institutions, financial institutions,government officials all are shifting from offline data management to online data management .There are now various softwares for paying Income Tax return,bills,e-banking,airways and railways ticket booking,movie ticket,etc. By the substantial increase in growth of usage of cloud services ,there has been exponential growth of cyber threats and cyber attacks incidents[Peter W. Singer, Allan Friedman, 2014]. Malware had been the primary tool used by the hackers to do malicious activity.The most used malware is ransomware and ,in that also DJVU/STOP family viruses are the most common. These viruses will not only affect the big companies, but also small scale startups or businesses and even common people [K.A. Francis, 2019]. According to the University of Maryland ,Hackers attack every 39 seconds,which results in an average of 2,244 times a day. So, considering the need of awareness, this paper has been written to give the all information about this type of ransomware.Moreover, this paper will also cover the discussion on -how virus has entered into system(that is the way/ entry point), working of the virus (that is how it affects the system), processes to remove the virus correctly,various methods to recover the data and the preventive measures to avoid such virus attacks.This paper is for the people who are the the victim of such viruses or having keen interest in learning new viruses. Also, this paper motivates the readers to use this for further research.

KEY WORDS: ONLINE DATA MANAGEMENT, CLOUD SERVICES, MALICIOUS ACTIVITY, RANSOMWARE, RECOVER DATA.

INTRODUCTION

As the technology evolved and use of internet got more robust which enabled digital advertising,marketing in wider area,etc ,many large enterprises are taking interest in using and developing cloud services for efficient and safe online data management systems.If we consider safety of data,they have to verify that their clients/users data is safe and protected.According to the report of the Information Systems Security Association(ISSA) , the big problem is 82% of employers lack cybersecurity skills. Hence many large enterprises are spending nearly $1 million annually on data and cybersecurity. This shows the need of awareness about cybersecurity. Hence cyber security issue should not get restricted to company/personal issues but it should be considered as a national issue.Cyber security ensures no illegal access, unauthorized modification of data and protect the files from malware.

Data breaching/sealing is an unethical method to access someone's data without their permission. Hackers generally use this technique for cyber threats and crimes with the help of their primary tools which are - 'malwares'.Computer malwares can simply termed as a computer software/program which secretly enters into our system with or without concern and can duplicate itself to carry out many vulnerable activities like accessing

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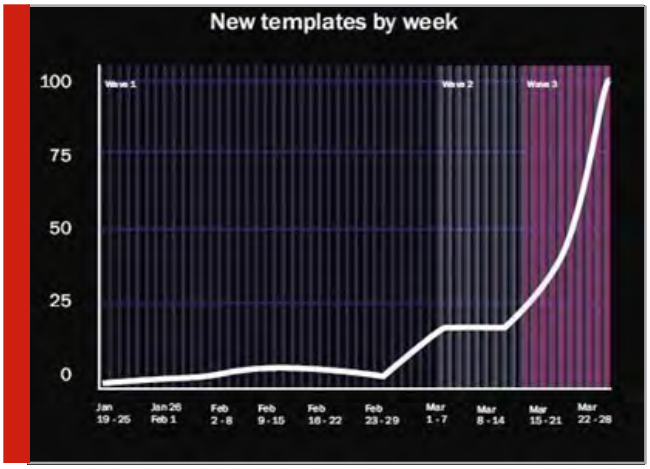
and modifying our private ,as well as system files which can lead to encryption of data , lose all data or system abnormal behaviour 'ILOVEYOU' virus which is considered as one of the most popular and worst viruses spread through emails.They sent the mail with the subject 'I LOVE YOU' and the attachment 'LOVE-LETTER-FOR-YOU.txt.vbs'.After opening the file the virus will quickly try to hide itself after modifying the different types of files like jpg / jpeg (image) , mp4 (video) , .mp3(audio),etc and sends the copy of the email(infected) to the first 50 contacts of the Windows Address Book.This virus has affected nearly 10% of internet-connected computers in the world. During this Pandemic one thing has been proved ,that ransomware cases crossed over 20% around the world in the first half of 2020 itself.[Refer fig<a>]



*New template refers to new and unique COVID 19 phishing template.

*3 parts are made according to the intensity, being lowest -Wave 1 and highest - Wave 3

As Cybercriminals are taking advantage of this pandemic by tricking the common people with the subject of COVID-19 and make them click the ad which steals their information.Also, the another reason for the rise in cyber threats could be that most of the people were working from home so they had weaker IT security than corporate network security.

fig<a> :New phishing (scam) covid templates by week
Image Courtesy: www.beazley.com
Source:knowBe4

Types of Malwares

- Adware: Adware is a program which redirects the user to advertisement pages while the user is surfing on the web or even connected to the internet.
- Spyware: Spyware is deployed by hackers into the systems to keep a check of the system files,personal information,login credentials and also intellectual properties.
- Trojan: Trojan or Trojan horse is a type of malware which can secretly enter our system with some legitimate software and gain access to our system files.It can also copy /modify/block or even delete the data.
- Ransomware: It is a malicious software which infects the system and the only way to open the system/ access our files is to give the ransom as demanded by the hackers.
- Viruses and worms: It can be defined as malicious software that has the ability to self duplicate themselves via local/network resources without any concern of the owner of the system.Also worms can directly penetrate the computer memory and then execute the worm code , coded by the hackers.
- Bots: Bots are nothing but robots which are used to do repetitive tasks like spamming requests to a particular website server to make their server down,steal personal information, gain total access over the computer.These infected systems are commonly referred to as zombies.
- Bugs: A software bug is deployed to gain unauthorized access to certain system.It exploits data integrity,data confidentiality,authorization of users to access the rights and other entities.
- Rootkits: It is a malicious software which allows an unwanted and unauthorized user to access and restrict the access of the data.When rootkits enter they first gain the administrative access and then they steal the administrative credentials and privileges. The most common observed this year was ransomware and that too of DJVU/STOP family. DJVU(family of specific viruses cryptoware encrypts the user files by using the AES-256 algorithm and put the extension of its own.

Related Work: DJVU/STOP4 is a family of viruses which contains more than 240+ variants.These viruses use AES(advanced encryption standard)-256 algorithm(CFB mode).CFB mode stands for Ciphertext feedback mode. These types of viruses can't encrypt the whole file , but approximately encrypts nearly 5MB of the beginning. KASP virus belongs to DJVU/STOP4 ransomware family. [Brendan Smith, 2020].The Kasp ransomware can only encrypt the first 150KB of files. So if you have a big mp4 file you can play it through media players(for example Winamp) but the first 3-6 seconds(the encrypted portion) would be missing.

Some of the common variants of viruses are: COPA Virus (.copa extensions),KOLZ VIRUS (.kolz extensions) ,Ogdo Virus (.ogdo extensions),KASP Virus (.KASP extensions) ,Boop Virus Ransomware(.BOOP extensions),Vari Virus (.VARI extensions),OONN VIRUS (.oonn extensions) .The best part is that the working of these viruses are nearly the same which makes it easy to remove it and recover data.My pc was infected with .kasp and at that time I was unaware of this ransomware so didn't find any other alternative rather than formatting the pc.But by doing research I found out some working methods which I proposed below - to identify the mode of virus, remove the virus ,and also to recover data. Following are the associated files:%LocalAppData%\[guid]\[random_numbers]tmp.exe ,%LocalAppData%\[guid]\4.exe,%LocalAppData%\[guid]\2.exe,%LocalAppData%\[guid]\3.exe, %LocalAppData%\[guid]\updatewin.exe.

Proposed Methods

How does the virus enter?

1. Many users experienced that the cryptoware is injected after downloading unethical/crack version of applications,games,modded apks, pirated softwares/ torrent files,and even crack key of MS Windows / MS Office (example: KMSPico,KMSAuto Net ,etc.) distributed by the hackers through dark/pirated websites.The other means can be weak RDP(remote desk protocol)configuration which enables remote connection to other system, via email spam and infected attachments, downloads from malicious/ infected websites, exploits, web injectors, fake/faulty updates,etc.[Brendan Smith, 2020]
2. The below-mentioned extensions can be encrypted by these viruses. MS Office or OpenOffice documents, .PDF and .txt(text files), databases, photos(jpg/jpeg), mp3(music), mp4(video), archives,.exe (application files), etc.
3. After infection these types of files will be stored in all folders which demand ransom in exchange for the decryption key.In this file they give their contact information for obtaining ransom (490$ to 980$ for this type DJVU/STOP) !!!OPEN_ME!!!,_readme.txt or _open_\DATA_FILES.txt,!!!CLICK_ME!!!

*In my case it was _readme.txt.

Working of the viruses[DJVU/STOP family]

- Command-and-Control [C&C] server is a method in which systems can be controlled by a cybercriminal .This cyber criminal sends commands and in return it receives stolen data from a target system/network using cloud-based services, such as file-sharing services,webmail.
- C&C servers also serve as the headquarters for infected machines in a botnet.The systems used by botnets follow these three models: the centralized model, the peer-to-peer [P2P] model, and the random model.
- Besides this just the presence of C&C the applications may also crash and the resources/data files can be misused.

Detection whether the decryption is offline/online

- Open PC in safe mode>>>uncheck the hide system file option of This PC folder options(view menu)>>>Open the PersonalId on location C:\ SystemId\PersonalId
- If the file contains the codes with ending t1 that means the encryption key is offline otherwise online.
- ex:**********t1 (* can be any character/ number) - offline.
- If the encryption key is online try to avoid internet connection till the virus is not removed .Also the retrieval of the original file is impossible even the super computer will take 1,00,000 years to decrypt the files.But you can recover the useful data.
- If the encryption key is offline, data recovery is comparatively easy.

Virus Removal method: To remove viruses there are two methods - Auto and Manual(for offline decryption). Auto method involves installing the well-paid anti malware software like MalwareBytes, Emsisoft anti malware. Just run the scan it will detect the viruses and just remove them.Now your system is free from viruses.

Antivirus scan reports(trojan names): Api.2ip.ua,Morgem.ru ; Antivirus detection: Troj/Emotet-CNM,Trojan.Agent.EWXA,Trojan.Agent.EWXL,Trojan.Agent.EWXC,Win32/Emotet.CB,Trojan.Emotet.ALX,Trojan-Banker.Win32.Emotet.pef,MSIL/Kryptik.XWJ,Trojan:MSIL/NanoBot.D!MTB

Manual Methods:

Disclaimer:As we are going to delete the malicious programs manually make a restore point because we are dealing with system and registry files.Also if in case you delete the incorrect file you should keep the scope to correct the mistake.

a. Manually deleting method:

Delete the following files

i. Go to location >>C:\Windows\System32\drivers\etc\ hosts and delete the last added IP(internet protocol).

ii. Open Task scheduler >>If the Time Trigger task is present delete it.

Open Task Manager >>In startup disable all malicious programs>>go to the file location change the access from the properties and delete it.

iii. Click windows button + R >> Use command regedit to open registry editor and delete the unwanted registry files which are added by the virus from the following locations.

HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\SysHelper
HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run
HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run
HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunOne
HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunOnce

b. If you have restore point (which should obviously be before the infection date),Then your work becomes easy you can directly restore the system to that restore point date (mean your restore point will work as a checkpoint).Just select the date and click restore.Your system will now become the past system i.e malware free.In this process if you had made any changes,downloads between the restore point date and till now then that progress will also lost. [The above method is applicable only for offline decryption because when the decryption is online it deletes all the restore points].

Results And Discussions:

By following procedure we can decrypt the files and recover the data:

Data Recovery / Decrypt files
Offline files decryption: Just install Emsisoft decrypter tool like a normal software from. Open it and select the drive where your encrypted files are present.Then choose the target location where the recovered files would be stored Recommended : external drive like pendrive ,harddisk,etc.

> System Restore point (is available)

If this is the case then download shadow explorer and install it.Then open it and select the appropriate restore point.By this all the files which contain images ,videos,docs,etc will change to that specified date files and would easily get decrypted.

> Generalised Methods(for offline as well as online decryption)

i] Using PhotoRec software: In beginning remove the extension which was imposed by the virus in my case it was .kasp For example img.jpg.kasp>>>img.jpg Then download and install the testdisk software and then run qphotorec application qphotorec.It can recognize and recover 480 file extensions (which are nearly about 300 file families)including jpg,mp3,mp4,docs,.pdf,etc. Choose the target location where the recovered file would be saved.[Recommended : Use an external disk to take recovered files like hard disks,pen drives,etc].

ii] For recovering pdf files: You can just go to ILOVEPDF website where a pdf repair tool is present where we have to import the pdf file removing the malicious extension. Then download it and save it in an eternal disk.It will now open like before.

iii] For recovering psd,word,sql,excel,zip files using DataNumen: Just remove the malicious extension and now install DataNumen. Select the file and location and click on repair .Now go to any certain online editing website according to the files(extensions)

Example: For a psd file I will go to a photo editing website like photopea from there I will select the recovered psd file(output of datanumen) then I can download it or store it on the cloud.

Note: PhotoRec recognizes .word pdf .pdf extension as well but still I mentioned a particular method that is DataNumen and iLovePDF website for efficiency.

CONCLUSION

As we learned many types of viruses some can be removable,irremovable,mendable or even irremediable so it is better to be on the safe side and practice the following measures to remain aways from malwares.-When infected just take the system disc backup because it takes time to affect/modify data files.-Employ multi-factor authentication on all remote access points into an enterprise network to secure or disable remote desktop protocol (RDP) access[Thomas Roccia, 2020].-Use penetration testing to identify weak points in networks..-Backup all your important files, and store them independently from your system (e.g. in the cloud, on an external drive).-Always check and verify that you are on a company's legitimate website before entering your login details/sensitive information.-Ensure you have the latest legit anti-virus software installed on your computer and mobile devices.-Ensure secure email gateways to thwart threats via spam;Make your home network secure.-Disable third-party or outdated components of programs that could be entry points for malwares; Check regularly and update the privacy settings on your social media accounts.-Update passwords and ensure they are strong enough (a mix of uppercase, lowercase, numbers and special characters).-Do not click on links or open attachments in emails which seem unfamiliar to the subject /sender.

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A Review Paper on Contextual Information Retrieval

Charvi Sanjay Suri
[1]*Shri Ramdeobaba College of Engineering and Management, Computer Science, Nagpur, India*

ABSTRACT

In a world where data is multiplying at a fierce rate, getting results of the queries from the whole stack of data is a tough job. In addition to that various words or phrases have multiple meanings and references. To get the result of such preference gets tougher with every step. Therefore, to get the desired results contextual information retrieval is used. There has been substantial growth in this subject and further studies are still going on. This paper gives an overview of some milestone researcher's studies which have made the search issues next to minimal.

KEY WORDS: CONTEXT, INFORMATION RETRIEVAL, CONTEXT PROCESSING, NATURAL LANGUAGE PROCESSING.

INTRODUCTION

There is an immense growth in the electronic data on the World Wide Web (WWW) and to make sure that the correct set of information is extracted, there is a need to make use of certain technics; one such technic is information retrieval. Even if the extracted information needed from the web is found, there is a chance it might be in a different context, not the one asked in our query. For Example, Taj can be a hotel in Mumbai, the seventh wonder of the world, the monument Taj Mahal in Agra, or the tea brand Taj we all love. To solve this issue we need to focus on contextual information retrieval. This technique will help to find an exact match of the query in a big stack of data on the internet.

Everybody around the world will be benefitted from growth in contextual information retrieval. The main use of it is to give exact results of the query asked for and refine the other results which are out of context.

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The basic goal of this paper is to present an overview of the experimental and theoretical works which directs the context in information retrieval.

Related Work: There has been much advancement in the field of contextual information retrieval over the years and some of them are mentioned in this review paper.

In (1987) Willam Collins developed the Cobuild English Language Dictionary, in which the established meanings of the term include:

1. The context of anything consists of the ideas, situations, events, or information that can relate to it and make it possible to understand.
2. If a statement is seen in context, it is considered with all the factors that are related to it rather than considered on everything it is supposed to mean so that it can easily be understood.
3. If a question, remark, statement, or anything else are taken or quoted out of context, it is only considered on its own, and the circumstances in which it was said are usually ignored. Therefore, it seems to mean something different from the intended meaning. [William Collins, 1987]

In (2000) based on the categories of context and the entities in which the context is evaluated the content information is classified by Dey & Abowd.

Those 3 entities are given as follows:
1. Places (topographical space),
2. People (with their location, in groups or individual),
3. Things (Tangible objects or applications). [Dey. A.K, 2000]

In (2002) Context was explained in 5 categories by Goker & Myrhaug as follows:

1. The environmental context, surrounding the user is in, like temperature, people, services, noise, and things.
2. The Spatial-temporal context that recognizes the spatial extent and time of the user.
3. The personal context tells us about the mental and physical information of the user.
4. The task context describes what the user working is on like his activities, tasks, and goals.
5. The social context tells us about the current social aspects of the user such as his friend's neighbors, allies, and co-workers. [Goker A, 2002]

In (2008) Mansourian pinpointed certain categories that were considered as main contextual elements that affect the search performance of users. Those 5 categories are as follows:
1. Web user's characteristics, it is divided into 3 sub-classes,
(a) Thoughts,
(b) Feelings,
(c) Actions of the user while searching.

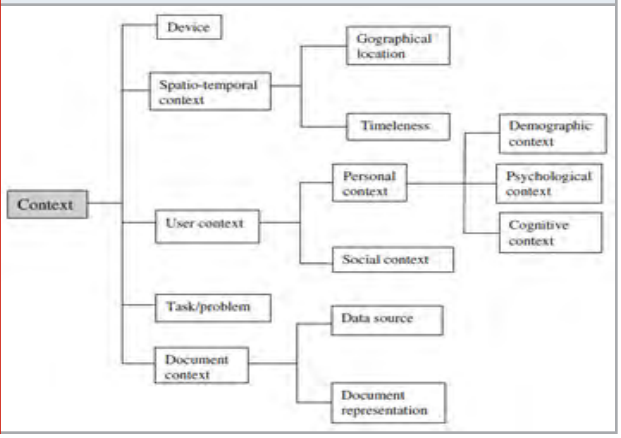
Even after completing the search, checking whether the search is done is giving valid or invalid results,

(2) The Type of the search engine,
(3) The Topic to be searched, whether it is related to the user's work or a daily life search.
(4) The situation in which the search is done which is also divided into 4 sub-classes
(a) Immediate search
(b) Type of search
(c) Place of search
(d) Importance of search.
(5) Features of the retrieved information resources, subdivided into 3 categories
(a) Ability to search
(b) Provision level
(c) Format of presentation. [Mansourian Y.,2008]

The context in information retrieval can be defined in many ways. There is no particular definition to cover the whole notion of context. In general terms, context can be defined as an important association of the user , interaction and object to the query or search words we put forth. [John D. Bransford, 2002] Discussion on the context in information retrieval is done in this paper. In the case of seeking and retrieving information, context can be referred to as whole data, applications, metadata and cognitive structures. All these data have an effect on the user's behavior and perception of relevance.

The interaction between user and system consists of a rich repository of possible or probable information on preferences, usage, experience, interests, and knowledge. [Ingwersen P, 2005] The context of the interaction is represented by information repository which is looked up for the source of evidence that allows user's information that needs to get captured precisely. It also helps to measure the relevance of supplied information with more specifications. Therefore, the estimation of relevance of the system can rely on both user's context- document accuracy as well as the results of query- document matching.

Figure 1: The multi-dimensional concept of context in IR [Tamine L.,2009]



In (2009) Tamine, Boughanem and Daoud classified context into various categories as given in the figure (Fig.1) above. The context depends on:

(1) Device: A device helps us to access the user's information, like what kind of tool they are working on (e.g.) a computer, a mobile phone, a tablet, etc. Various devices have different characteristics and have their advantages and disadvantages. Using a mobile phone can get us fast results, but the queries might be ambiguous. On the other side, queries on a computer might process a little slow but will have a high level of interaction, and memory resources are huge. This makes the revival more sophisticated and gives apt outputs.

(2) Task/problem: The main goal of it is to decide what kind of search is to be made, facts are to be found or complete detail or an article is required here. There are various kinds of tasks in web search as transactional, exploration, navigational, or informational. It mainly acquires information about the location of the user. Just like maps in taxis helps the driver to get to the desired location.

(3) Spatial- temporal context: Given in the name itself, it consists of details about the geographical location and time. This provides us with information that addresses the user's situation in spatial-temporal applications. Just like in networks routing, and tourist guide applications, the data or query objects vary their location frequently.

(4) User context: It contains all the personal and social details about the user.
(a) Personal Context:

1. Demographic Context: To customize the search, attributes such as language (English, Hindi, Hinglish, etc.) and gender (Male or female) are used.
2. Psychological Context: The mindset with which the user is searching the query also matters a lot. If the search is made quickly, it might be a result of anxiety and frustration, or if a person is calm and poised the searches are more accurate and fine. User's effective characteristics play an important role in influencing information-seeking behavior and its relevance assessments.
3. Cognitive Context: This is the most crucial dimension which leads most of the search queries. It checks whether the user's interest and user's levels of expertise are short-termed or long-termed.
4. (b) Social context: User's community is a great factor to look upon when we talk about social context. User's friends, colleagues, enemies as well as neighbors all come in this category. Recommendations are given while a search is based on these collaborative filtering techniques. These techniques are based on previously made searches, preferences, and similar users. The user community affects searches on a major scale.
5. Document context: There are two main sub-dimensions that could characterize the document context. The first one talks about the perception of the users on data source characteristic. The other talks about the document substitutes (relevant text fragments) such as form, colors, structural elements, citations, metadata. This tells us about how the document is designed (fonts, title, header, footer, paragraphs, words, style, layout) and the content of it.

DISCUSSION AND RECOMMENDATION

The contextual information retrieval is a vast topic to work on but it completely based on a few principles. All the studies show that context revolves around a person's life, choices, people around him, etc. According to Willam Collins, the context of anything consists of the ideas, situations, events, or information that can relate to it and make it possible to understand. Also if a question, remark, statement, or anything else are taken or quoted out of context, it is only considered on its own, and the circumstances in which it was said are usually ignored. On the other hand, Dev & Abowd explains contexts as entities which are places, people, and things. Whereas Goker & Myrhaug has divided context into five categories which explains that environment and social structure have a very important role while deciding the context. Mansourian put forth a new aspect in front by telling the type of search engine can also affect the search. The ability of search, provision level, and format of presentation is equally important as feelings and social network of the user.

Tamine, Boughanem, and Daoud added to the studies that the device, as well as the data resource from which we extract the query, is of great importance too. All of the above researchers have put forth their valuable studies and cleared the concept of contextual information retrieval for future researchers interested to work in this area. The recommendation made is as follow, prediction of the searches from the current trends is going on the whole internet. For Example A meme is spread via the Internet, often through social media platforms and especially for humorous purposes. Many company brands use meme strategies for getting more market for their product. One of such example is the "Rasode me kon tha" meme. It brought back the show "Saath Nibhana Sathiya" back into the picture. When this meme was on-trend whenever a person wrote "R" on google search, the first option that came to picture was the "Rasode me kon tha" meme. It was the most searched topic on the internet. There might be a possibility that a person who does not know about it will search about it. So we can cross-refer social media trends for getting a proper context.

CONCLUSION

The context has been a vital part of everybody's search and it provides an overview of its various definitions. It has been divided into different categories and discussed what factors are important to identify the context. In the end, a concept has been proposed that the trend going on social media needs to be considered while knowing the context. There has been a lot of work done in finding out what factors affect the context, now we should focus on solving the problems that come alongside when we do not get the results right.

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Accident Detection and Emergency Alerting System for Road Safety

Dilipkumar A. Borikar[1*] and Manoj B. Chandak[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

ABSTRACT

On road accidents is a key issue for road safety and is a major source of loss of lives both of the drivers and commuters. Even with all modern developments in the field of vehicle design, road lane design and management, accidents are still more common. Timely accident detection and the concurrent action in providing emergency health care to the victims are necessary to ensure road safety. This may be ensured by informing an emergency healthcare and administration units like hospitals and police stations about the accident on priority. Road traffic accidents contribute to large number of deaths world-wide every year. In these cases it is necessary to inform the family members in time and seek healthcare assistance at the earliest. Unfortunately, in many cases either the family members are communicated very late or the emergency services reach the spot at a delayed time. The delay in attending the accident victims, informing the concerned authorities and family and in mobilization of ambulance services for relocating the victims for immediate healthcare lead to casualty and many a times to fatal injuries. This paper proposes real-time accident detection and alerting system that uses smartphones. Every smartphone has number of sensors embedded in its design. Our system makes use of few of these commonly available sensors across all smartphones to build a web application for remote monitoring. The system will provide faster response time in locating and mobilizing the emergency services for the victims. When the system detects an accident it alerts the nearest emergency station like police administration, healthcare service and ambulance operators of the same. It also provides real time tracking for these emergency service providers.

KEY WORDS: ROAD SAFETY, ACCIDENT DETECTION, EMERGENCY ALERTING SYSTEM, HEALTHCARE, G-FORCE.

INTRODUCTION

Now-a-days, due to increased traffic and human recklessness, there has been a huge rise in road accidents. Many-a-times, these accidents either remain unnoticed or are addressed late as they occur in isolated locations. The local public and health administration that include nearby police station, hospitals and ambulance service NGOs, are not informed in time and it results in delayed assistance to the victim. This demand for immediate and timely identification and localization of such events and providing necessary assistance in saving lives of victims.

In the existing systems the external hardware intervention has been the major source of difficulties. These systems are costly and are high on maintenance that is attributed to the hardware centric solution. Accident detection and emergency alerting system is an application that can be remotely accessed for alerting the public and official authorities such as police, healthcare services and paramedical services such as ambulance when an accident occurs.

The proposed system focuses on reducing the time of accident detection and increasing the chances of

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emergency services assistance for the victim. On detecting an accident the system will alert the nearest emergency service provider and public administration about the location of the accident seeking immediate help. The servicing party on receiving exact details of accident may track the accident spot using Google map through this system and provide timely assistance to the accident victim.

According to the World Health Organization, 1.35 million deaths were estimated per year (approximately 4 casualties every minute). The major reason is not the criticality of an accident; rather it is the delay in emergency assistance.

The proposed system aims

- To identify the accident and its severity and to make the nearby authorities aware of the case.
- To alert the public authorities nearest to the site of accident so that the accident gets noticed as soon as possible.
- To detect the accident accurately and send alerts.
- To record driving habits of vehicle owner and driver and to assess the driver while the vehicle is on the road.

MATERIAL AND METHODS

Smartphones are being used extensively in applications that identify road traffic accidents. A variety of algorithms and techniques use accelerometer and GPS to detect vehicle accidents. Zaldivar, et, al., has demonstrated a system incorporating smartphone as primate device coupled with ODB-II connections in the vehicles. Their system sends SMS containing particulars of accident to emergency contacts specified by the user when an accident has been detected [Jorge Zaldivar, 2011]. Simultaneously, a call to the emergency services is made automatically. ODB-II connections is common among all most every modern vehicle that can transfer vehicle parameters such as acceleration, oil pressure, speed, etc., in real-time.

Alwan and Ali have proposed an accident detection and notification system for cars that uses smartphones. Their systems consider the high speed of the moving vehicle as the most important parameter in confirming the possibility of an accident. This is due to the fact that major accidents are caused due to over speeding. The have used GPS in smartphone to track the speed of vehicle and the G-force value obtained through accelerometer of the smartphone. This system has been reported to provide encouraging results [Zainab S. Alwan, 2015].

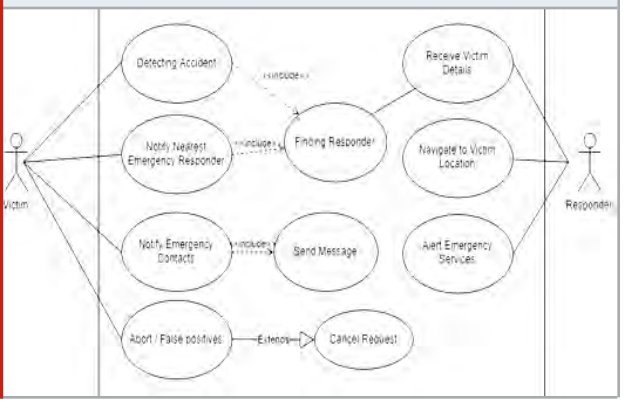
White, Thompson and others have demonstrated a system using smartphones for automatic detection and notification of traffic accidents in US [Jules White, 2011]. Their system uses accelerometer and acoustic data collected from smartphones to alert the emergency services by sending accident data records via VOIP communication channels. They have dealt with combining sensors and context data, communication channels and web services to effectively detect a traffic accident and spreading awareness of the situation to emergency respondents.

The application for detection of accidents and alerting to concern parties incorporates following tasks and services:

1. Localization: Accident alerts are sent to the nearest control station such as police station on the very first moment of collision. This results in reduction of late emergency services. Use of GPS helps in giving the precise location results so that the rescue team can be reached to the site of accident easily.
2. Rescue notifications: Alerting system notifies the contacts and also the nearest population to the victim so that supervision or aid can be received immediately.
3. Consideration of multiple factors: To achieve accuracy for accident detection and to reduce the false positive scenarios, the system takes various environmental cases and parameters as input. These environmental factors are calculated with the help of android device based sensors.

The Proposed System: The system accounts for improvisation of the accident alerting and benefits the user in many different ways. Different functionalities of the systems are depicted in Fig. 1. The activity diagram detailing the sequencing of actions is shown in Fig. 2.

Figure 1: Accident Detection & Alerting System Use Case



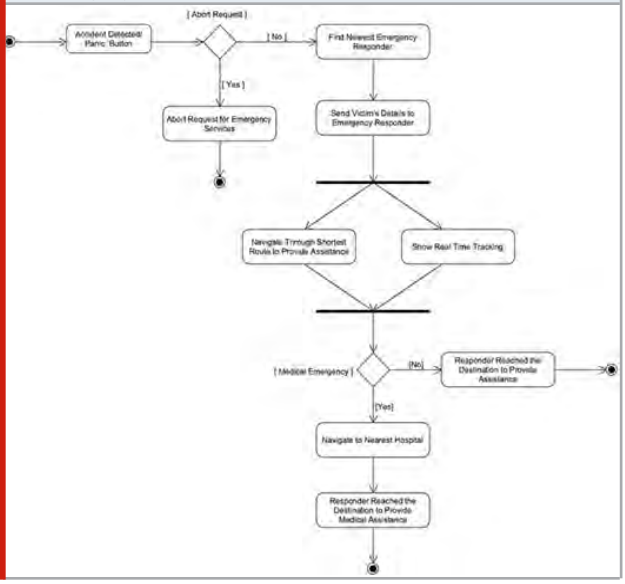
Moreover, the current system improvises on the existing systems on following parameters:

- Hardware independent: The current system is based on mobile based sensors and requires less or no dependency on external hardware, thus free from wear and tear.
- Cost effective: The existing systems are costly and require quite maintenance as they are hardware based. Due to no such dependency in this system, accessibility to the application is quite cheap and easier.
- Localized real time notifications: Accident alerts are given to the nearest control station such as police station on the very first moment of collision. This results in reduction of late emergency services.

Cellular network usage is the key to notification and thus, is faster unlike system.

- Multiple factor consideration: The system takes various environmental cases and parameters as input. These environmental factors are calculated with the help of android device based sensors instead of IoT based sensors. These parameters altogether make the detection and alerting mechanism effective which results in lesser false positives.

Figure 2: Activity diagram for Accident Detection & Alerting System



RESULTS AND DISCUSSION

In the road traffic accident when an impact is severe, the system based on collected parameters from the smartphone sensors detects the accident. At the accident victim's end, the victim is usually not in a position to contact the public administrative service or healthcare service due to lack of information. From the victim's perspective the system on detecting the accident sends emergency alert to nearest emergency service provider and the family members listed in the emergency contacts.

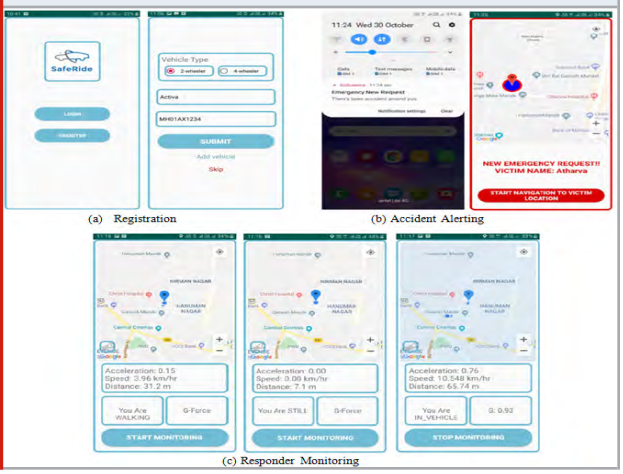
Table 1. G-Force finding

Height (in centimeters)	G-Force value		
	Maximum	Minimum	Average
10	2.4846214	1.1262852	1.8054533
15	2.5383567	1.2018174	1.8850871
30	2.9815913	1.7661392	2.3738652
40	3.3154914	2.0415938	2.6285426

At the service provider end, the details about the time of accident, the location parameters (using GPS) such as longitudes and latitudes of the accident spot are received when the system detect an accident. This real time alert to service provider helps them to mobilize the resources including ambulance services in time. They may track the mobilization of assistance to the accident spot in real-time. Tests were conducted where the smartphone was subjected to undergo abrupt situation like hard shake, or motion to notice the G-force value changes. Few tests involved dropping of smartphone from height of 10, 15, 30 and 40 centimetres to record the variation in g-force values. The results are shown in Table-1.

The maximum G-force value was recorded when the smartphone was dropped from a height of 40 centimetres. The proposed system generates an alert if the G-force value exceeds 4g. It was observed in fatal accident the vehicle subjected to it had recorded the G-force value in excess of 4g. Therefore, 4g was considered as threshold value in generating emergency alerts. This value serves to detect occurrence of an accident. It may be used to differentiate the false positives that may be reported when the smartphone is dropped from a certain height and/or the vehicle stops when the brakes are applied suddenly. The system snapshots depicting the activities on the user end on smartphone are shown in Fig. 3.

Figure 3: Working of the system



CONCLUSION

The proposed system aims to reduce the fatality in road traffic accidents. It incorporates the use of smartphone sensors such as accelerometer to decide whether or not the emergent situation is an accident. If the system detects the situation as accident, it alerts the nearby service provider that includes public administration such as police station and healthcare services like hospitals and ambulance services. This system bridges the requirements of the accident victims in localizing and alerting the public authority and for servicing agencies to track the emergent situation by mobilizing assistance. The system serves to better the survival rate of the victims in road traffic accidents. The proposed improvements to this system include – employing an acceleration filter that ignores G-force values below 4g, and maintaining a count-down time alert which will allow the victim to

cancel the alert within 15 seconds when a false alert is generated in exceptional cases. The system may provide better and more accurate assistance for road safety if additional sensors like gyroscope, microphone, camera and a voice recognition module can be integrated into it.

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Detection of Steganography Using Convolution Neural Network Machine Learning Method Over Wireless Network

Devishree Naidu[1*], and Shubhangi Tirpude[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, India*

ABSTRACT

Steganography is the science of storing information secretly by embedding it in media (e.g. Images). Steganalysis can apparently be described as the opposite of Steganography. The strength of steganography algorithms is a trade of how well steganalysis of the encrypted file is done. Steganalysis algorithms helps in improving the image robustness to resist detection of steganography. Traditional approaches of detection are mostly human based. There exists several steganalysis consisting of image examinations or humanoid graphic that includes inspection for detecting whether a file contains hidden message using steganography algorithm. These approaches are very delicate, a miniscule change in algorithm can render a steganalysis approach useless. An approach of steganalysis using machine learning algorithms can foresee the capabilities of human observation skills to be a harbinger for steganalysis. launching dictionary attacks for such framework is quite communal this includes knowledge of distributed computing. In Machine Learning approach, canvas formally used as representation form of any media file wherein available spaces can be used to hide informative messages. The distinguishable features get improved from clean to stego-bearing files which then goes under processing. The proposed method seamlessly explores the use of machine learning CNN scheme that are used to distinguish clean and stego-bearing files.

KEY WORDS: STEGANALYSIS, STEGANOGRAPHY, DISCRETE WAVELET TRANSFORMATION, MARKOV CHAINS, CNN.

INTRODUCTION

Many investigations are closely deliberately conveying that terrorists are using steganography to hide their communication from law enforcement. There isn't a way to verify these claims as per technical information is concerned. However, number of new sources intellect about hiding of messages inside images that are posted on internet public sales sites like Amazon, FlipKart, or eBay. Detecting and preventing data leakage is one of the most important things. Especially, in terms of corporate networks, it is observed that the significance of this issue increased lately. Many open-source Data Prevention solutions are used to prevent data from thieves.

Steganography is the way to hide the secret messages. Messages can be hidden in images or any other digital objects. To any unpremeditated spectator inspecting these steganographic images, the messages are invisible. It seems to be similar to cryptography but they are different. The most important difference is that; in cryptography, while data is being transferred, data encryption is seen by someone, but in steganography, the transferred secret data cannot be directly recognized by someone. We focus not only on hiding messages but also the hidden messages sent should go undetected. Steganography supports hiding messages amongst the huge volume of Internet traffic. The process of detecting embedded messages stored in any digital media is known as steganalysis, as identified by steganographic methods, and performing steganalysis technique this is referred as attack. It focuses on breaking

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the security of steganography. The original content of file identification and creating statistical experimental setup for signature detection evolves current state of art. The messages which are hidden are characteristically placed in images or digital-media files.

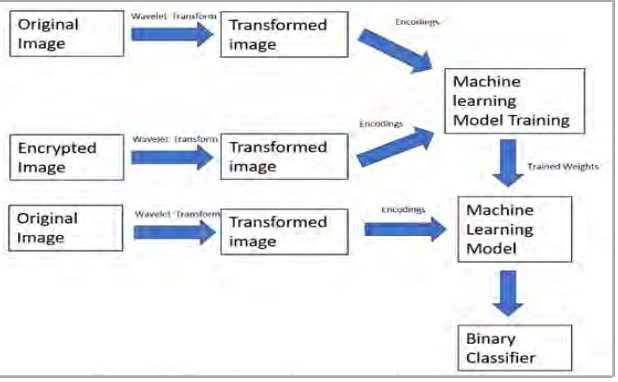
Machine Learning and Data Mining application are difficult due to its variation in size of files and its varying formats. Typically, JPEG/MPEG results into lossy compression whereas GIF uses lossless representation for efficient indexing. This makes a difference for its difficult representation. Our approach is quite appropriate to many media and makes the images or media to be used as canvas i.e. hidden messages can be made easily available to be written in the files. We can then apply Standard machine algorithms to detect steganography in both the formats as JPEG and GIF. Applying Machine Learning algorithms our experimental shows that This particular approach supports capability in detecting hidden messages in all types of file formats. It is a very difficult task to design such tools to automate pattern recognition that uses complex domain analysis. It is with various examination and several experimental observations, we analyzed that how concealed image can be detected using steganography algorithm.

Literature Review: Fast Fourier transformation forms the basis understanding of DCT method, and is known for best standard for JPEG due to its significant reasoning. One important reason is, it has capability to pack entire energy in its low frequency, image data and second one is reduced blocking effect which enables sub-image boundaries to get visible. Block pixel calculation is carried out by converting the raster data into 8 x 8 blocks of pixels extraction for JPEG. Each block further gets compressed by Huffman encoding, in most cases process results into Lossy Compression and it representation may allow in varying degree. It means that we cannot recreate the exact original image, typically its due to loss of information while applying compression algorithm. DCT Transformation can lead to different levels of compression owing to its varying severity. In comparison we follow another technique as optimized Discrete wavelet Transform where decomposed image undergoes with manipulating the transform coefficient to hide the secret information that are also subjected to various types of attack related to image processing.

A. Technique for Image Embedding: All types of traditional image steganography methods are mostly based on embedding technique. We can embed the secret information using particular image carrier by applying some modification, the main focus of our research is to keep embedding distortion to be at minimum level and improving its capacity by means of technique such as least significant matching (LSB) as proposed. Many techniques are into practice, they include highly undetectable stego (HUSGO) and subtractive pixel adjacent Matrix (SPAM) representation. These methods have been designed principally based on minimum distortion function. It is usually according to the weighted total summation of vector feature image, extracted from covered image and its modified one. A scheme called as wavelet obtained weight (WOW) that involve maximum gain of covered images including rule-based texture modification with more pixel value. A source-based technique named as S-UNIWARD also works in a similar manner with noisy based multifaceted surface section. In the existing internet communication, much of confidential information needs rigorous protection and with the advent of larger threats that are concerned with origin content under embedding technique, the steganalysis capability have been improved a lot by using Machine learning approaches and the way statistical analysis gets performed.

B. Expansion of Steganalysis: An extension of the spatial rich model for the steganalysis of color images a novel approach of SWE based on deep convolution adversarial network has been introduced by mapping secret into noise vector and thereby giving training to network model for generating carrier image based on noise vector using extractor.. As a security concern sometimes encrypted images hidden message on the cloud can undergo steganalysis, in such cases authentication dependencies for retrieval of information may change the entire embedding that creates a noise and are difficult to detect. Stego signal are very much similar to noise like pattern which can be captured from learned illustration for feature visualization in such cases deep models are preferrable to be more focused onto steganalysis automation. A hybrid deep-learning framework is proposed for JPEG image steganalysis that makes use of three phases as Convolution, Quantization, and Truncation for training model parameters can be applied to confidential message for authentication as an extension.

Figure 3: Flow Control of proposed methodology

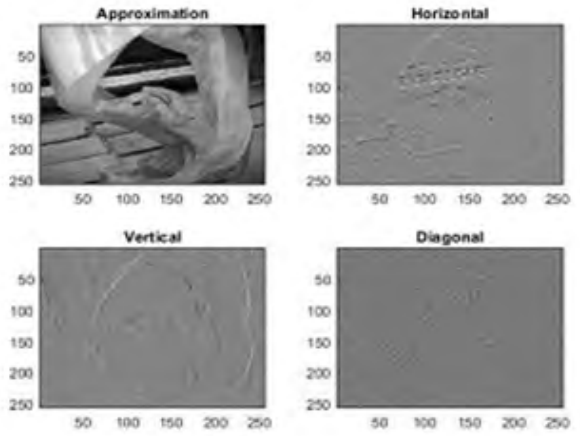


Proposed Approach: The first and important part of our approach contains application of wavelet transformation on the provided image and its non-processed image. From this we can obtain an assumption of the deviation occurring in the steganography. The wavelet transform (WT) uses a type of mapping from L2(R) → L2(R2), if we compare it with spaced time-frequency localization, wavelet transform, the time frequency is most superior where transform invertibility is more focused. Normally it follows same algorithm used for 1D as 2-D wavelet for decomposition purpose. The way scaling function and

vector wavelet works here it makes a difference. Moreover two-dimensional DWT leads to a decomposition of guesstimate coefficients at level j in four constituents: the approximation is at level j + 1, and the details in three orientations (horizontal, vertical, and diagonal).

The reconstruction of a signal from its transform values are dependent on unevenness grid samples but on a similar line oversampling may result into information loss for which framing concept is very much appreciated for addressing the issues. The image below in the Figure 1. portrays the basic breakdown steps for images. The design of DWT requires that scaling vector to be satisfied for the constraint of invertibility and the system applies these vectors as discrete convolution kernel for its implementation.

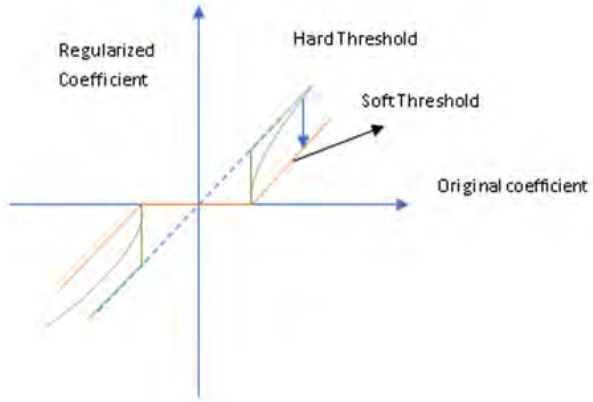
Figure 2: Single-level discrete 2-D wavelet transform



The training data would be the deviations being observed in the steganalysis. On feeding the machine learning algorithm with these data we can generate a model which can create rules to detect steganography in the given images. The model will be further annotated with a binary classifier which will confirm steganographically processed image.

Experimental Results and Analysis: The main goal of this experiment is to determine the fact that Machine learning Techniques and mining process can it be combinedly identifies whether messages are hidden using a specific steganography technique. As in Figure 3 transformation performance includes the outcome of transformation coefficient to hide the secret which involves the analysis needs to be drawn from the hard and soft threshold to get the original coefficient. Techniques required for statistical major attacks against steganography needs to be updated frequently. We can create good learning models for existing steganography by making use of datamining methods and deep learning methods. They can be trained to successfully attack on variety of steganography which includes formerly invisible disparities of existing techniques. In order to prove that steganalysis algorithm used for forensic investigation offered by CNN can also resist detection from the created stego images by the prescribe method.

Figure 5: Transformation Steganalysis Performance



We experimented on 2D wavelet transformation images and applied machine learning based method for further binary classifier processed image and realized a unique way to detect the rules for steganalysis for better result. The method also allows to check that clean and stego bearing files are distinguishable. The detection accuracy is turned out to be 0.98 which is not low it means this approach shows good detection capability that is desired for forensic analysis.

CONCLUSION

Our approach provides the solution that mainly focuses into stego analysis related to image steganography to detect clear media files for canvas features. We consider wavelet transformation as an application. As the internet services are being available easily at cheap costs to the masses, it is becoming easier to hide information for unethical activities. On similar platform we can hide the information over videos. An extension from images to videos can be thought for further consideration. Also, the scalability and optimization of the method needs to be worked on for large scale to be used over millions of search data at a time to cover at all the ground. use unsupervised anomaly detection approaches to steganalysis. On improvisation of the model and acquisition of computing resources we can also look forward to use steganographic approaches for video steganography detection. This trivial contribution towards data breaching and data security can be materialized by acquiring more training data, with this we forestall being able to extend this work to these approaches should be able to identify and differentiate between stego bearing files and clean media files.

All this is performed without having a knowledge of steganography technique that was used and hence should also able to detect steganography hidden messages using more advanced algorithms. This conveys strongly exciting potential to surpass the current fragile nature of modern steganalysis – it may be possible to identify

that a file has a hidden message, that is unidentifiable due to formerly unobserved steganography algorithm. Nevertheless, steganalysis and forensics methods can be used in real-world applications, by keeping our method secret for the required training set. During pandemic situation lot of medical image information that are confidential to be treated and in case there is a cyber-attack then this kind of analysis is certainly be useful. In future it can be implemented with more improved learning.

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Provisioning of Optimized Cab Services in Secured Blockchain Framework

Manoj B. Chandak
Department of Computer Science and Engineering Shri Ramdeobaba College of Engineering and Management, Nagpur, India

ABSTRACT

Modern online cab booking services such as Ola and Uber are becoming increasingly popular due to ease of use and cost effectiveness. With rising popularity comes the responsibility of providing quality service to the customers. The presented research work illustrates a system that aims to provide maximum customer satisfaction by reducing the waiting time for a cab, improvising on the availability of cabs and providing data security. Availability of the cabs can be improved by reducing the distance between the locations of available cabs and the customers. One of the methods to reduce the distance is the prediction of cab bookings and ensuring availability of the cab service to the potential customer location in advance. The presented paper proposes a prediction mechanism based on a data set of social events happening in a particular region. As social events normally bring masses of participants at a location, the probability of use of cab services increases at that location. A Machine Learning (ML) model is built to predict the number of cab bookings for different areas, based on historical data & the type of participants attending the event. The predicted number of required cabs, current cab locations and event location are then used by the designed system to find the nearest drivers from the event location. The nearest drivers are notified to reach the location beforehand thereby making cabs readily available when the requirement arises. To ensure security of data in the compact system, private Blockchain network is used for data transfer and storage, making it reliable while also maintaining data integrity and confidentiality..

KEY WORDS: BLOCKCHAIN, ETHEREUM, SMART CONTRACT, MACHINE LEARNING, ARTIFICIAL NEURAL NETWORK, K-NEAREST NEIGHBOUR.

INTRODUCTION

Concept of organized rental cab was introduced to the Indian consumer market in 2004. It was first introduced by Meru cab service in major metro cities of India. Almost, after a gap of six years, app based rental cab services were introduced to the Indian consumers. Amongst various transportation modes, cab services gained popularity as they facilitate door to door service for consumers. Due to advancement in technology, operational procedures like bookings and payments got automated, which increased the overall potential of the business domain. As the popularity increased, the scarcity and non-availability of cab at desired locations also increased which resulted in escalated waiting time for the customers. The escalation was largely observed during peak business hours. After the launch of Uber services in 2013 [Rajesh (2018)], competition in the business domain intensified. Eventually the service providers started creating better and simpler automated services for the customers.

As customers became more demanding, it became a challenging job for rental cab industry to live up to the expectations. In today's world not only the price but also the quality of cab services plays an important role

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in customer satisfaction. The presented research work describes the system design, implementation and test cases to improve the quality of cab services. Hence it aims at providing maximum customer satisfaction with the help of modern technologies such as Artificial Intelligence, Machine Learning (ML) and Blockchain.

Proposed Methodology: Machine Learning for Prediction: Online cab booking services are extensively used in the modern world. The services are easily accessible anytime, anywhere by the use of a simple mobile application. After a customer books a cab, he/she has to wait for the cab to arrive. The delay in arrival depends on the distance between the customer and the cab at the time of booking. Reducing the distance reduces the waiting time and therefore improves quality of cab service. One of the ways to reduce is by the use of prediction systems. To predict the number of cab bookings from a location, prediction system makes use of historical data. The concerned cab drivers are notified beforehand which dramatically reduces and consequently reduces waiting time.

The quality of data used for prediction is of utmost importance. Therefore various cab booking patterns were observed as datasets to accurately predict the bookings. It was found that booking hotspots may form at certain locations because of events like arrival of a train at a station or some social gathering. Various such event data can be used for building the prediction system. The proposed system uses information about happenings and events in a city or locality to predict the customer cab booking at a location. Publicly available event data from a website (meetup.com) is used as a data source for the operation of system. Prediction is feasible as the number of cab bookings at a location is dependent on the number of people attending social events and gatherings near the same location.
In other words,

$$E \propto B$$

Where, Eis the number of people attending an event and is the number of cab bookings in that area.

The probable sequence of actions that a customer may take before reaching for a cab is as follows:

- Customer looks for a social event on a website and registers for it.
- On the day of the event, the customer decides to take a cab to reach the location of the event.
- After the event, the customer takes a cab to reach home/some other destination.

The presented research work mainly focuses on the 3rdaction. Data from an event portal is used to predict customers who decide to take cab from the event location. The Prediction system makes use of ML. A trained ML model with satisfactory accuracy is required for deployment. Whenever a new event appears on the event portal, the ML model must start predicting cab bookings without delay. The prediction provides an estimation of bookings from the spot around the event location. The estimation is used to send the available cab drivers to the event location in advance. For the drivers to arrive early, they are notified about the estimation around the time the event takes place. In a standard cab system, only nearby cabs are able to reach the destination in reasonable time thus only the nearest drivers are notified. K-Nearest Neighbours (KNN) algorithm is used to determine the nearest available cabs, given the required number K.

Implementation

Prediction Model: The process of building an ML model prediction system involves data selection, data extraction, data pre-processing, selecting an ML model and, finally training, evaluating and tuning a model. The first step towards building an ML model is selecting an appropriate dataset. The dataset used in the system consists of information about social events and gatherings in a city or locality. Website portals like meetup.com where users register for local events, provide a public event dataset, making them a good data source. The system makes use of public dataset provided by meetup.com which consists of various attributes and information about events. Among the various attributes available, only a few are selected based on their relationship with the required, prediction of number of cab bookings.

- Event Type like Social Gathering, Technical Workshop, Volunteering, etc (Cab bookings can depends on the type of people attending the event).
- Event Organiser ID (An organiser's reputation has an effect on the number of people attending)
- Number of Registrations (Is directly related to number of people attending)
- Positive and Negative Comments (Reputation of event has an effect on the number of people attending)
- Rating of Event

To process the public dataset further, following Python Programming Language libraries are used:

1) NumPy 2) Pandas. To build the ANN model, Keras library was used.

Blockchain: The implementation of the blockchain system involves configuring a private blockchain, writing scripts for data transfer and finally, compiling and deploying the scripts on blockchain network. For the configuration of the private blockchain network, Ganache software is used. Ganache is an in-memory virtual Ethereum blockchain network for developing and testing blockchain Applications locally. It is configured to create some virtual blockchain accounts (Blockchain IDs) and a port is specified to listen for blockchain requests. Each virtual account consists of a Public-Private Key pair.

After configuring Ganache, the next step is to write a script that enables data transfer via blockchain network i.e a Smart Contract. A Smart Contract is a self-executing Contract with a set of defined tasks and functions to

perform. The code contained in a Smart Contract exists across the nodes in distributed blockchain network after its deployment. The code controls process execution and makes the transactions trackable and irreversible. The Smart Contract is written in a high level Object Oriented Language called Solidity. It is then compiled into bytecode and deployed on the blockchain network.

In the system presented, a Solidity file "CabService.sol" is used. The structure of the solidity file includes CabService as "contract". In the "CabService.sol" file, the function "sendLocation" is used to interact with blockchain. The main task of the "sendLocation" function is to transfer location data to the blockchain network. The function has id and location (as latitude and longitude) of a driver as the input parameters. To compile and deploy contracts on the blockchain, Truffle framework is used.

Implementation of Android Application: An accompanying Mobile Application for the cab drivers is an integral part of the proposed system. The main purpose of the Application is to transfer the location of drivers from their mobile devices to the blockchain network securely. The application has to establish connection with the blockchain network while hiding its details from the user. Focus on responsive User Interface (UI) is also necessary for good user experience. An Android application was developed for the purpose of testing the prototype system. There are 2 major steps for implementing the Android Application i.e. connection configuration and data transfer to blockchain network.

Connection configuration requires setting up IP addresses and port numbers along with the Smart Contract address, Public-Private key pair and Solidity file in the Android Application.

In a blockchain network, data is transferred with the help of transactions. For a transaction to occur, a Public-Private Key pair (linked to a Blockchain ID) is required. The Public and Private Keys are randomly generated strings of case sensitive letters and numbers which act as lock and key and hence provide authorization. Public Keys are widely distributed and used to identify the creator of a transaction. Private Keys are kept secret and used to create Digital Signatures. These signatures are then used to authenticate the creator and also verify data integrity.

Finding Nearest Drivers: The Prediction of the ANN model, as discussed in a previous section, helps to determine number of cab requests for a locality in advance and the corresponding number of cab drivers that need to be notified about the prediction. Selection of the best subset of all the available drivers can be performed by finding the ones nearest to the location of interest. KNN algorithm is used in the proposed system for the same. The algorithm takes as input a set of co-ordinates, a test data point and a value "K" (number of required co-ordinates). It gives as output K number of different coordinates from the set, which are closest to the test point. In case of the system described, input set of coordinates correspond to available cab locations and test data point represents the event's location. Prediction of the ANN model obtained earlier is the input "K" for the KNN model.

KNN Algorithm:
Step 1: Load the set of coordinates (Cab locations).
Step 2: Load the value "K" i.e. the required number of nearest cabs from the event location.
Step 3: For each data point in dataset:

- Calculate the distance between each point in the dataset and the test data point using Haversine Distance.
- Now, based on the distance value, sort the data points in ascending order.
- Choose top K data points from the sorted array.

Step 4: Provide chosen data points as output.
The "NearestNeighbor" class present in "sklearn. neighbors" library of Python Programming Language, is an unsupervised learner used for doing neighbor searches. It takes as input, the "number of Neighbors" and optional parameters like Radius, Algorithm, Metric. The "kneighbors" method of "NearestNeighbor" Class takes as input parameter, an array of features i.e set of locations of cabs, and returns a set of lengths i.e. the distance array and the corresponding indices of the nearest points .The distance and indices array are used to determine the nearest cab drivers to be notified. As location of event and drivers is in Latitude and Longitude, a distance metric called "Haversine Distance", which takes input in radians, is used. Haversine Distance is given by distance function:

$$d = 2\arcsin(\sqrt{\sin^2(0.5*dx)\cos(x1)\cos(x2)\sin^2(0.5*dy)}) \quad (1)$$

The Latitudes and Longitudes of the locations obtained from the GPS are in degrees which is converted to radians. The conversion is performed by the use of an inbuilt function of Python i.e "math.radians". It is part of "math" library of Python Programming Language.

Integration of Blockchain with Database: As mentioned previously, a database system synchronizes data with the blockchain network. Synchronization is performed periodically to keep the database up-to-date. In a single synchronization cycle, data is fetched from the blockchain and then updated into the MongoDB database. Web3.js library is used to fetch the data from the blockchain cluster. Once the connection with the blockchain nodes, using specified IP addresses and port numbers is established, truffle-contract library helps to interact with the deployed contracts as explained in a previous section. To create the contract instance, a JSON file of the contract is used which was generated in the process of contract deployment. Using the contract instance, details of all the drivers are fetched from the blockchain.

The next step is storing these details into the database. The MongoDB JavaScript library has a function which takes URL of MongoDB database, Username and

Password as input parameters to establish a connection with the database. Using the obtained connection instance, recently fetched details of all the cab drivers are updated in the database. The flow diagram of database synchronization is shown in Figure 1.

Figure 1: Database Synchronisation Flowchart

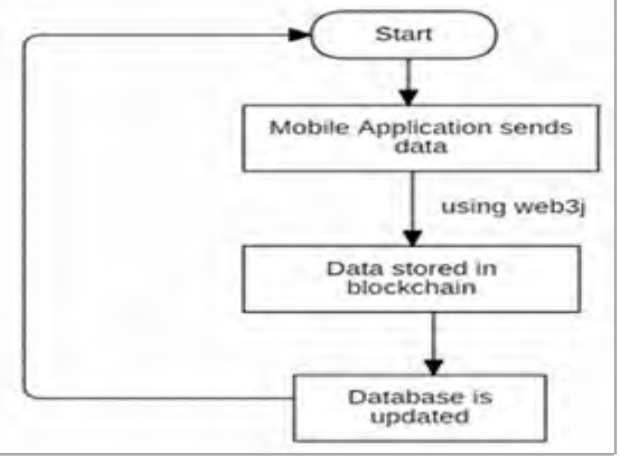
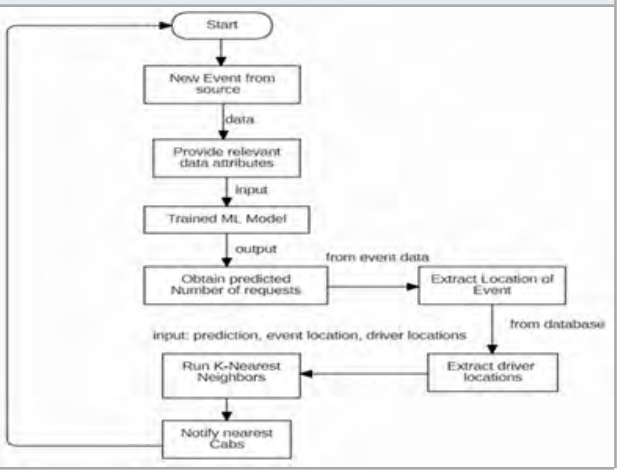


Figure 2: Flowchart of the integrated ML and KNN subsystem



Integration of Machine Learning and K-Nearest Neighbour: The ML and KNN scripts are implemented using Python Programming Language. Output of the ML script i.e the prediction of estimated number of bookings for an event is given as an input to KNN script along with the event location and the cab drivers' location. The integration of scripts is simple as they are written in the same programming language.

The Flowchart of the integrated ML and KNN subsystem is shown in Figure 2.

CONCLUSION AND FUTURE SCOPE

After integration of modules with the mentioned tools and libraries, a fully functional prototype system was developed. All the modules were found to be working in conjunction with each other. The conclusions drawn were as follows:

- It is feasible to use blockchain as a medium to transfer light data.
- The data transfer in blockchain took place in reasonable time frame for a realtime application.
- System is highly scalable because of distributed Blockchain network and features of Mongo DB.
- Accuracy of the ANN model was found to be acceptable.

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A Review on Visual Secret Sharing Schemes for Binary, Gray & Color Image

Vishal V. Panchbhai[1*] and Suchita W. Varade[2]
[1,2]*Department of Electronics & Telecommunication, Priyadarshini College of Engineering, Nagpur, India*

ABSTRACT

Today's fast growing world of the internet is acquiring more attention of people. People are using more services provided by e-commerce and social sites, they exchange multimedia data over the internet thus there is need of data confidentiality, integrity and availability. Cryptography is used to solve some of above problems. Visual Secret Sharing (VSS) schemes capable to handle the problem related with sharing of visual data. But display quality, variations in share sizes, insecurity in transmission of shares, originality of share, pixel expansion, etc. are still open problems. The aim of this paper is to review and examine numerous existing visual secret sharing schemes, which tries to solve above problems. This information will be useful to researchers who would like to work in this area.

KEY WORDS: VISUAL SECRET SHARING SCHEME (VSSS), VISUAL CRYPTOGRAPHY (VC), VSSS PERFORMANCE MEASURES

INTRODUCTION

Today many people are using the internet to transfer their multimedia data. This data transfer on an open network environment is not safe because an intruder tries to check, alter or access your confidential data so there is an urgent need to provide security to this data. Security will be provided in terms of confidentiality, integrity and an availability of data. Confidentiality limits access to data and which is managed by encryption of data. Integrity is related to reliability of data and which is managed by hashing algorithm and availability is assurance of getting unbreakable service from a reliable source. In order to tackle the problem of data encryption and hiding, cryptography and stegnography techniques are used respectively.

Visual Secret Sharing Scheme (VSSS) is the cryptography technique for visual sharing of secret images. Naor M. et al.(1994) invented this cryptography technique in year 1994. They proposed and demonstrate k out on n VSSS. In this scheme 'n' shadows / shares are generated by a dealer on transparencies. When 'k' shadows out of 'n' shadows are stack together then only secret data will be visible otherwise not. Following figure 1 shows an example of 2 out of 2 visual cryptography scheme (VCS) by putting four sub-pixel in the shadow image for each pixel in a secret binary image. Secret will be reconstructed using Boolean OR operation. It will increase the size of output image.

Visual data may be monochrome image, gray image or color image. Many researchers work on different visual data to solve various existing problems such as a quality of reconstructed image, variations in share sizes, insecurity in transmission of shares, originality of share, etc. In this paper, we study and analysis various VSS schemes based on some performance parameters.

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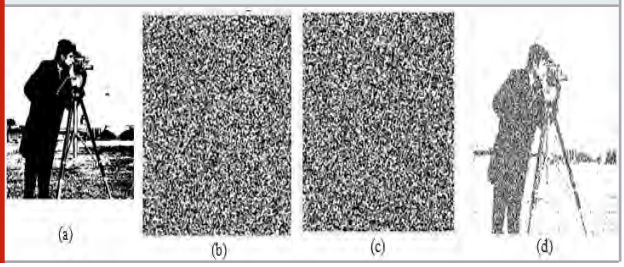
Various Visual Secret Schemes: Visual secrete sharing scheme is a method of generating two or more shadows with or without making changes and retrieving visual data by combining all or some of them. The existing VSS schemes are mainly classified based on black and white, gray scale & color images (secret image type) and discuss in the next section.

Figure 1: a) Cameraman image as a secret image (256 x 256) b) share 1 (512 x 512) c) share 2 (512 x 512) d) reconstructed Secret image (512 x 512)



i) VSS schemes on black and white image: The VSS scheme based on a black and white image contains secret image in black and white format. The OR based visual cryptography is mostly used in the scheme stated above. Naor et al. (1994) proposed cryptographic scheme based on black and white image, in this scheme, 'n' number of noise like shares created by dealer and it is distributed among the ' n' number of users, secret image can be visualized by overlapping at least 'k' numbers of user shares otherwise not. This scheme is called as (k,n) VSSS. Kumar et al. (2014) proposed (2,n) threshold based approach for a visual cryptography scheme on black and white image using hadamard matrices. In this scheme two groups of shares are available namely qualified set and forbidden set, secrete data will be discovered through overlapping at least two shares from a qualified set without any cryptographic computation.

Lee et al. (2013) define General Access Structure (GAS) based VCS approach to solve the problem of increased size of generated shares through encryption of pixels in a secret image by column vectors. In GAS the dealer specified reasonable combinations of shares to be used for decryption. Hou et al. (2011) tried to solve a pixel expansion problem by using progressive VCS. To solve the problem of increased size of generated shares, Lee et al. (2012) proposed simulated annealing based algorithm for encryption and use stamping algorithm for adding cover to a black and white secrete image. To address the above problem Fan et al. (2018) proposed random grid and XOR based VSSS.

As noise like share is not user friendly and it gives suspiciousness to intruder thus some researchers worked on the generation of meaningful share. To address above problem Liu et al. (2011) proposed VSS scheme based on embedded extended visual cryptography, S. Shyu (2014) proposed (k,n) VCS based on integer linear programming, Yang et al. (2016) proposed scheme in which shares are generated by (k, n) VSSS and then color pixels are added in shares to generate meaning full shares.

ii) VSS schemes on the gray scale / color images: The VSS scheme based on the gray scale / color image contains secret image in gray scale or color image format. Boolean functions such as OR, EX-OR, EX-NOR, AND & NOT based visual cryptography operations are performed in this. Luo et al. (2014) proposed a VSS technique, based on transfer of color, in which secret color image is braked into red, green and blue 8-bit planes then halftone algorithm is used to generate shares from this planes. To recover secrete color image computer computations are required. Another approach using Floyd's halftoning proposed by Kar et al. (2018) this scheme is based on the CMY color model. In this scheme secrete image is decomposed into cyan, magenta and yellow planes first then halftoning algorithm is used to generate shares.

To address the problem of pixel expansion and to increase security of black and white, gray and color image shares Wu et al. (2014) proposed two solution methods for GAS based scheme, first is XOR based VC which is useful to solve an expanded size problem of shares and second is based on an adaptive area enhancing VC using the boolean EXOR operation which is useful to increase security of share. Another solution based on sharing matrix and encryption of an image proposed by Bao et al. (2017) which is useful to generate lossless (k,n) VSSS. Lee et al. (2014) proposed binocular VCS for black and white & gray secret image without increasing the size of shares and hide the shared pixel in another image.

To increase contrast of a recovered gray scale image, Wang et al. (2013) developed VC scheme using basis matrices and reversing techniques. Another approach is proposed by Wu et al. (2013) based on a generalized random grid. To increase the visual appearance of recovered image various researchers proposed different approaches which will be discussed here. To address above problem, Mhala et al. (2018) suggested solution based on block-based progressive VSS and additional data hiding techniques for gray and color secret image. Deepa et al. (2014) suggested a color image based VSS scheme using the artificial bee colony algorithm to resolve the above problem.

To address the problem of secure transmission of color secret image shares, Lee et al. (2014) proposed algorithm that uses various carrier media to send shares of a secret image generated through the natural share based VSSS. Another method provided by Abdelfatah (2020) uses two stage encryption, elliptic curve encryption based on first stage and XOR operation is carried out between the first stage output and a pseudorandom sequence generated by multi chaotic pseudo random generator algorithm. Visual cryptography can be pooled with steganography for a meaningful share generation in order to improve the security of secret messages. Least Significant Bits (LSB) based approach is suggested by Gupta et al. (2012) to encode a secret message by using genetic algorithm and it is useful to retain an original characteristics of the images.

VSS Performance Analysis Parameters: Performance of visual secret sharing schemes can be evaluated based on the some of the following parameters.

1) Peak Signal to Noise Ratio (PSNR): PSNR is the most commonly used metric to check the visual appearance of a recovered image (Ahmed et al., 2016). It gives the peak of error between an original and recovered image. Ideally PSNR value should be infinity and practically as large as possible. PSNR value of a reconstructed image should be greater than 30 dB is acceptable.

2) Mean Squared Error (MSC): MSE (Ahmed et al., 2016) gives a mean square of the differences between the respective pixels of the two images. Ideally MSE value should be zero and practically as small as possible.

3) Correlation Coefficient (CC): The quality of cryptosystem is determined by correlation coefficient metric (Ahmed et al., 2016). It is ideally one for an indistinguishable image and zero for an uncorrelated image. CC value should be minimum (towards zero) recommended.

Table 1. Performance Analysis of Various VSS Schemes

Reference	Secret Image Format	Encryption Method	No. of shares	Noiselike / Meaning-ful Shares	Pixel expansion
(Value of m) (Naor et al., 1994)	Binary	Boolean matrix based	2,3,4	Noiselike	4 & 9
(Kumar et al., 2014)	Binary	Threshold based VCS using Hadamard matrices	2	Noiselike	4
(Lee et al., 2013)	Binary	GAS based VC algorithm	5	Noiselike	NIL
(Lee et al., 2012)	Binary	progressive VC algorithm	6	Noiselike	NIL
(Fan et al., 2018)	Binary	Random grid and XOR based VC algorithm	2	meaningful	NIL
(Shyu, 2014)	Binary	Threshold based VCS with meaningful shares	2 to 7	Meaningful	4 to 77
(Yang et al., 2016)	Binary	Colored black and white visual cryptography scheme	2, n	Meaningful	4, 2n
(Lee et al., 2014)	Binary	binocular VCS	2 to 10	Noiselike	NIL
(Wu et al., 2013)	Binary	Generalized random grid based VC algorithm	2, n	Noiselike and meaningful	NIL
(Jana et al., 2014)	Binary	Self defined algorithm with stego data for fake share identification	4	Noiselike	4
(Gupta et al., 2012)	Binary (text to binary)	VC based on pseudorandom number and pixels exchange.	3	Noiselike	NIL
(Liu et al., 2018)	Gray	Embedded extended VCS algorithm	2, 3	Meaningful	Present
(Wang et al., 2013)	Gray	Reversible VCS (GRVCS) by using basis matrices	2, m	Noiselike	Present
(Hou et al., 2011)	Gray and color	Halftoning and color decomposition based	2, 3	Noiselike	4
(Kar et al., 2018)	Gray and color	Self generated algorithm is used on halftone image	3	Noiselike	4
(Mhala et al., 2018)	Gray and color	Block based progressive VC with additional data embedding facility using DCT technique	4 to n	Noiselike and meaningful	NIL
(Luo et al., 2014)		Color VCS based on color transfer and halftone method	2,3	Noiselike	2
(Deepa et al., 2014)	Color	Visual Cryptography Scheme using Artificial Bee Colony algorithm	2	Meaningful	4
(Bao et al., 2017)	Binary, gray and color	Sharing matrix and image encryption based algorithm	4,6,8,	Noiselike	NIL

4) Pixel Expansion: In most of VSSS, shares are generated by placing m sub-pixels in shares for each pixel in a secret image. This will increase the size of each share by m times as compared to a secrete image is called as pixel expansion.

5) Structural Similarity Index quality Measure (SSIM): SSIM is used for measuring the resemblance between an original & recovered image. SSIM value ranges from zero to one. Ideally SSIM value should be one but practically it should be nearer to one.

Performance Analysis of Various VSS Schemes: Following table – 1 shows performance analysis of various VSS schemes based on secret image format, encryption / share generation method, number of shares, generated shares are meaningful or noise like and pixel expansion. From this table it is found that various researchers work on different techniques to solve the problem in existing VSS schemes such as an increase size of generated share, a meaningful share generation, secure data transmission, fake share identification, etc. It is also found that many researchers work on binary secret image format only and very few works on gray and color secret image.

DISCUSSION

From the study and analysis of different research work, on the visual secret sharing scheme based on performance measure, helps us to find the limitation / area where research may be carried out to get the better result. The visual secret sharing schemes with meaningful shares are more user-friendly and secure for transmission than noise-like shares thus it encourages to develop algorithm for generation of meaningful shares. Cheating prevention / fake share identification based VSS is required to increase security, very few works is done in that direction. Whatever data is embedded in shares it will create the blocking artifact in a recovered secret image, thus there is need to eliminate this artifact to increase the visual appearance of a recovered secret image. Most of the VSS schemes based on gray and color image use large computation at receiver side to decrypt the secret image which should be minimized to get the better result as limited power and processor capability is available with most of handheld devices now a days.

CONCLUSION

In today's world of the internet, a significant role played by the visual secret sharing scheme for data confidentiality over an open network environment. In this paper various existing schemes on visual secret sharing is studied and analyzed. It is found that various researcher contributed their best to solve the existing problems in VSS schemes such as increase in size of generated share, a meaningful share generation, secure data transmission, originality of share , etc.. Still problems are open to do research as most of work done on binary visual data and very little work done on grayscale and color visual data.

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Design of Palm Vein Authentication System

Minal Ghute[1*], Mridula Korde[2], Kanchan Kamble[3] and Sachin Khade[4]
[1,3,4]*Yeshwantrao Chavan College of Engineering, Nagpur, India*
[2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Palm vein technology is one among the upcoming technology which is very secure because nobody can copy it. To verify the identification, this palm vein system uses the vein pattern of the palm of human hand. This technique is safer than the other biometric system because it's contactless system and each person has different vein. During this paper Palm vein authentication system is meant using Raspberry Pi single-board computer. Palm vein system consists of vein detection and equalization and thresholding. Comparison of the registered palm vein and input palm vein is completed in few seconds. Palm vein authentication system is predicated on embedded platforms like Raspberry Pi with libraries tenser flow and Open-CV.

KEY WORDS: MATCHING, PALM VEIN, RASPBERRY PI, REGISTERING, THRESHOLDING.

INTRODUCTION

Palm Vein Authentication is nothing but pattern authentication technology. In this system the human palm vein is employed as biometric feature. Palm veins of every person are different from one another and it exists beneath human skin, hence it's difficult to at least one to repeat it. Palm Vein Authentication System is used to confirm the identification of a specific person. During this system Raspberry PI B+ model used, which is card sized computer [Mr.Shobit, 2014, Gunjan Shah, 2015, K. C. Smith,1981]. In this system images can passes through different sort of process. It uses detection and equalization, thresholding. Finally input image and registered image get compared. Then identification of that person is identified. Raspberry Pi with libraries tenser flow and Open -CV.

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Palm Vein Authentication System is based on the vein patterns which is different for each individual. When user palm is held over a scanner, a near-infrared light maps the things of the veins [J.-C. Lee, 2012, Vicky Ambule,2013, Swati K Jichkar,2016]. The rays are absorbed by the blood cells present within the veins and it maps veins as a black lines, whereas the remaining hand structure shows up as white[Wenxiong Kang and Qiuxia Wu,2014]. Now this vein pattern is compared with the preregistered pattern in order that the individual or peoples are often authenticated. As veins are internal within the body and have a wealth of differentiating features, attempts to forge an identity are extremely difficult, thereby enabling a high level of security [Vicky R Ambule, 2012, Raj Gusain, 2018, Y.Zhou, 2011]. After conducting the literature survey on palm vein recognition techniques, the overall description of Palm Vein Authentication and its corresponding method. A lot of work has already been done on the Palm Vein recognitionThe accuracy and reaction time of the prevailing system is slow which may be improved.

METHODOLOGY

Working: Palm Vein Authentication Functional block diagram is shown in fig.1, it consists of Raspberry PI B+ model, IR-LEDS, Noir Camera and Power Supply. For

designing purpose Tenser Flow and Open-CV software are used. In this paper Raspberry B+ is used, which is modified version of the original Raspberry Pi. This is nothing but the card sized computer, this device have ability to interact with the outside world and used in wide array of digital maker projects, this is the low cost computer.

The infrared Camera Module v2 (Pi NOIR) replaced the original Pi NOIR Camera Module in April 2016. This noir camera consists of a Sony IMX219 8-megapixel sensor. It is almost similar to regular camera; there is only single difference that it is not consist of infrared filter. According to that pictures that you take at day light it looks curious, but we can see in the dark with infrared lighting. IR LEDs are used.IR LED is nothing but the Infrared light emitting diode. It is a special purpose LED emitting infrared rays ranging from 700nm to 1nm wavelengths. This IR LED is usually consisting of gallium arsenide or aluminium gallium arsenide. This IR LED used as sensor in this Palm Vein Authentication System.

Power supply is given with the help of 5v adaptor and one pin is plug in to PC.There are various steps involved in registering the user through the palm vein is as follows: First the palm pattern is registered in the scanners of the palm vein. The registered palm vein pattern and the private detail of the user is saved.

Figure 1: Block Diagram of Palm Vein Authentication System

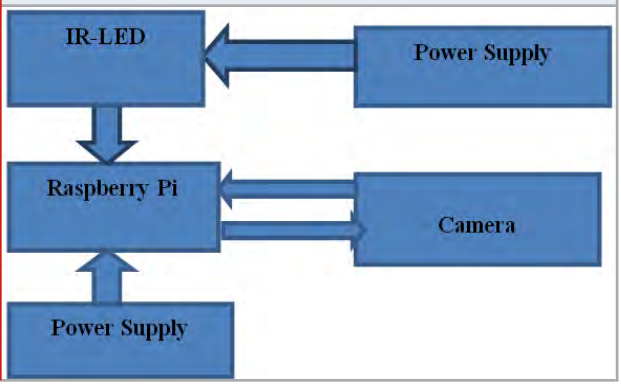
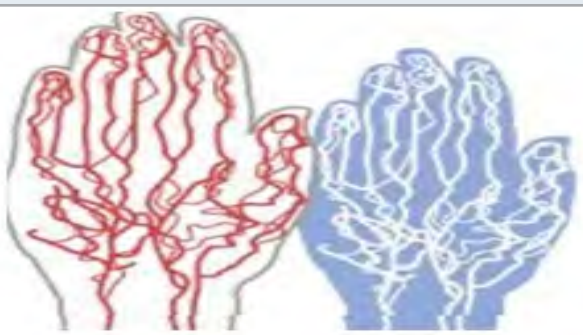


Figure 2: Images of Palm

Step1: In Palm vein authentication technology the Noir camera is used which has high speed and accuracy. It is also easy and simple to use. To read vein pattern simply hold palm a few centimetres over the camera, within a second camera reads user's unique vein pattern. By capturing the vein picture as shown in fig.2, the palm pattern is registered.

Step2: The registered palm pattern is saved into the database with the private details of the client as shown in fig.3.

Figure 3: Images of registered Palm



Working of palm vein security system is explained as follows: User must place his/her palm near to scanner as shown in fig.4.After that the scanner/camera use special characteristic of the haemoglobin flowing through the palm vein which absorbs the near-infrared light. Due to which it is possible to get image of what is below the outer skin, something very hard to read or steal. Flowchart is shown in fig.5.After taking image, that image converted into grayscale. In this process colour image get converted into grayscale image.

Figure 4: Palm in front of scanner

In this process remove all colour information, leaving only the luminance of each pixel. While grayscale image get recorded it contain some noise hence then de-noising of the image is done. In this process the image noise get remove or at least get reduce. After de-noising the image, histogram equalization is done. In this process the contrast of the image is improved. It is accomplished by stretching out or distributing the intensity values. After adjusting the contrast of the image, then image inversion is done. After that erosion process is done. In erosion process is one of two fundamental operations in morphological image processing form which other morphological operations are based.

It is similar to many other kinds of filters like the median filter and Gaussian filter. After that thresholding is done. It is simplest method of segmenting image. Form a grayscale image, thresholding can be used to create binary image. With help of the noir camera the image of palm vein is taken and then it is digitized after that it is encrypted and finally stored as registered palm vein image in the database. Sensors which are connected in the module that is temperature-humidity sensor, gas sensor, dust sensor will monitor the concentration of respective parameter in the underground coal mines. Recorded values of environmental parameters will get displayed on 16*2 LCD displays which is programmable.

Figure 5: Flowchart for processing the captured image

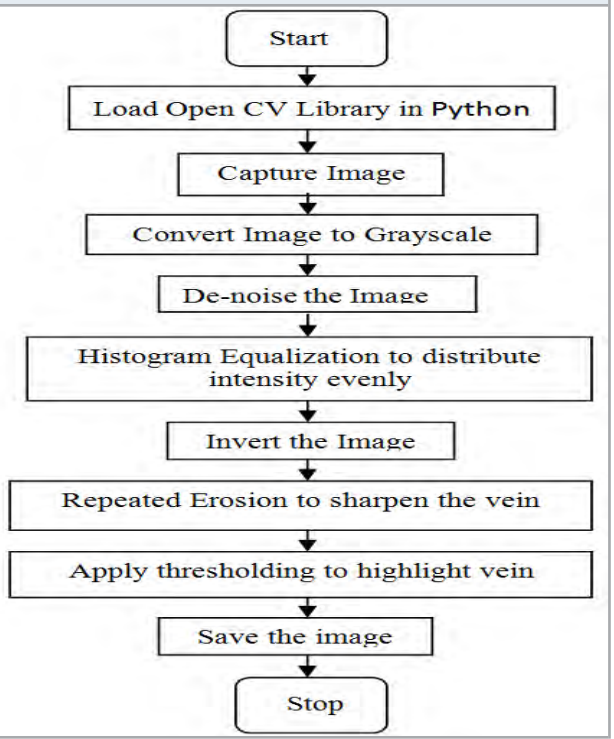


Figure 6: Post crop image of palm

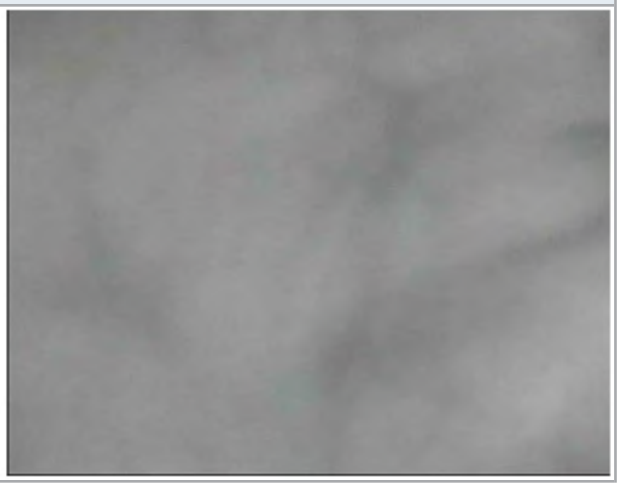
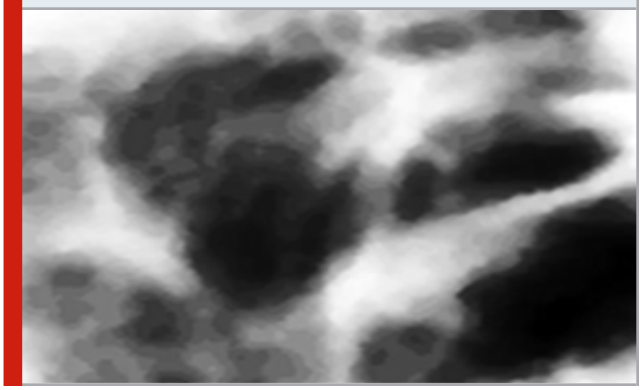


Figure 7: After image denoising

Figure 8: After histogram equalization and inversion



If the concentration of any of the above parameter rises above threshold value then, the alert are going to be given through the buzzer. In case of dust sensor, when the concentration of dust increases in the environment of underground coal mine, the buzzer will get activated and immediately spray pump will start working. Dust sprayer is connected within the module through wired connection. Spray pump is connected to the driving force IC via relay. Relay acts as a switch. On the basis of monitored value of dust sensor, microcontroller will instruct whether to act as open circuit or close circuit. Dust sprayer will settle down the dust in the coal mine. For the safety purpose message will be sent using WSN (wireless sensor network) means using Zigbee module.

RESULTS AND DISCUSSION

Fig.6 is a cropped image of a palm. Noise is removed in fig.7, which gives smoother image. After that the contrast is increased by using histogram equalization. Then image is inverted as shown in fig.8, in Open CV background of image must be black and foreground is white. The result after Erosion is shown in fig.9.Due to erosion the unwanted outer layers of data in images are striped out. To see how accurate this was, result in fig.10 is overlaid the vein pattern over the original image as shown in fig.11 which shows the correlation.

Figure 9: After skeletonization (repeated erosion)

Figure 10: Result after image processing operations

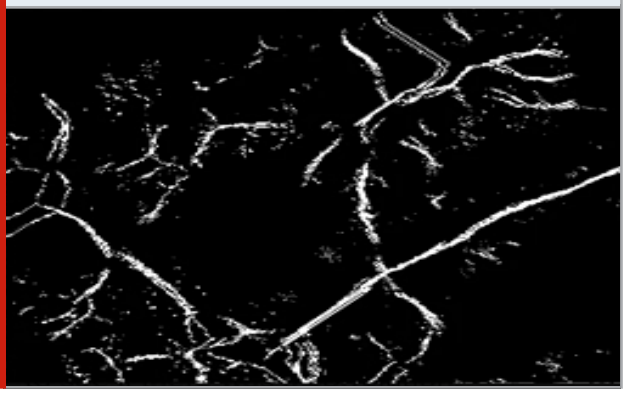
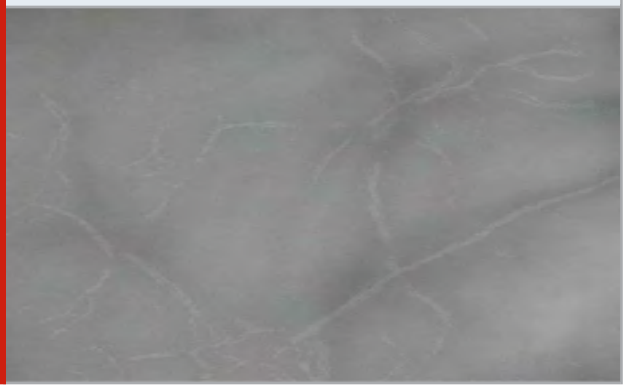


Figure11: Result overlaid on the original image



CONCLUSION

In this paper palm vein authentication system is designed. This technology is highly secure and accurate. The vein pattern in the palm is very much complex and unique to each human being. After comparing the scanned image at that instant of time with save in database if those images are matched then you can entered otherwise again scanned your palm. Palm vein authentication system is highly secured hence it is used in banks, colleges, vertical market, for security purpose, government offices, in passport issuing and in hospitals also. Instead of water Agree Bind is also used which is water based cross linking styrene acrylic environment friendly polymer for dust suppression because it has excellent property to bind with dust particles which will help in dust suppression. In this paper Raspberry Pi having memory 2GB used .If memory increased or use Raspberry Pi with more memory then more data can be saved with all personal detail of user or client.

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Feature Extraction and Classification for Electro-Encephalography Based Bci: A Review

Vasundhara Rathod[1,2*], Ashish Tiwari[2] and Omprakash Kakde[3]
[1]*Ramdeobaba College of Engineering and Management, Nagpur 440013, India*
[2]*Visvesvaraya National Institute of Technology, Nagpur 440012, India*
[3]*Indian Institute of Information Technology, Nagpur 440012, India*

ABSTRACT

A Brain Computer Interface (BCI) system provides a method for controlling a peripheral device. A BCI may use the magnetic, electrical, or metabolic activity of the brain. Electro-encephalography (EEG) is a non-invasive technique. It is popular for BCI research and is preferred due to its high temporal resolution, low cost of devices, convenience and movability. BCI based applications have massive potential in assistive devices, health care, and amusement industry. A regular BCI system comprises of these steps: signal acquisition, pre-processing, feature extraction and classification. An EEG contains the impulsive electrical activity of the brain taken from electrodes placed on the scalp of the subject. The EEG signal is then processed to remove noise and enhance the signal for analysing further. Features are mined from the amplitude and frequency of the recorded analog signals which can be transformed into feature vectors, and given as input to a classifier. Since EEG is non-stationary in nature, vulnerable to artifacts and has high variability, we need algorithms that efficiently extract relevant features and classify the signals accurately. This study reviews some recent applications of BCI and the feature extraction techniques used by them. Machine learning algorithms typically used in EEG-based BCI applications are also studied.

KEY WORDS: BRAIN COMPUTER INTERFACE (BCI), ELECTRO-ENCEPHALOGRAPHY (EEG), FEATURE EXTRACTION, MACHINE LEARNING, CLASSIFICATION.

INTRODUCTION

A BCI system offers to control an external device, like, a wheel chair or a mobile phone using the electrical impulses of the brain instead of the usual way of manual muscle control. BCI promises to transform human thoughts to logical commands which can control external devices through signals obtained using an invasive or non-invasive technique. BCI applications require interdisciplinary knowledge as it syndicates many fields including brain physiology, neuroscience, electronic instrumentation, signal communication, signal processing, pattern identification, machine learning, etc (Bansal and Mahajan, 2019b).

Electro-encephalography (EEG) is a popular non-invasive technique used for BCI research. It involves connecting electrodes to different areas of the scalp to record electrical potential vs. time recordings (Choubey and Pandey, 2019). EEG is usually preferred in BCI applications due to its high temporal resolution i.e. ability to record spontaneous activity without any time lag, low cost than other non-invasive techniques, ease of use and portability. EEG signals are complex, random, non-stationary and nonlinear in nature. EEG signals are also very weak and vulnerable to artifacts. A major hurdle

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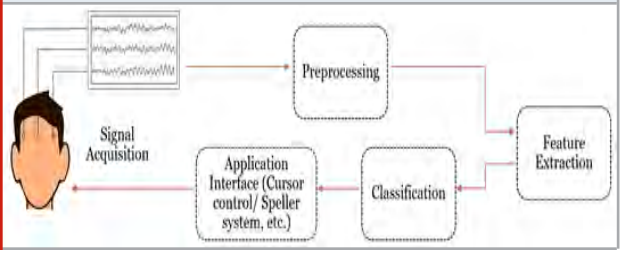
apart from this is that EEG exhibits high inter-individual and intra-individual variability. There are four key tasks to practice for a successful BCI system as shown in Figure 1; signal acquisition, pre-processing, feature extraction and classification.

Figure 1: Flow of a typical BCI system



In this paper a variety of BCI applications have been reviewed to study the feature extraction and classification techniques for EEG signals. This paper is organised as follows. Section 1 provides a brief introduction of BCI systems. Section 2 describes the articles surveyed and an overview of the applications studied. Section 3 describes the working of each of the key tasks of the BCI system focussing on feature extraction and classification along with a detailed study of the techniques used by recent applications.

Related Work: The papers reviewed for this study were shortlisted from the year range 2014 to 2020, based on their abstracts. The keywords used to filter journal articles were 'EEG', 'feature extraction' and 'classification'. IEEE XPlore, Science Direct and Springer link repositories were used for this literature survey. 4 studies are surveys of feature extraction or classification techniques. These studies span varied applications of BCIs such as motor imagery, speech imagery, cognitive tasks, seizure prediction, emotion recognition, sleep state analysis, etc.

All papers that are studied follow an implementation where an electro-encephalograph (EEG) records the spontaneous activity of the brain with the help of electrodes placed on the surface of the brain. The input is then processed to remove artifacts and enhance the signal for further analysis. Features are extracted from the amplitude and frequency component which can be transformed into feature vectors, and given as input to a classifier. This study majorly covers the feature extraction stage and classification stage of a brain computer interface system. In the reviewed papers, EEG signals have been used for diagnosis of Alzheimer's disease and depression, prediction of epileptic seizures(Wang and Lyu, 2015; Amin et al., 2016; Choubey and Pandey, 2019), sleep related disorders (Memar and Faradji, 2018), ADHD, drug effect classification, emotion recognition (García-Salinas et al., 2019), etc. It is also widely used in assisting physically challenged subjects for cursor control (Zhang et al., 2020), robotic arm control and speller systems with the help of motor imagery tasks. Recently EEG-based BCIs are also used in the entertainment industry and are revolutionizing VR and hands-free applications.

Working of a BCI system: This section elaborates four key tasks to implement for a successful BCI system.

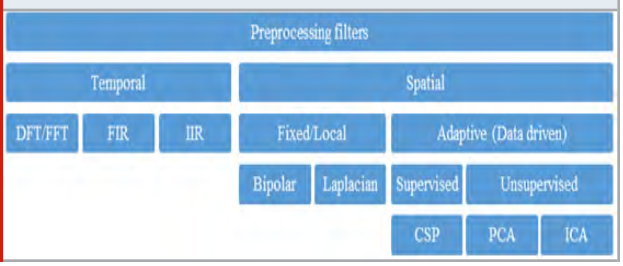
Signal Acquisition: Biosignals from the brain are acquired using a variety of sensors. Most acquisition units follow the standard 10-20 system of electrode placement. EEG units used for medical purposes can be used which employ wet electrodes, or commercially available devices as shown in Figure 2 can also be used. Some of these provide great user comfort as they employ dry electrodes.

Figure 2: Various types of commercially available signal acquisition units from G.tec, Emotive, Neurosky

The signal acquiring unit amplifies the brain responses and removes noise. This is followed by analog-to-digital conversion. Effective ways to obtain EEG signals are motor imagery, auditory, visual or sensory stimulus. EEG signals are usually stored in edf format. It is used for efficient interchange of multichannel biomedical signals.

Pre-Processing: Some outlying electrical and muscle activities (like eye movement or eye blinks) are also recorded while acquiring signals. These undesired temporal or spatial variations originated from non-brain regions are called artifacts. To ensure good performance of BCI systems it is very important to identify and remove artifacts. Figure 3 shows various techniques used for pre-processing of EEG signals.

Figure 3: Commonly used pre-processing filters



Feature Extraction

Features are derived from signal of one electrode or a combination of more than one electrodes. Features are differentiated in time, frequency, time-frequency and spatial domain. Some EEG features have good selective power to detect diverse EEG patterns (Wang and Lyu, 2015). Such features with high discriminating power are required to create a trained model. The dimensions of the extracted feature vector directly affects the processing

time of the classification system. A wide series of features extracted from EEG are proposed in earlier studies.

Time Domain Features

- Event Related Potentials (ERP) are changes that occur exactly after or before a sensory, motor or mental events. Amplitude and latency of ERPs can be used as a feature. ERPs are difficult to detect for applications where event onset is unknown, like for emotion recognition. e.g.: P50, N100, P300, etc.
- Statistical properties of signal - like mean, deviation from standard values, difference between sequential terms, normalized 1st difference, difference between successive 1st differences, normalized 2nd difference are used as feature of the signal.
- Hjorth introduced some statistical features in 1970. Activity represents signal power. Mobility represents mean frequency and Complexity represents the change in frequency (Zhang et al., 2020).
- Fractal Dimension is how complicated a self-similar figure is.
- Autoregressive approach represents the signal at each channel as a linear combination of the signal at previous points (Zhang et al., 2020).
- Entropy is the degree of restraint or randomness present in a signal. This feature is a measure of complexity of the signals. e.g.: Approximate Entropy (ApEn), Sample (SampEn), Shannon, Rényi, Tsallis Entropy and Permutation Entropy (Bansal and Mahajan, 2019a).

Table 1. Summary of Feature Extraction Techniques used in Literature Survey

Technique		Literature Reference	Advantages
Time Domain			
Statistical Parameters		(Wang and Lyu, 2015; Amin *et al.*, 2016; Jiajie *et al.*, 2018; Memar and Faradji, 2018; Choubey and Pandey, 2019; Seo, Laine and Sohn, 2019)	– Simplicity, Ease of computation – Works with stationary and non-stationary signals
Autoregressive Model		(Wang *et al.*, 2016; Zhang *et al.*, 2017; Seo, Laine and Sohn, 2019)	– Improved frequency resolution and decreased spectral loss with shorter duration of data – Well suited for non-stationary signals
Fractal Dimension		(Memar and Faradji, 2018)	– Handles scale-invariant properties of the signal – Effective around dynamic changes – Some FD methods are fast and noise sensitive e.g. Petrosian FD method
Entropy	ApEn	(Zhang *et al.*, 2017; Jiajie *et al.*, 2018)	– Allows view of activity, redundancy, signal noise – Best suited for non-stationarities, event detection, and disturbances. – Applies globally to the entire signal, as well as locally around certain points.
	SampEn	(Wang *et al.*, 2016; Jiajie *et al.*, 2018)	
	ShEn	(Memar and Faradji, 2018)	
Frequency Domain			
Power Spectral Density (PSD)		(Bascil, Tesneli and Temurtas, 2016; Seo, Laine and Sohn, 2019)	– As PSD works on stationary signals, it can be used to eliminate white noise. – It is mostly used in combination with some other technique to capture non-stationarity
Time-Frequency Domain			
Discrete Wavelet Transform (DWT)		(Amin *et al.*, 2015, 2016; Zhang *et al.*, 2017; Seo, Laine and Sohn, 2019)	– Suitable for non-stationary signals – Ability to analyse discontinuities through variable window size – Shorter basis functions with higher resolution – Ability to analyse both time and frequency information

Frequency Domain Features: An EEG signal is composed of events occurring at different frequency bands. Frequency domain features include power features from different frequency bands. Most commonly used method to estimate frequency component is Fourier transform. Power Spectral Density is the most commonly used frequency domain feature (Harpale and Bairagi, 2016). It estimates the amount of power caused by events at each frequency. It cannot isolate the time at which frequency of interest occurs.

Time-Frequency Domain: Fourier Transforms separates various EEG waves which helps in analysis of occurrence of periodic events in signals. Helps in observing parameters by taking ratios of different bands. Discrete Wavelet Transform decomposes a signal in detail levels consistent to diverse frequency ranges, while preserving the time points.

Spatial Domain: Common Spatial Pattern can be used to transform multiple electrode EEG data into a lower-dimensional subspace. It is based on concurrent diagonalization of the covariance matrices of dichotomous classes representing matching and un-matching comparisons (García-Salinas et al., 2019).

Features from combinations of channels: Many findings suggest asymmetry between right and left hemisphere of brain. These features can be divided into:

- Differential Asymmetry - difference in power band of matching pairs of channels on the left/right hemisphere of the brain.
- Rational Asymmetry - ratio of values from symmetric electrodes used as features.

Classification: The next stage is recognition to translate the extracted features into commands to drive the external devices. Most of the literature that has been surveyed adopts k-fold cross validation method for evaluating the performance of classifiers. Various machine learning algorithms used in the surveyed papers are summarized in Table 2.

Table 2. Summary of Classification Techniques used in Literature Survey

Technique	Literature Reference	Advantages
SVM with RBF kernel	(Amin *et al.*, 2015, 2016; Wang and Lyu, 2015; Zhang *et al.*, 2017)	– High accuracy and prediction speed – Uses quadratic optimization to avoid local minima – Non-linear decision boundary – Performs wells with small number of observations
Linear SVM	(Bascil, Tesneli and Temurtas, 2016)	– Solves multi-class problems – High computational speed – Works well with large datasets
Quadratic SVM	(Jiajie *et al.*, 2018)	– Non-linear decision boundary – Does not require a kernel – Performance is independent of any tuning parameter
Least Square SVM	(Bascil, Tesneli and Temurtas, 2016)	– Solves for a set of linear equations – High accuracy and prediction speed
MLPNN	(Wang *et al.*, 2016; Zhang *et al.*, 2017, 2020; García-Salinas *et al.*, 2019; Seo, Laine and Sohn, 2019)	– Good for modelling nonlinear and complex processes – Non-parametric model – Convergence is slow, but guaranteed
Learning Vector Quantization	(Bascil, Tesneli and Temurtas, 2016)	– Solves for multi-class classification – Works on distance measures and similarity, so it is easy to implement and interpret prototypes
Probabilistic NN	(Bascil, Tesneli and Temurtas, 2016)	– Converges more rapidly and more precise than MLPNN with high accuracy – Comparatively unaffected by outliers.
Naive Bayes classifier	(Amin *et al.*, 2015)	– Ease of implementation and quick convergence – Requires less data for training
Random Forest Classifier	(Memar and Faradji, 2018)(55 trees), (Seo, Laine and Sohn, 2019)	– High accuracy – Estimates missing data effectively, so suitable for online processing
K-nearest neighbour	(Amin *et al.*, 2015, 2016; Jiajie *et al.*, 2018; Choubey and Pandey, 2019; Seo, Laine and Sohn, 2019)	– Simplicity – Ease of implementation

CONCLUSION

This paper presents a brief overview of feature extraction and classification techniques suitable for EEG signals. The feature extraction techniques belonging to time-frequency domain yield best results combined with autoregressive model and/or any entropy model as used in (Amin et al., 2015, 2016; Zhang et al., 2017; García-Salinas et al., 2019). Of all the supervised machine learning algorithms employed in the literature, SVM with RBF kernel (Amin et al., 2015, 2016; Zhang et al., 2017), SVM with Gaussian kernel (Wang and Lyu, 2015), and Multi-layer Perceptron Neural Networks (Wang et al., 2016; Zhang et al., 2017, 2020; García-Salinas et al., 2019; Seo, Laine and Sohn, 2019) are the most frequently used due to their capability of handling non-stationary and complex signals.

EEG-based BCI applications have enormous potential in health care, assistive devices, and entertainment. BCIs based on speech imagery tasks can be explored further. Since the main hurdles in EEG-based BCIs are weak input signal, low signal to noise ratio, non-stationarity, and high inter-individual and intra-individual variability, the feature extraction and classification tasks can be improved to achieve increased accuracy with the least number of biologically plausible electrodes to construct an efficient BCI system.

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Comparative Analysis of Keyword and Semantically Enhanced Question Answering System on Law Domain

Shubhangi C. Tirpude*[1] and Devishree Naidu[2]

[1, 2]*Shri Ramdeobaba College of Engineering & Management, Nagpur, India*

ABSTRACT

As compared with the traditional approach to a search based on keyword, semantic analysis and semantic based search are advanced techniques which understands the linguistic of the search query & makes it accurate intelligent search engine for any domain. We have developed a Question Answering system that considers the semantic information of question inputted and answer retrieved focussing on retrieval of information which is context based. The question answering system is based on syntactical & semantical analysis by creating the semantic graph and defining the semantic relationship between semantic entities. We have designed closed domain question answering system on law documents dataset which answers the queries related to law domain. We tested the queries using keywords matching approach and compares it with by considering the semantic involved in the query, & we found that the semantic based approach produces the result with high accuracy than keyword-based approach, because it considers the Conceptualization and user intents involves in the user's query.

KEY WORDS: QUESTION ANSWERING SYSTEM (QAS), SEARCH ENGINE, COMPUTATIONAL LINGUISTIC, SEMANTIC WEB, N GRAM, FEATURE VECTOR.

INTRODUCTION

The Question Answering (QA) system interprets the question specified in natural language and returns the correct information(answer) using collection of documents. A lot of research has been done in the keyword-based information retrieval which retrieves correct answer of the query based on keyword matching. But the problem with this approach is that if two or more queries with same keywords but different meanings will give the same result because it doesn't focus on understanding the meaning of the query posed in natural language. Even most of the search engines like Bing, Yahoo etc. are continually identifying & enhancing the new features to increase the user experience [1]. Even retrieving the data form the large repository of documents & finding the accurate & correct answer is a complex task in terna of complexity and time. To solve this problem, we have developed the semantically rich Question Answering Systems.

The semantic based information retrieval understands the meaning of the query which improves the accuracy of the information retrieval. To understand the semantic of the query we need to define the complex structure. The lot of research has done in keyword-based information retrieval where only the keywords are matched. But the problem with this approach is that if the two queries having the same keywords but have different meaning, then for both the queries will give the same result. If we use the semantic based approach, it understands the meaning & user indentation involved in the query which retrieves the accurate answer

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Literature Review: Miriam Fernandez, Iván Contador, Vanesa López, David Valet, Pablo Castells, Enrico Motta (1) suggested the fully-fledged ontologies in the semantic-based perspective. The paper describes a semantic search model which integrates the benefits of keyword and semantic-based search and addresses the challenges of the huge and diverse web environment. The target search space is defined as a collection of unstructured content. The results describe that as compared to the best TREC automatic system; the semantic search model attains better performance results.

Athira P. M., Sreeja M., P. C. Reghu Raj (2) describes suitable methods which process the complex questions by enhancing the capabilities of current QA system. They have used the ontology and domain knowledge for redeveloping queries and detecting the relations. The system will generate short and precise result to the question asked in the natural language in a specific domain. The system will be implemented and result shows accuracy of 94 % in natural language question answering.

Maksym Ketsmur,, Mário Rodrigues, and António Teixeira[3] design a QA system to knowledge bases such as DBpedia, using factual questions in Portuguese, English, French and German. The system was tested with 30 random questions from QALD 7 (Question Answering over Linked Data) training set. Considering that the answer existed in the knowledge base, a correct answer was produced for 67% of the questions for the Portuguese version and up to 55% (for English) of times for multi-language version. Results proved that this approach is promising and further investigation should be carried out to improve it. The robustness observed, and capability to handle several languages, fosters future work to expand the system to answer

Table 1. Comparisons of different types of Semantic based QA System.

Type of Question and Answering System	Methods used	Dataset or Corpus	Result
Semantic question answering model for question answering system [1]	User modeling & relevance feedback methods are used for semantic question analysis	GeoBase Ontology dataset consisting of 880 annotated user questions of US Geographical information.	Compare with Aqualog and FREya&t achieved 0.947 f- measure
Ontology based question answering system on software test document domain [2]	Model view controller pattern is used	software test document domain	Retrieves answers to factoid type questions
Ontology based question answering using semantic similarity matching [3]	Blooms Taxonomy questions of various levels of are generated (i. e. low to high, slight to large, modest to composite)	Open domain questions using Google	Find different patterns for the same questions
Open Domain Real-Time question answering based on semantic & syntactic question similarity [6]	Latent based question similarity, WorldNet based semantic & syntactic similarity	Yahoo answer corpus site includes topics as Art & Humanities, health, home, sports & travel etc.	Extract answer in less than 1000 characters in less than 60 sec. 899 questions answered out of 1088 questions
Towards a Question Answering system over the semantic Web [9]	Multilingual KB-agnostic approach	Knowledge base Wikipedia, DBpedia MusicBrainz, DBLP & Freebase	Uses five different languages as English, German, French, Italian & Spanish for the evaluation of system

Vivek Datla, Sadid A. Hasan, Joey Liu, Yassine Benajiba Kathy Lee, Ashequl Qadir, Aaditya Prakash, Oladimeji Farri[5] implements a real-time question answering system using the syntactic and semantic similarity on open domain. The system defines real time user questions. These questions are extracted from the stream of most recent questions and it is given to the participants via a socket connection. The systems in turn provides an answer with length of 1000 characters in less than 60 seconds. These answers are evaluated by the human expert in terms of accuracy, legibility, and precision and so that the correctness of the generated answers is checked. For generating the answers, question disintegration, question relatedness and answer generation strategies are used. The following table shows details about the question answering system and their working.

MATERIAL AND METHODS

The proposed system retrieves the correct answer by increasing at the semantic level, the linguistic knowledge and also the better understanding of the domain used.

The System is divided into 3 components:
i) Query understanding
ii) Document Retrieval
iii) Ranking and exact answer selection

To develop a question answering system, we used the data set of law domain. We develop the corpus of the 500 files related to various sections & articles of law domain. To create the knowledge base, the basic concept is to identify the syntactic information which gives us the lexical construct like noun, verb and other terms. The noun, verb and the adjective keywords are analysed with the semantic meaning using WordNet with hyponym & synonym of the semantic entities if any exists.

Figure 1: Proposed Approach

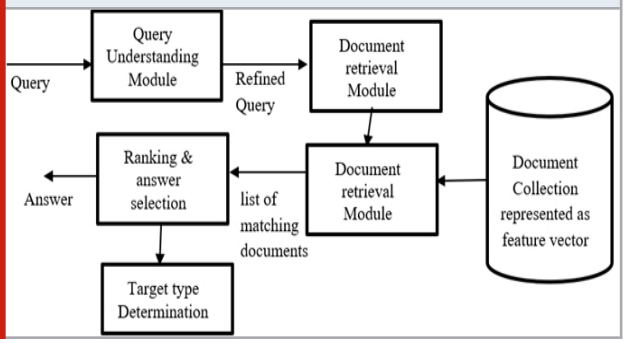
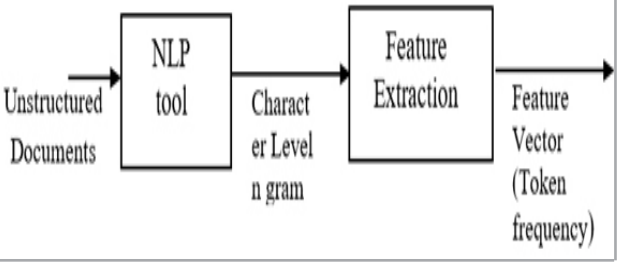


Figure 2: Creation of Corpus

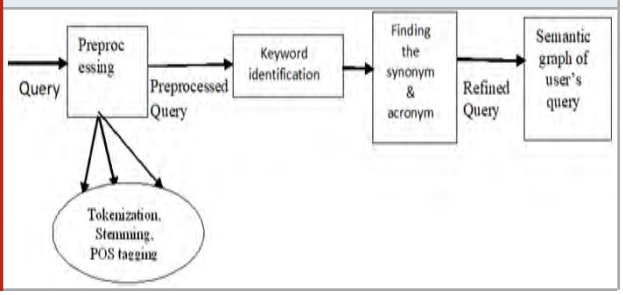


Corpus: The corpus of the text files related to the IPC sections are created. To create the knowledges base of the files for the fast retrieval, the pre-processing like tokenization, stop word removal, stemming etc. be carried out. After the pre-processing, we have to identify the keyword present in the files & creating the dictionary of keyword. It also determines, for each keyword the number of documents & the documents where that keyword is present. To do this, we divide each document into n-grams (sequences of n tokens). For Natural Language Processing (NLP) tasks, n-grams are often computed at the word level, but we found that computing it at the character level gives better performance in our source code task. Another advantage of character level model is that we don't have to tokenize the text or don't have to break it into words. For each document the frequency of each possible token is computed. We convert the character level bi-gram combined with other n-grams to an array of numbers by counting the occurrences of the token sequences in the document. We call this numeric representation of a document the feature vector. Next, we will create the semantic graph of the all the documents with important keyword & also maintains the semantic relationship between them.

Query Understanding: The query(structured/unstructured) is inputted to the system. Understanding the semantic of query is important to get the accurate result. Initially the query gets analysed and identifying the keywords. The complex query is divided into small parts for better finding the semantic. After that the query get expanded to find its synonym so that the query with the different meaning of the same keyword is not to be missed out. Also, the acronym expansion carried out expanding the terms like "IPC" to "Indian penal code". Now the query gets classified so that the target of query will be determined. The target type indicates what type of answer is expected to retrieve. The target type which we considered here is "what", "when", "yes/no" short descriptive" & "factual". After the classification, the refined query is the passed to the Document retrieval module.

To understand the semantic, we created the semantic graph which captures the internal structure such as syntactic & semantic which determines the semantic relationship between the semantic entities. It then searches the documents using the semantic graph created. Some pre-processing task that we apply are tokenization, lemmatization, stop words removal and stemming for better matching the documents.

Figure 3: Query Refinement Process



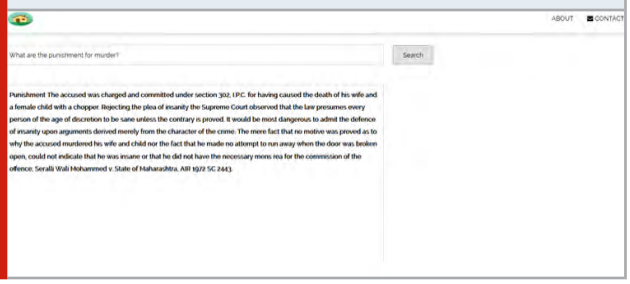
Question Dataset: We need the question dataset to train our system to deal with the closed domain, The question data set of 150 questions was designed related to total 511 IPC section.

Examples:

1. What is punishment for attempt to murder
2. Which IPC is applied for attempt to murder?
3. Under which section the offences affecting the human body and punishment for the crime are defined.

Document Retrieval: The keywords in query is gets matched with the documents represented by feature vector. All the relevant documents get identified & retrieved based on keyword present in the query. The union of all the keywords present in the query & thus it finds the relevant documents. They will be extracted from the documents stored in our data corpus. Below is the screenshot of search module representation: Both the keyword based & semantic based search is taken into account. For semantic based search, the semantic graph of the query is considered, which gets matched with the documents represented by semantic graph.

Figure 4: Search Module



Ranking & Answer Selection: For the factual questions, what type of question, explanative answers, fact-based questions, the system determines precise answers to the query. The ranking of the documents is provided based on the semantic matching. For the keyword-based search, the result is less effective compared to that of semantic based search.

For example:
If the query 1 is "Which punishment is given for attempting to murder?" & query 2 is "Are there any punishment for murder?" Since the keyword defined in both the queries are same, it returns the same answer for both the queries. But as the first query is descriptive type & second query is Yes/ No type. So the answer also expected to be of descriptive type answer & answer in the form of yes/no. So, by understanding the user intent & conceptualization behind the query, it retrieves the accurate result. We have specified classification of the questions based on the target of each question depends on the tokens present in the query as per the following table:

As the documents are represented as the feature vector, this feature space is transformed into the latent semantic space. In this new space, we used the similarity to find the relationship between the queries and documents. We have used the popular ranking model, BM25 model for ranking the documents. After retrieving the collection of passages from the various documents based on the target type, the next task is the exact answer section for the given query. The ranking will return the documents with highest relevance, then next highest up to the lowest relevance. We use the graded relevance to determine the measure of usefulness & accordingly selection of the final answer carried out.

Table 2. Target type and tokens

Target type	Tokens
Description type	What, Define, give reason, Suggest, tell us, what happens
List type	List various section, List the punishments, List the IPC
Yes/No type Factual type (When type) Location based type (Where type)	Whether, Can, Is, Would, Will When, how long, how much, Where, at

RESULTS AND DISCUSSION

The system is evaluated on the basis of Precision, recall & F-Measure, which is most commonly used metrics for evaluating the performance of the information retrieval. The following table indicates the comparison of the results of keyword-based approach & semantic based approach. The proposed system is tested with 150 different questions which are in structured form.

Table 3. Experimental Results showing precession & recall of both keyword & semantic approach.

	Keywords based search	Semantic based search
Question dataset used for testing the system	150	150
Answers generated by the system	95	125
The correct answer generated	90	120
Precision	0.94	0.96
Recall	0.6	0.8

FUTURE SCOPE AND CONCLUSION

The system is tested for 150 question (structured and unstructured) on the various evaluation parameters, showing the accurate & precise results for the semantic based search. In future, we can implement the summarization which will summarize the results of the top 3 retrieved results so as to get detail description of the query. We can use the concepts for developing the question answering system for COVID-19 data set to answer COVID-19 related queries.

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Prediction of Heart Disease using Machine Learning Algorithm

Viraj S. Varale[1*] and Kalpana S. Thakre[2]

[1]*Student (Final Year B.E. IT), SCOE-Sinhgad College of Engineering Pune, India,*

[2]*Professor, Sinhgad College of Engineering Pune, India*

ABSTRACT

Human hearts suffer through various heart ailments. There are several diseases related to the heart like cardiomyopathy, Aorta diseases, Coronary Heart Disease (CHD) and arrhythmia which majorly contributes mortality and morbidity rates worldwide. One in 4 deaths in India is now because of cardiovascular disease with ischemic heart disease. The biggest challenge to overcome is the prediction of cardiovascular diseases via data analysis in the clinical domain. Now a day's large number of data is produced in health care and wellness industry. Finding meaningful data and patterns is the urgent need to make the proper regulations and forecasting. We proposed a framework for predicting a heart disease using three different algorithms: Random forest, Naive Bayes, and logistic regression. Proposed system uses Cleveland dataset from machine learning UCI repository for training and testing of the model. This model imbibes various significant features and classification techniques to predict the results. We also compare the results of proposed system with the algorithms that are existing in the literature, on the same dataset and it is observed that model produce an enhanced accuracy performance of 94.73%.

KEY WORDS: MACHINE LEARNING, HEART DISEASE, RANDOM FOREST, LOGISTIC REGRESSION, NAIVE BAYES, VOTING CLASSIFIER, CHI SQUARE METHOD, CLEVELAND DATASET, DECISION TREE, SUPPORT VECTOR MACHINE.

INTRODUCTION

Nowadays, whole world is suffering from Coronary artery and is a crucial source of death rate all over the world. According to a report prepared by various national and international health organizations, cardiovascular disease (CVD) caused 17.5 million (30%) of the 58 million deaths worldwide. A daunting increase is observed over last 20 years in the widespread presence of cardiovascular deaths in our country and other countries in Asia.

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In India, heart disease becomes the major cause of disease. Heart disease caused 17.8% of total demises. Demises due to heart diseases increased 15 lakhs in 2016 if compared with the statistics of year 1990. Heart disease is more deadly in males than in females. As per the report given by "The Wire" in 2016 more than half of the total heart disease demises in India were in people not older than 70 years. This condition was increased in the states of India, where the health care system is less equipped with cutting edge technology, which is a major challenge posed to the health systems. An urgent attention and action require to be provided in all the states of India for decreasing the deaths that are caused by cardiovascular disease in the economically productive age groups. Heart disease, stroke, diabetes and cancers are the main alarming causes that India has witnessed in last 25 years in India.

Statistical evaluation of the diseases like heart disease, cancer, chronic respiratory disease, and diabetes states that the prevalence of such disease increased in India from 1990 to 2016. A total death caused due to heart disease has

almost double in the past 25 years and it is significantly increasing at alarming rate. Latest revolutionary technologies like machine learning, artificial intelligence and big data can be used to rehabilitate heart disease to reduce premature deaths. We have studied various machine learning techniques for heart disease. As per methods that is existing in the literature lot of algorithms are used to develop similar kind of systems but the results are not satisfactory. We have studied hybrid random forest and linear model (HRFLM) for prediction of heart disease. HRFLM model achieved 88.7% accuracy. HRFLM model proposed implementation of random forest and linear model algorithm for prediction. The proposed work suggests the prediction of heart disease using supervised machine learning algorithm using random forest, Naive Bayes and logistic regression algorithm by using voting classifier algorithm to integrate these algorithms into a single model.

Literature Survey: Forecasting of heart disease is an important provocation in the area of health care industry. Many of the researchers have worked in this particular domain. Some of the research paper that are existing in the literature are explained here.

[Senthilkumar Mohan, 2019] have proposed a system for the prediction of heart disease using random forest and linear model algorithm. This research paper shows that use random forest and linear model gives better accuracy than any other algorithm like decision tree, genetic algorithm and neural network in these particular areas. [Resul Das, 2009] proposed a framework that uses SAS based technology for forecasting of heart disease. They developed an ensemble based neural network-based method by combining the posterior probability for the prediction of values. This neural network-based model obtained an accuracy of 89.01%, reactivity 80.95% and 95.91% specificity values. [Hamidreza Ashrafi Esfahani, 2017] proposed a cardiovascular disease detection system that uses a new ensemble classifier.

They proposed a hybrid algorithm to increase the accuracy of proposed method. They collected the patient's data from Cleveland dataset from UCI repository and applied discovery pattern algorithms like Decision tree, Neural Networks, Rough Set, SVM, Naive Bayes algorithm. They finally compared their accuracy and prediction. Based on results the hybrid method achieved an F-measure of 86.8%. [V. Krishnaiah, 2015] proposed a heart diseases detection system using Naive Bayes Algorithm. This algorithm is used to classify the data set. The F-measures values they observed are 74% accuracy, 71% precision, 74% recall and 71.2%. In this paper author [Suganya Ramamoorthy, 2016] used naïve Bayes and particle swarm optimization technique to design a forecasting system of heart disease. Particle swarm optimization technique is an efficient evolutionary computation technique which selects the most optimum features which contribute more to the result. This system obtained 87.91% of accuracy.

Proposed Method: In this study we have used Anaconda and Jupyter notebook to perform heart disease classification. It is easy to use and provides simple user interface. First step to create machine learning model is data pre-processing phase followed by feature selection using chi2 method. We train and test ML model using UCI Dataset. We used Random Forest, Logistic Regression, Naive Bayes and Voting Classifier algorithm from sklearn library. We used python libraries numpy for mathematical operation, pandas for data manipulation, sklearn for importing machine learning algorithms and seaborn, matplotlib for ploting graphs We evaluate performance of the model using confusion matrix.

Figure 1: System Architecture final prediction model

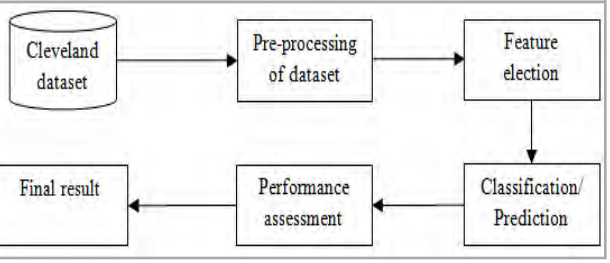


Figure 1 depicts the system architecture of final model. 6 steps in architecture diagram describes the development of final prediction model which are explained below.

UCI Dataset: Proposed method uses the patient's data form Cleveland dataset of UCI repository. This dataset contains total 13 features with class label in which 11 contains vital clinical records and 303 instances. We selected 8 features from 13 features to create model. 1. Chol 2. Thalach 3. Oldpeak 4. Thal 5. Cp 6. Ca 7. Exang 8. Age these 8 features are selected using chi square method.

Data Pre-processing: This is the first step for the implementation of proposed method in this step the Cleveland dataset is processed and anomalies are removed this dataset contains 303 patient records and we have used all instances of dataset for training and testing of the proposed model. During this process it is observed that 142 records shows the presence of heart disease by value 0 and 161 records shows the absence of heart disease by value 1. It is also observed that males are more prone to heart disease if compared with female.

Feature Extraction

We used chi square ($\chi 2$) method for feature selection
O - Observed number
E - Expected number
Step 1: for O = 1 TO N { (O – E).
Step 2: (O –E) 2.Step 3: [(O - E) 2 / E]}

Classification Using Machine Learning Algorithm:

We used 3 different algorithms for forecasting of heart disease and a voting classifier algorithm that will give the final prediction results

1. Random forest (RF) 2. Logistic regression (LR)
3. Naive Bayes (NB) 4. Voting Classifier (VC)

Random Forest

Precondition: T:= (p1, q1), . . . ,(pn, qn), features F, and D are number of trees in forest.

1. RandomForest(T, F)
2. R ← null
3. for i = 1, . . . , D {
4. T (i) ← A bootstrap sample from T
5. Ri ← Decision_tree(T (i) , F)
6. R ← R ∪ {hi}
7. end for
8. return R }
9. function Decision tree(T , F) {
10. for each node:
11. f = subsection of F
12. divide on feature f
13. return the training model of decision tree}

Logistic Regression

X-Matrix of input features

Y- Class label 0/1 (yes/no)

β - Coefficient matrix of X.

B0- Y intercepts.

Step 1: Mathematical formula for Logistic regression

Z={ β0+ β1X1+ β2X2+... βm Xm.} Z= βX.

β = { β0 ,β1 ,β2...βm}. X= {X1, X2, X3...Xm}.

Step 2: Calculate β by using maximum likelihood estimation (MLE)

$$ħ\ (\beta) = \sum_{i=0}^{n} (\ \dot{y}\ ) Ln P(X\ |\ \beta) (1 - \dot{y}\ ) ħ\ (1 - (P(X\ |\ \beta)))$$

Step 3: Sigmoid function

$$g(z) = \frac{1}{(1 - e^{-z})}$$ where 0<=g(z)<=1

Naive Bayes

Step 1: find the prior probability for given class labels. P (yes) and P (no)

Step 2: Find Likelihood probability of each attribute for each class

P(B|A) where B-features and A- class labels.

Step 3 : Put these value in Bayes Formula and calculate posterior probability for class yes and class no

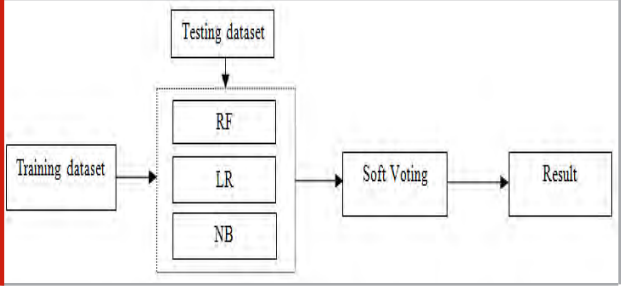
$$P(A \mid B) = \frac{P(B \mid A) P(A)}{P(B)}$$

A= {yes, no} B= Features

Step 4: result will be the class with higher probability.

Voting Classifier: Voting classifier is ensemble method used to aggregate the prediction of each classifier and predict the class that gets most votes. A voting classifier is used to find the result that is based on probability. As shown in figure 2.

Figure 2: Voting Classifier



RESULTS

Chi Square Test: Different performance evaluation terms such as accuracy, precision, recall and error in classification have been calculated for performance efficiency of this model. Accuracy calculates the percentage of correctly predicted true positive and true negative values. Precision calculates corrective predicted value in terms of percentage. We used confusion matrix to calculate accuracy, precision, recall and error rate.

Table 2. Chi square score

Features	Score
Age	23.29
Gender	23.91
Chest pain	81.68
Blood pressure	47.70
Cholesterol	173.10
Fasting Blood sugar	0.23
Ecg	10.02
Heart rate	110.13
Exang	57.79
Oldpeak	89.43
Slope	47.50
Ca(Fluoroscopy)	74.36
Thal	85.30

Table 2 shows the score of each feature calculated by using chi square method for feature selection. From the chi square result, we observed that the feature Chol scored 173.10 highest among all and feature Fasting blood sugar scored 0.23 lowest among all features as shown in figure 2. We removed irrelevant features selected only those features which are relevant and help to increase the accuracy of the prediction model.

Confusion Matrix: Cleveland dataset is used for tutoring and examine the data values. 75% of data is used for tutoring and 25% of for examining. We used 76 instances from Cleveland dataset for testing. Table 3 shows TP, TN, FP, FN values calculated by comparing Actual class label of 76 instances and value predicted by prediction model.

Figure 2: Chi square score

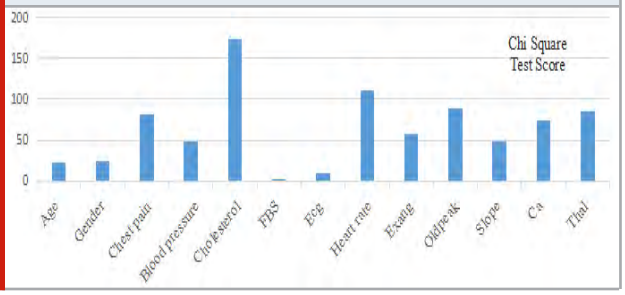


Table 3. Confusion matrix result

Algorithm	TP	FP	FN	TN	Instances used for testing
Decision tree	31	7	8	30	76
SVM	20	18	5	33	76
Random forest	32	6	2	36	76
Naïve Bayes	35	3	5	33	76
Logistic regression	34	4	2	36	76
Voting classifier	36	2	2	36	76

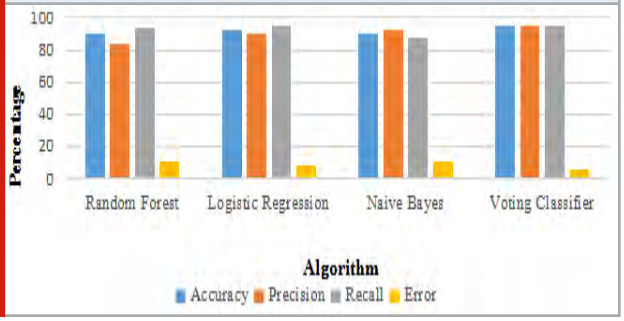
Table 4. Comparing different algorithms

Algorithm	Accuracy	Precision	Recall	Error
Decision tree	80.26	81.57	79.48	19.47
SVM	69.73	52.63	80	30.27
Random forest	89.47	84.21	94.11	10.52
Naïve Bayes	89.47	92.10	87..50	10.52
Logistic regression	92.10	89.47	94.44	9.21
Voting classifier	94.73	94.73	94.73	5.26

Table 4 compares result of Decision tree, Support vector machine, Random forest, Naive Bayes, Logistic regression and voting classifier (final prediction model). The maximum percentage of accuracy is achieved by our prediction model in comparison with existing heart disease prediction models.

System Performance Result: The prediction model is train and test using 8 features and the accuracy is evaluated for modelling techniques. The prediction model obtained 94.73% accuracy. Features are selected using chi square test. Table 4 shows accuracy, classification error, precision, and recall of various machine learning algorithms in percentage. Figure 3 is graphical representation of Accuracy precision recall and error rate of random forest, naive Bayes, logistic regression and voting classifier.

Figure 3: Confusion matrix result



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Implementation of Convolutional Neural Network with Optimization Techniques for Face Recognition

Roshni S. Khedgaonkar[1], Kavita R. Singh[2], Mukesh M. Raghuwanshi[3] and Pravinkumar M. Sonsare[4]

[1]*Assistant Professor, Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur, India*
[2]*Associate Professor, Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur, India*
[3]*Professor, Computer Engineering, G.H. Raisoni College of Engineering and Management, Pune, India*
[4]*Assistant Professor, Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Face images is the key factor though which an individuals are distinguished. Because of current pandemic impact of COVID-19 the entire universe is drawing closer towards contact less Gadgets where less physical collaboration is required. In view of this, we have proposed the Convolutional Neural Network (CNN) model and applied on various face databases by measuring the behaviour of various optimizers. The experimentation has been performed on various face databases. In particular, AR, LFW, LAG, DFW, UKFace Database, PSD, ASPS. These databases contains the facial images with variations in illumination, expression, various poses of face image, occluded images by face mask, sunglasses, beared, mustache also contains face images of different age group. Furthermore, the proposed CNN model have evaluated on pre and post plastic surgical face images. The working of some of the optimizers listed as, PowerSign, AddSign, RMSprop, Adam are observed on these face images. From the said optimizers, PowerSign and AddSign perform better for sequential data. However, it comes to 2D pictures its performance diminishes to incredible expand. When performed an experimentation with RMSprop achieved better accuracy. Nevertheless, suffers from the local minimum. On a contrary, Adam outperform with respect to CNN model by obtaining local minima in less time. Adam achieves 98% to 90% of accuracy for AR to PSD(Plastic surgery face database) and ASPS(American Society of Plastic Surgeon) database.

KEY WORDS: CONVOLUTIONAL NEURAL NETWORK, LOCAL PLASTIC SURGERY, DEEP LEARNING, MACHINE LEARNING, ADAM OPTIMIZER.

INTRODUCTION

Face recognition (FR) is useful thoroughly in the field of institutes, data security, crime controlled zones. Generally, face recognition system does not need the sense of touch or interaction from human to conduct the process of recognition. It is one of the benefits of face recognition over the other recognition strategies. for example, The flare-up of novel coronavirus 2019 (COVID-19) has prodded the critical advancement of biometric recognition technologies that can dissect and distinguish subjects wearing facial masks, particularly in high security applications. In spite of the fact that, from last endless many years, face recognition is considered as a developed area of computer vision it actually battles with performance issues because of different challenging issues, for example, variety in pose of a face is because of various angle or edge, from which image of the face has been procured. The variation in illumination emerges

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**Corresponding Author: roshni.k86@gmail.com*
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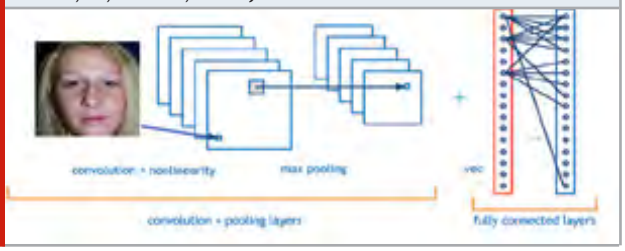
due to uneven distribution of light from different sources on face.

Further, facial images have different expressions that also directly affect the appearance of the facial images. Furthermore, various other obstacles, for example, wearing mask, beard, mustache, and sun glasses, scarf changes the presence of an individual where some segment of face is blocked because of which few feature gets lost (Khadatkar, Khedgaonkar and Patnaik, 2016). Another difficult issue is facial plastic surgery procedure which additionally changes the presence of a face and result in complex issue in face recognition(R.Singh, 2010) Normally, facial plastic surgery is applied for enhancing the facial appearance(Singh, Khedgaonkar and Gawande, 2011). All the aforementioned issues changes the features of face which makes face recognition a challenging task. It may create uncertainty author in(Raghuwanshi and Singh, 2009) handle this through roughest theory.

In earlier study, many researchers have proposed various algorithms for feature extraction listed as, Principal Component Analysis (PCA) (D Xiaoqian , H Huan, 2010), Linear Discriminant Analysis (LDA) (]H Yu, 2001)(]H C Kim , D Kim, 2002)and Local Binary Patterns (LBP)(L Lei, D H Kim, W J Par, 2016). Recently, deep learning based feature extraction algorithm is used which gives incredible advantages (Boureau, Y.-L.; Ponce, J.; LeCun, 2010). Particularly, CNN is the promising technique for face recognition. As per the recent literature, the CNN performed well in an unconstraint environment(Fredj, Hana & Bouguezzi, Safa & Souani, 2020)(Ridha Ilyas, Bendjillali & Beladgham, Moh & Merit, Khaled & Miloud, 2020). It worked well with occluded faces The Section II focuses on overview of Convolutional Neural Network. Section III discussed the proposed approach. The detailed database description is given in Section IV. Section V is highlighted the result and conclusion part.

Figure 1. The General Architecture of CNN(Boureau, Y.-L.; Ponce, J.; LeCun, 2010)



Preliminaries: This section gives the insight of Convolutional Neural network and its various layers as well as the variety of optimizers have been used in this paper. A convolutional neural network is a kind of artificial neural network (ANN). A typical CNN architecture can be seen as shown in Figure1. The structure of CNN contains Convolutional, pooling, Rectified Linear Unit (ReLU), and Fully Connected layers.

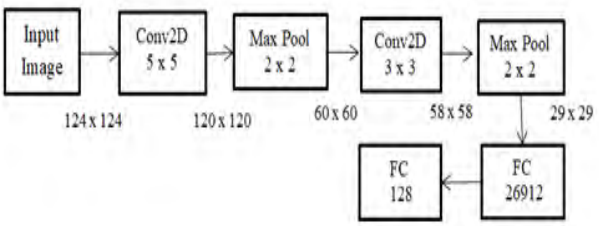
Convolutional layer: Convolutional layer is considered as an essential block of CNN. The mathematical representation (Boureau, Y.-L.; Ponce, J.; LeCun, 2010),is represented in Equation (1)

$$y_i = b_i + \sum_{x_i \in X} w_{ij} * x_i \quad (1)$$

where $y_i \in Y, i=1,2,...D$. D is the depth of the convolutional layer. Each filter w_{ij} is a 3D matrix of size [F×F×C_x]. Its size is determined by a receptive field (F), and (C_x) is the depth of feature-map. Pooling layers: Pooling layers are mainly authorized for dimensionality reduction which reduces the input dimensions by performing the down-sampling operation(Boureau, Y.-L.; Ponce, J.; LeCun, 2010). Fully connected layers: Fully connected (FC) layers transform the two dimensional feature map to the single dimension feature vector. In respect to this, 1D feature vector act as a classifier for classification purpose.

Proposed Approach: Feature extraction is the system of capturing the ideal feature esteems utilizing CNN instead of extraction of hand-crafted features. The general process of face recognition comprises of same traditional steps: Image capture, Feature Extraction and Classification. Features are extracted using CNN instead of hand-crafted way of extraction. The overall process of proposed CNN model consists of various layers as model, 7-layer CNN architecture has designed. The person identification is done be describe in figure 2.

Figure2: Proposed 7- Layers CNN Model



The convolution kernels are utilized over and over in each fields of the entire region, and the convolution result comprises a feature map of the input image. The convolution layer containing the weight matrix w and bias b. in this chapter, the size of the convolution kernel use as 5x5 and 3x3. The input size to be used as 124 x 124 x 3. In this paper, we have used 2D convolutional network with 32 kernels of size 5 x 5 each which is produced an output image of size 120 x 120.

It has used ReLU activation function which is consider to be most popular activation function. Next, The MaxPool layer is used for dimension reduction purpose with dimension as 2 x 2. It reduces the dimension of Conv2D network to 60 x 60. Again, the process of Conv2D and MaxPool layer is repeated but only change in the size of kernel. This time kernel size to be consider as 3 x 3. The output of MaxPool layer is being given to the Fully connected layer which flatten it to 26912. Another Fully connected layer is introduced with size as 128. It act as a classifier for classification task. In this paper, the Stride

of 1 is used for Con2D layer and stride of 2 is consider for MaxPool Layer with padding 0 for all the layers.

Figure 3: Sample face images under various face databases: (a)AR (b)LFWCrop (c)UK Face images (d)LAG (e)DFW (f) PSD

1. http://www2.ece.ohio-state.edu/~aleix/ARdatabase.html
2 http://conradsanderson.id.au/lfwcrop/
3 http://iab-rubric.org/resources/dfw.html
4 http://www.ivl.disco.unimib.it/activities/large-age-gap-face-verification/
5 https://cswww.essex.ac.uk/mv/allfaces/index.html
6 http://www.iab-rubric.org/resources.html

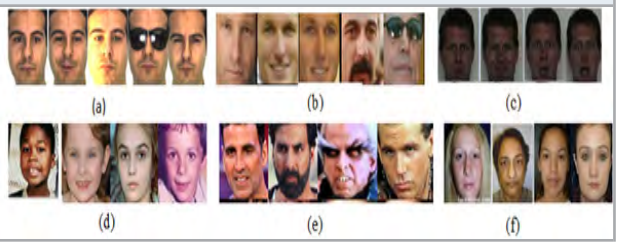
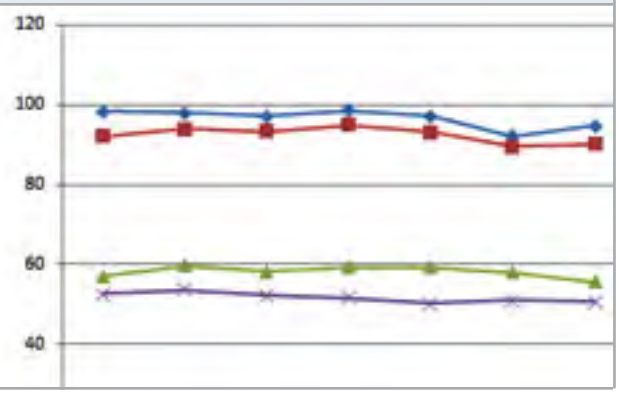


Table 1. The accuracy of proposed CNN model on various optimizer

Types of Optimizer	Face Databases							No. of epoch
	AR	LFW	LAG	Disguise	UK Face Database	PSD	ASPS	
Adam	98.4	98	97.2	98.5	97.1	92.2	94.7	10
RMSprop	92.1	94	93.4	94.9	93.2	89.5	90.2	10
AddSign	57.1	59.7	58.2	59.2	59.2	58	55.7	10
PowerSign	52.7	53.7	52.2	51.6	50.2	51	50.7	10

Figure 4: Graphical representation of results



RESULTS AND DISCUSSION

We have investigated and evaluated the performance of face recognition algorithm using 7-layer CNN architecture on various face database such as AR,LFW,LAG, DFW, UKFace Database, PSD, ASPS. AR Face database1, LFWCrop face database2, DFW face image3 contains variety of face images corresponding frontal view faces with variation in facial expressions, illumination , and occlusions (scarf, sun glasses, mask). Large Age-Gap (LAG) dataset4 and UKFace Database5 containing facial images under various age group(child to adult or young to old). The PSD6 and ASPS(American Society of Plastic Surgeon Face Database, 2019) contains various types of local plastic surgical faces before and after surgery out of which we have performed experimentation on proposed CNN model with three types of surgery. specifically, Rhinoplasty, Blepharoplasty, Lip-augmentation. The sample face images of aforementioned face database is shows in Figure 3.

The proposed proposed CNN model has binary_ crossentropy loss function which was shown the sum of all losses and tested this algorithm with various optimizer algorithm as PowerSign, AddSign, RMSprop, Adam. The accuracy of proposed approach is measured on the above mentioned face databases by applying types of optimizer is result is tabulated in Table II. The graphical representation of result is figured out in figure4. From the above discussion, it has been observed that the performance of proposed algorithm on PowerSign and AddSign is at lower accuracy(Kingma, D. P., & Ba, 2015). Whereas, RMSprop gives better accuracy as compare to earlier two optimizer. Adam outperform with respect to various face databases (Bello et. al, no date).

CONCLUSION

Now a days, one of the highly demanding field in the area of image processing is face recognition. Looking to the current scenario due to COVID-19 disaster whole universe is approaching towards touch less Gadgets where less human interaction is required. Face recognition system is now important for recognition purpose in Educational institute, offices, child care unit, crime controlling bodies and where security is the major concern. In this paper, author has measure the performance of face recognition gets affected due to different factors such as aging, pose variation, facial expression, occlusion, illumination variation problem and facial plastic surgery. This makes face recognition still a most challenging task.

As per the literature, various state-of-art face recognition algorithms used to extract hand crafted facial features. This motivates us to propose the CNN model and applied on various face databases by measuring the behaviour of various optimizer. As per the literature PowerSign and AddSign perform better in terms of sequential data but when it comes to 2D face images its performance gets decrease up to 50%. RMSprop achieved better accuracy but still struggle with finding local minimum. On a contrary, CNN outperformed with respect to Adam

optimizer. It gives good result up to 98% for variety of face images includes, variation in expression, change of angle in terms of pose variation, change in illumination, occluded faces. However, Plastic surgery face images the performance reduces to 90%. So, we can conclude that Plastic surgery face image is considered to be a more challenging task.

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Microstrip Antennas: Rectangular, Circular & U-Shape: Performance Comparison

Nishant M. Borkar[1*] and Pallavi K. Parlewar[2]
[1,2]*Shri Ramdeobaba College of Engineering and Management, Nagpur*

ABSTRACT

In this paper a performance evaluation of Microstrip Patch antenna is discussed. Theoretically various shapes of microstrip antenna can be designed, simulated and fabricated. But performance point of view Rectangular, Circular and U-shaped microstrip patch antenna are widely used in various microwave applications. Hence these three microstrip antennas are compared in this paper. The most widely used application of these antennas are in ISM Band. Hence 2.45 GHz frequency is selected here in this paper for simulation and evaluation purpose for comparison. The commonly available and cheapest substrate FR4 (Flame Retardant) Epoxy material is selected commonly for these three antennas. All structures are simulated using HFSS 13 version software. Performance is judged depending upon parameters such as return loss, gain and directivity of these antennas.

KEY WORDS: MICROWAVE, RADIO, MEDICAL IMAGING, SUBSTRATE, VSWR, IMPEDANCE

INTRODUCTION

Microwave and optical communication integrated circuits requires a compact, light weight and cheaper manufacturing antennas (Wong, 2003). Although low gain and narrow bandwidth are the limitations of these antennas, can be circumvented by implementing bandwidth and gain improvement techniques in microstrip antenna also with some modification in physical parameters of the antennas (Bankey and Kumar, 2015). These antennas are widely used in various applications starting from bar code sensors to mobile telecommunications, including medical application such as hyperthermia, imaging, etc. The performance of these antennas can also be improved by using various other techniques such as adding parasitic elements, modifying thickness of the substrate, altering substrate material and several other techniques which effectively modifying shape of the patch(Vaid and Agrawal, 2014) (Elo, Zulkifli and Rahardjo, 2017).

Depending upon applications and available space to fit in the patch antenna can be designed in various geometrical shapes, more over depending upon shape and size required gain, radiation pattern, directivity of antenna can be controlled to a required level up to some extent (Khan, Riaz and Bilal, 2016). Some of popular shapes of patch antennas are rectangular, circular, elliptical, U-shape, triangular and various combinations of all above in form of sector antennas like disc sector, circular ring for improvement of desired parameters(Giauffret, Laheurte and Papiernik, 1997).

In the coming paragraphs three microstrip patch antenna configurations namely simple rectangular, notch feed circular and U-shape antennas are compared depending upon their simulation and characterization results. All these three configurations are designed for contact feeding method where power is directly given to a patch, in general there are two types of feeding techniques for microstrip antennas: contacting and non-contact feeding (Bisht et al., 2014) have their own benefits and

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limitations. Other than telecommunication applications, short range low power device applications internationally allocated a dedicated an ISM band. One range in this band is 2.4 – 2.5 GHz centered at 2.45 GHz. ISM is a acronym for Industrial, Scientific and Medical band and have applications such as microwave ovens, cordless

Figure 1: Microstrip Patch Antenna Major Geometrical Shapes

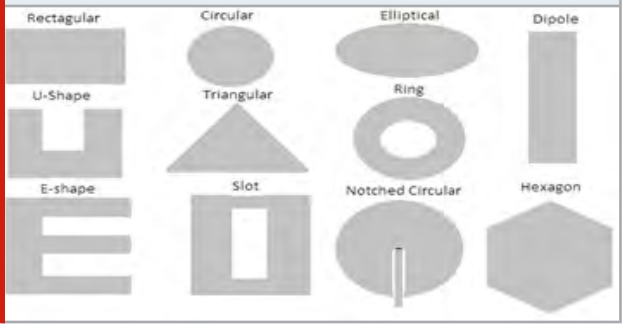


Table 1. Various medical applications of microwave antennas in ISM bands

Thermal Treatment	Microwave Imaging	Biotelemetry
Hyperthermia	Breast Cancer Detection Antennas	Wearable Antennas
	Flexible Antennas for Breast cancer detection Brain Stroke Detection Antennas Brain Tumor Detection Antennas	Implantable Antennas

phones, Bluetooth, near field communication, door openers, baby monitors, Wi-Fi networks. Other than these applications there are various medical applications where this ISM band can be used to treat certain ailments and diseases using antennas operating in this band (Kaur et al., 2015). Various medical applications of Antennas operating in ISM band are given below table.

Due to this reason there is an increased interest in microwave medical imaging systems, which resulted in development of various types of antenna which are suitable for this application. To design the antenna for this application, the electromagnetic (EM) modelling and required high frequency computation is required to perform in software such as HFSS or CST Microwave studio FEKO etc. The performance of the antennas is typically simulated separately from the whole Microwave Imaging System (MIS) in these high frequency structural simulator softwares and then these simulated structures are then fabricated using CAD machines. Even after perfect simulation after fabrication the simulated and actual characterization results of a fabricated antenna differ by some margin.

This difference in simulated results and actual characterization results have many reasons such as quality of dielectric substrate, quality of conducting patch, errors in physical implementations, etc (Durney and Iskander, 1988). For this applications Rectangular Microstrip Patch antenna, U-shape patch antenna and notched circular centre fed antenna operating at 2.45 GHz (ISM Band) are found suitable and hence simulated in HFSS software version 13. Simulation is followed by actual physical implementation i.e. fabrication of these devices and lastly all of these three types of antennas are characterized and results are matched with their simulated results.

Rectangular Microstrip Patch Antenna: Simulation: First a basic rectangular microstrip patch antenna is designed as follows. Physical Dimensions of Patch Length = 38 mm, Patch Width = 29.5 mm, Feed Length = 15mm, Feed Width = 2 mm, Ground Plane 60 mm x 60 mm Material FR4 Epoxy, Dielectric constant = 4.4.

Figure 1: Rectangular Patch Antenna HFSS Simulated 3D Modeler: Front and Back view

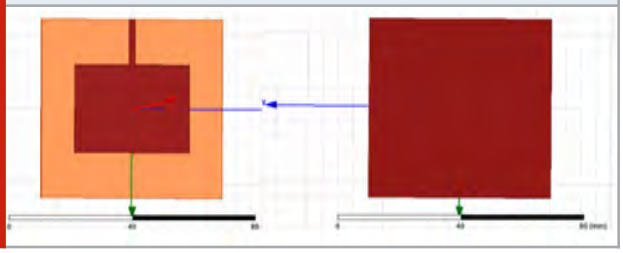


Figure 2: Rectangular Patch Antenna S11 Plot: Centre Frequency = 2.450 GHz & S11 < -25dB

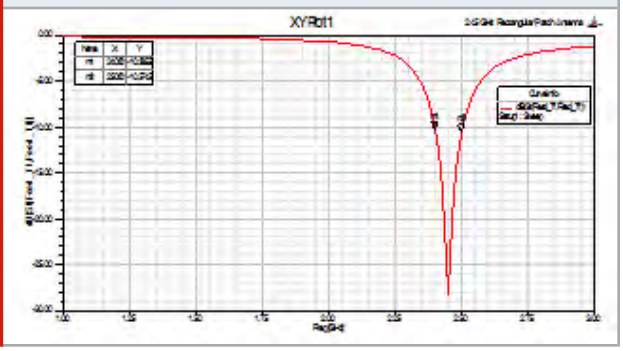
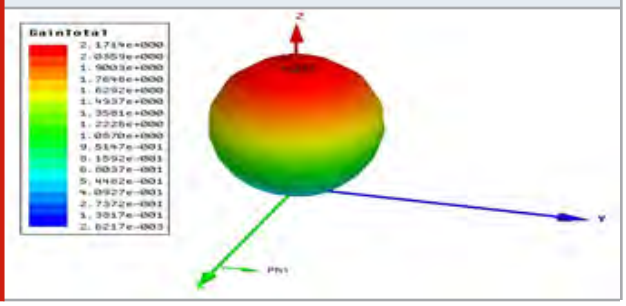


Figure 3: Rectangular Patch Antenna 3D Polar Plot Gain 2.17 dB – Radiation Pattern



Fabrication of Rectangular Patch Antenna

Figure 4: Fabricated Rectangular Patch Antenna: Front; Back View

Figure 5: Rectangular Patch Antenna S11 Plot on VNA

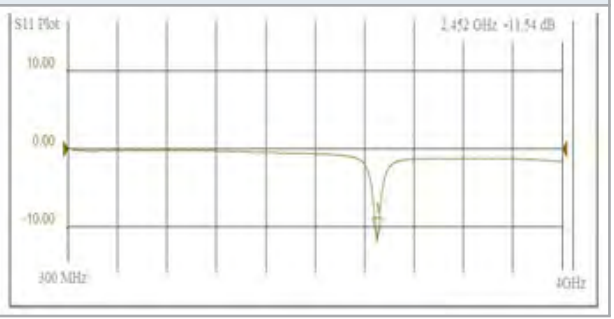


Figure 6: Rectangular Patch Antenna Smith Chart Plot

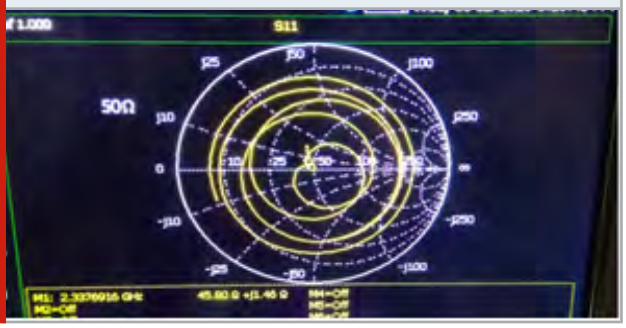


Table 2. Comparative results for Rectangular Patch antenna

Rectangular Patch Antenna	Simulation Parameter	Characterization Parameters
Centre Frequency	2.45 GHz	2.452GHz
S11 Band width	0.1 GHz	0.09 GHz
VSWR Band width	0.11GHz	0.1 GHz
Impedance	50 Ω	(45.80 +j1.46)Ω

Characterization of Rectangular Patch Antenna on Vector Network Analyzer (VNA) for S11 parameter

Figure 7: Model Simulation of Circular patch antenna

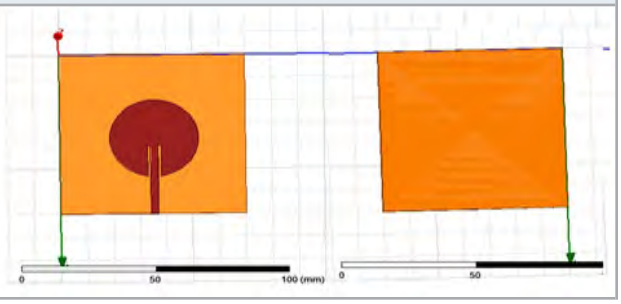


Figure 8: S11 Plot BW < -10 dB = 0.11 GHz

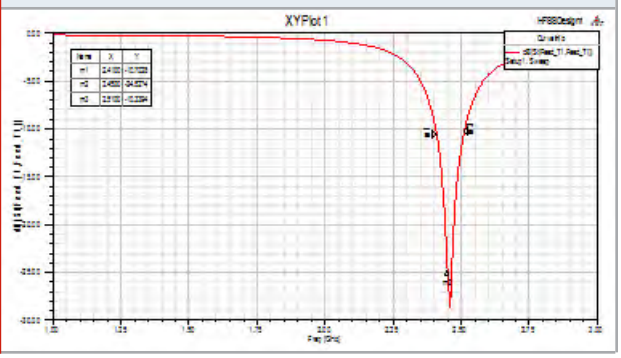


Figure 9: VSWR Plot < 3 dB BW = 0.06 GHz

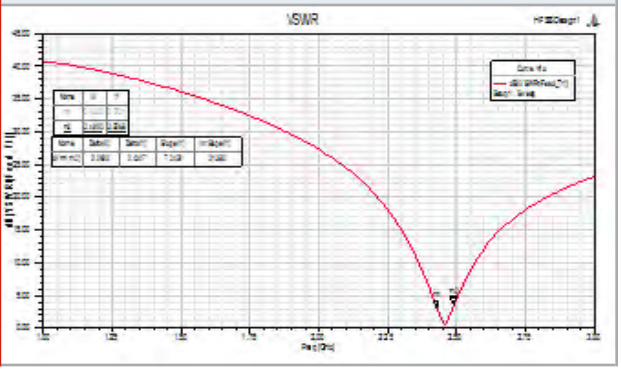


Figure 10: 2D Radiation Pattern Plot

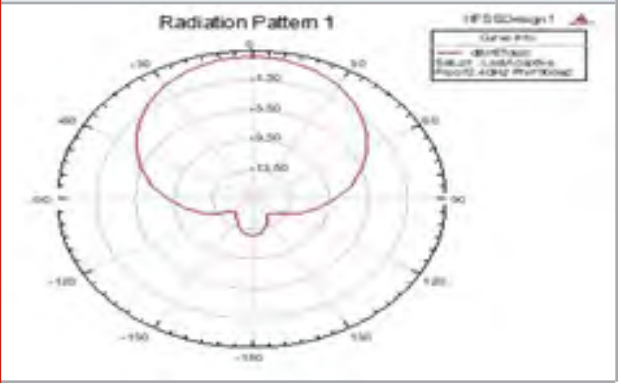
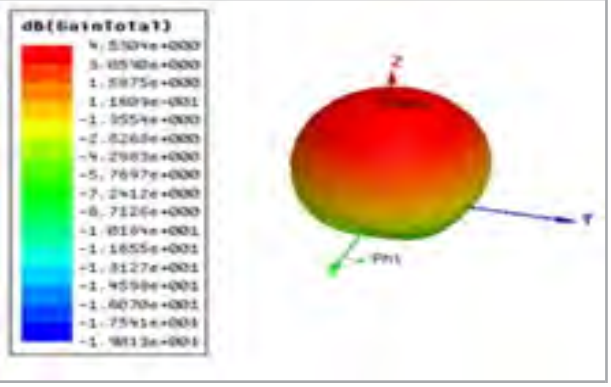


Figure 11: 3D Gain Plot, maximum gain of 4.53 dB



Circular Microstrip Patch Antenna at 2.45 GHz

Characterization of Circular Patch Antenna on Vector Network Analyzer (VNA) for S11 parameter

Figure 12: Circular Patch Antenna S11 VNA Plot

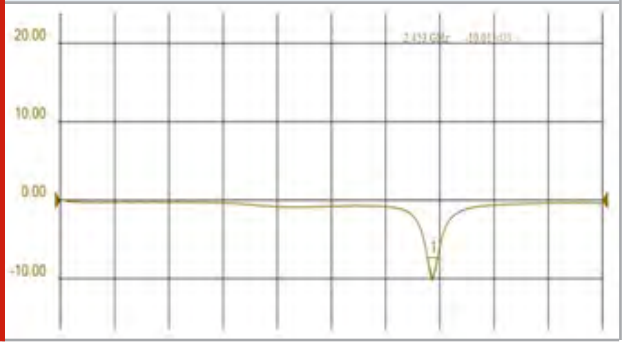


Figure 13: Circular Patch Antenna fabrication

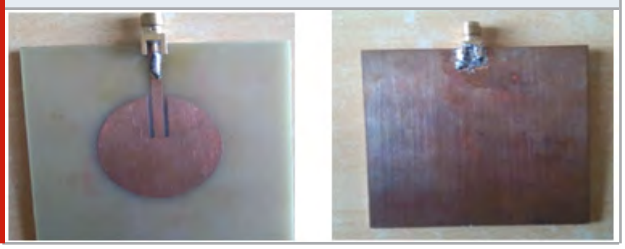


Table 3: Comparative results for Circular Patch antenna

Circular Patch Antenna	Simulation Parameter	Characterization Parameters
Centre Frequency	2.45 GHz	2.453GHz
S11 Band width	0.11 GHz	0.1 GHz
VSWR Band width	0.06GHz	0.05 GHz
Impedance	50 Ω	(45.85 +j1.41)Ω

Simulation of U-Shaped Patch Antenna

Figure 14: U-shape Patch Antenna HFSS Simulated 3D Modeler: Front and Back view

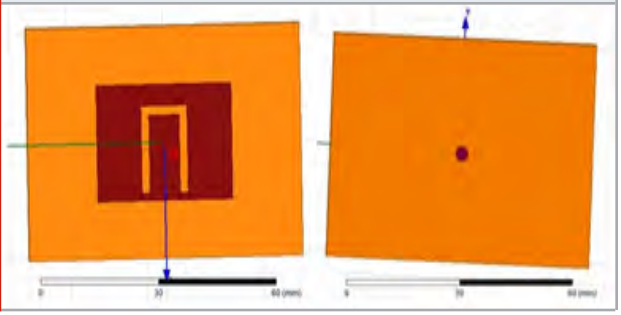
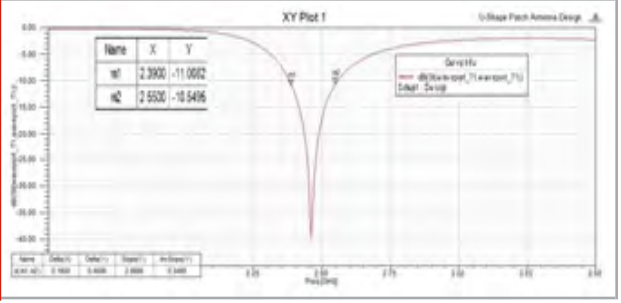


Figure 15: S11 Plot BW < -10 dB = 0.16 GHz



Characterization of U-Shaped Patch Antenna

Figure 16: Fabricated U-shaped Patch Antenna: Front; Back View

Figure 17 : U-shaped Patch Antenna S11 Plot on VNA

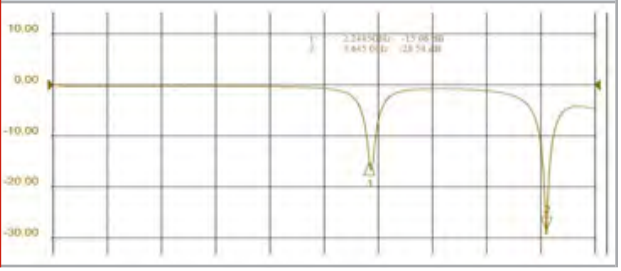


Table 4. Comparative results for U-shaped Patch antenna

U- Shaped Patch Antenna	Simulation Parameter	Characterization Parameters
Centre Frequency	2.45 GHz	2.453GHz
S11 Band width	0.16 GHz	0.15 GHz
VSWR Band width	0.12GHz	0.1 GHz
Impedance	50 Ω	(49.80 +j1.15)Ω

CONCLUSION

From above simulation and fabrication results it can be concluded that though patch antenna have inherent bandwidth and gain limitations, it can be modified up to certain extent by using different shapes like circular and U-Shape patch antenna. In above simulations we have got maximum S11 band width for U-Shape patch antenna at the cost of some complexity in the design during simulation and fabrication. Hence U-shaped patch antenna is a suitable device for medical applications.

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Real Time Person Independent Communication Between Dumb and Blind Person Using Sign and Text Detection

Rajesh Thakare[1*], Sandeep Kakde[2] and Pavitha U S[3]
[1,2]Electronics Engineering Department, Yeshwantrao Chavan College of Engineering, Nagpur
3Department of Electronics and Communication Engineering, M S Ramaiah Institute of Technology, Bangalore, India

ABSTRACT

Primary mode of communication is speech by which information can transfer. But hearing-impaired people are not able to communicate with the world. In this paper, low cost prototype model is developed to bridge communication gap for disable people like deaf, dumb and blind. Dump person uses sign language and blind person uses voice, both gives output in text and audio form. System uses atmega-32 as microcontroller, video recording module and flex sensor for developing communication between deaf and dumb with Blind person. For those persons who bothered to express their feelings due to their lack of ability, this device will helpful for them.

KEY WORDS: FLEX SENSOR, ATMEGA32, VIDEO RECORDING, TEXT DETECTION.

INTRODUCTION

Being a part of society, physically disabled person communication is important. Communication is the only way available for human beings to express their thoughts, feelings, emotions. But there are some disabilities in which it is quite difficult to express feelings by speaking or by hearing. Since in our society there are peoples who are having hearing, speaking and vision loss. Help these persons so that they will not face such difficulties in future. They can able to express their emotions without any trouble. It is not necessary that communicating members belong to same disability. This device can be used by peoples have any difficulty among deaf, dumb and blind or it can be used by normal people, if they want to do a trail of the system. The low cost system which uses lesser components to recognise alphabets, space, help and clear gesture. By considering all possible ways, if the person is speaking and hearing impaired, he will use the flex sensor to express his emotions, which is displayed as well as spoken out, so the other person might have any of the disability though he is blind, or same community, they can identify talks through LCD or Speaker. Similarly, if the person is speaking impaired as well as blind he can use flex or voice input. In future, we will focus on community, blind as well as deaf, since this person cannot visualize and are hearing impaired, it will be quite difficult for them to handle the system.

2. Related Work: A system is proposed by the author, in which the gesture recognition is done by detecting the skin colour segmentation and feature extraction. The recognised gesture is then converted in speech output [R. R. Itkarkar ,2013]. One more appearance based technique is derived in which various possible ways are developed to deal with different gestures [Matheesha Fernando ,2013]. The glove maps the orientation of the hand and fingers with the help of bend sensors, Hall Effect sensors, and an accelerometer [Vishal Bhame,2014]. The Virtual Talk Module which is a handy module which facilitates easy user communication for mute/deaf people. The module communicates satisfactorily by recognizing the gestures

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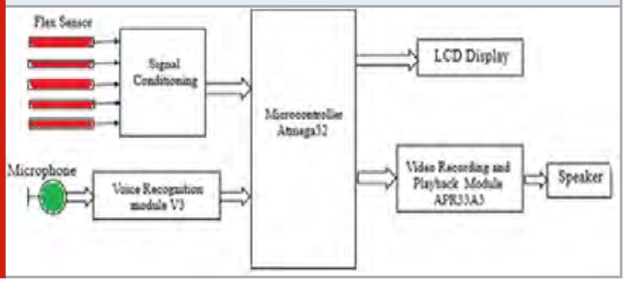
and converting it in words/phrases [Vikram Sharma ,2013]. The comparative study of free hand tracking and glove hand tracking is presented. Video is captured of continuous hand movement and from recorded video frame gesture is detected [D.Mazumdar,2013].Maximum work is carried over appearance based method, many times the recognition is not correct ,so there is chance that wrong message can deliver. Hence taking an idea from the developed system, we are designing a new device which will give best results and prove helpful to disabled person.

2.1 Problems Related to System implementation: The voice recognition V3 module has much accuracy. So the voice must match to the pre stored database of voice. The V3 module first check the accent of pronunciation then matching is done. If the pronounced word has same accent then output is produced through speaker as well as on LCD. The flex sensors are very sensitive. According to American Sign Language (ASL) we can show 26 alphabets on single hand. But this thing is not possible by using just a flex sensor. We must use more sensors to achieve the things according to ASL.

2.2 Training and Testing: The training to the microcontroller is to be done using Atmel studio 6.0 version. The training to voice recognition module is given using access port software.APR33A3 is having modes in it so by switching the mode to record we can save the voices in the module and by switching it to play mode we can test it.

3 System Implementation: Figure 1 shows the block diagram representation for real time implementation of system. The system has two inputs flex sensor and microphone via voice recognition module V3 for deaf, dumb and blind person respectively. The inputs are fed to microcontroller Atmega32.The output Microcontroller connected to Video recording and playback module APR33A3 to speaker in audio format and also onLCD display. The components used in the system is described below.

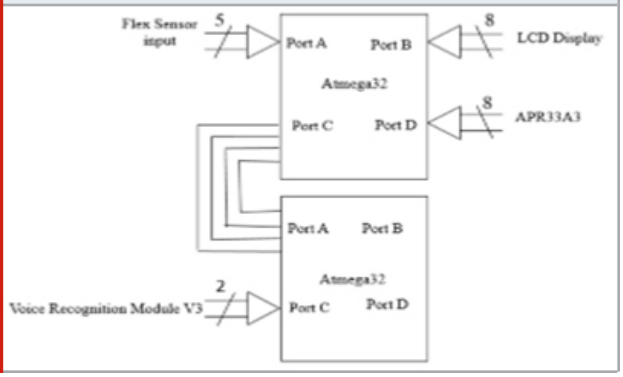
Figure 1: System representation using block Diagram



3.1. Microcontroller At-mega32: This microcontroller chip is of AVR family is used to process the input signal for producing an output. The main work of the microcontroller is decision making. By comparing the sign with stored values, it will produce the output in display mode and audio mode. At-mega32 is provided with four different ports- Port A, B, C and D, in which Port A is ADC port pin 40-33 is assigned to ADC0-ADC7. The flex sensors are connected to Port A. The LCD Display is connected at Port B, voice recording and playback module is connected at port D. The second microcontroller is having other input that is voice recognition V3 Module at port C. Both the microcontroller is connected to each other. The designed system is developed for deaf and dumb person in which flex sensor is used to feed the input. System uses 5 flex sensors on one hand, one flex on each finger.

3.2. Flex Sensor: The Flex sensor is used in our system for feeding input given by deaf and dumb person. Flex sensor is having conductive ink layer printed on the flexible base. When Flex bend, the conductive layer stretched and thus extends resulting in reduced cross section. This reduced cross section and increased length results in increase in resistance. The resistance value when flex is straight is 11.2KΩ and when it is bent the flex resistance is 19.3KΩ.Flex sensor of length 4.5"provide focusing of 90 degree and 180 degree bending. Deaf, dumb person use sign language to express their emotion, the hand expression is there talk. Hence, the sensor connected on fingers of their hand measures the movement of flex and describes a specific alphabet for that gesture.

Figure 2: Port connection of microcontroller



3.3. Voice Recognition Module V3: This module we are using to provide voice input. It is having around 97% accuracy. It is programmed using RS232 cable connector using access port software. It has 5*3 group, that is 3 groups are available which store 5 voice. Selecting one group, People who are blind or have very low vision can benefit from using the technology to convey words and here the device recite to them.

3.4. Voice recording and playback module APR33A3: This module is to generate the audio of our gesture. This module is having 8 channels which store one voice at each channel, by setting it to recording mode. To playback the sound set the module on play mode. The recorded voice is played back of that respective channel. To record another message on the same channel where already message exist then the previous gets replaced with this new one. The hardware implementation of the system is shown in figure 3. The flex sensors are connected to comparator IC along with 50KΩ resistor

(blue coloured in diagram). The reference voltage is set using potentiometer which is also 50 KΩ. The output from comparator is connected to microcontroller pin 33-37. The APR33A3 module (Blue coloured) is connected to pin 14-21. The speaker is connected to APR33A3. The LCD display is connected to pin 1-8 of microcontroller.

Figure 3: Hardware Implementation of Desired System

The voice recognition V3 module (Black coloured) is connected to another microcontroller. The microphone is attached to the module itself. The outputs from the desired system for deaf and dumb person using flex sensor is carried out for alphabets A, C, E, I, L, M, O, T, U, W, Y and help gesture, space gesture and clear gesture.

RESULTS AND DISCUSSION

These gesture and their respective outputs are shown in Table 1 below. The voice recognition systems will recognition the word 'WELCOME'. But it will recognize the word when u will speak out in the same accent. The additional gesture for indication of HELP is added in the system. If any emergency occurs the deaf, dumb person has to do that gesture, the pre-stored voice for help is spoken out from speaker. The American Sign Language is one handed language. All the 26 alphabets are indicated on the same hand. But for that purpose we need more sensors. For orientation, there is need of accelerometer sensor. For prototype model few alphabets have implemented in this system.

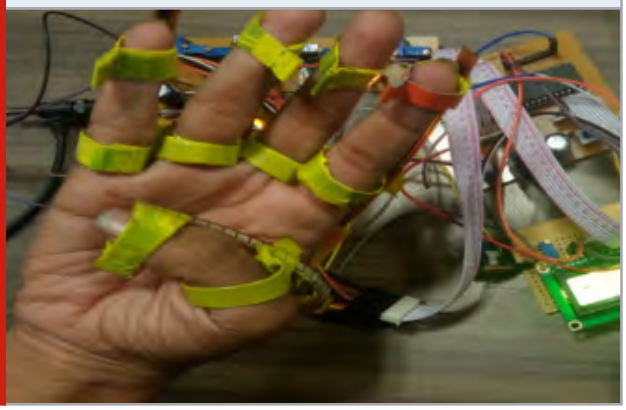
Table 1. Gesture Identification

Gesture	LCD Display	Description
		Gesture is shown for alphabet A, where ring finger and thumb is bend remaining are straight.
		Gesture is shown for alphabet C, where thumb is straight and remaining fingers are bend.
		Gesture is shown for alphabet E, where all the fingers are bend.
		Gesture is shown for alphabet I, where little finger is straight and remaining is bend
		Gesture is shown for alphabet L, where Thumb and index finger are straight and remaining 3 are bend.
		Gesture is shown for alphabet M, where index finger and ring finger are bend and remaining 3 are straight.
		Gesture is shown for alphabet O, where thumb and index finger are bend and remaining are straight.

Continue Table

		Gesture is shown for alphabet T, where index finger is bend and remaining are straight.
		Gesture is shown for alphabet U, where index and middle finger is straight and remaining are bend
		Gesture is shown for alphabet W, where the thumb and little finger is bend and remaining 3 is straight
		Gesture is shown for alphabet Y, where little and thumb are straight and remaining are bend.
		Gesture is shown for clear, where little and ring finger are straight and remaining are bend
		Gesture is shown for space, where middle finger and thumb are bend and remaining are straight.

Figure 4: Gesture for Help



CONCLUSION

The prototype is user independent system developed represents one of the way to design a low cost effective system which requires less power to operate. Anyone can use this system having knowledge of sign language. Since Text format is available so if any correction is needed, then this deaf, dumb person can re-correct it. Efficient working module is designed using easily available components in market. Since we are not working on ADC, the system will not require much time to recognize the gesture. The deaf, dumb person communicate using flex sensor. Whereas the blind user has the flexibility, he can use the flex senor or voice recognition V3 module for giving input. If any problem occurs to any user then an extra gesture for HELP is added in it. The module APR33A3 can stores 8 voices, just to develop the demo version of the system. Using programming and using many more alphabets, digits and sentences, the system can be designed at high level.

This system will become universally applicable if it is developed with same components and with more additional features. The fabrication cost for single is quite more, but to implement it at large scale then, the cost needed can be minimized. This developed module can be used in the disabled persons orphanage's, where these deaf, dumb and blind can actually work on this project and get help from it to establish easy communication. The deaf, dumb can also learn the alphabets using our system since display version is available. In future, we will focus on community, blind as well as deaf, since this person cannot visualize and are hearing impaired, it will be quite difficult for them to handle the system. Using Braille Lippi, this learning facility can be designed in the same system for blind community.

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Mental Illness Detection Through Audio Signal Processing

Pravin Karmore[1*], Swapnili Karmore[2] and Satyajit Uparkar[3]
[1],[3]*Assistant Professor, Department of Computer Application, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*Associate Professor, Department of Computer Science, G H Raisoni Institute of Engineering and Technology, Nagpur, India*

ABSTRACT

Mental illness is considered as great problem and sometimes it is incurable. It creates severe psychological issues as well affects the physical condition of a person badly. Causes may vary from person to person and different situations in their life. The physical and mental health in a human body goes hand in hand but if any one of them is disturbed the other automatically is devastated. The human body and mind is balanced between physical and mental world, when the harmony is disturbed it causes decease. Mental health is furthermore important in our life because the cause of mental disorder is usually undetectable. Most of the youth is mentally unstable nowadays because of the current lifestyle. Speech is an important factor for mental health. It is the physical expression of the mental state of mind. In this paper, we have discussed and developed a novel neural network model that can examine the audio signals from interview sessions to discover voice patterns that could indicate stress level. The user-generated data helps to distinguish between different disturbed groups and abnormal symptoms which can manifest in people with various mental illnesses in different ways. In particular this would automatically predict the stress level scale and differentiate disturbed mental condition from other mental disorders using the patient's psychiatric illness history and dynamic descriptions extracted from the user inputs. The proposed framework is an extension of the pre-existing frameworks, replacing the handcrafted feature extraction with the Deep feature extraction technique.

KEY WORDS: AUDIO SIGNAL PROCESSING, DEPRESSION DETECTION, DEEP LEARNING, MENTAL ILLNESS.

INTRODUCTION

Nervousness is commonly severe medical disorder. The difference between manic-depressive psychosis and major mentally disturbed episodes is the regular incidence of obsession within the latter, a state of mind with lack of confidence, discontent sleep, purposeful action, impulsivity, and enlarged activity [Cacheda F, 2019]. Each disease is a genetic disorder, and maybe well acknowledged as a hormonal imbalance to the atmosphere distressing the inner genetic circumstances and probably causing mood swings. Anxiety is related with non-continuous genetic rhythm caused by environmental annoyance like seasonal revision in hours of daylight, change of social rhythms thanks to as an example shift work or line of longitude wandering; moreover joined to lifestyles related with everyday rhythms unpredictable with the normal day to day cycle [M. Deshpande, 2017]. The looks of mental illness indications relate moreover to disturbed physical health and issues associated with it.

Medical aspect effects, community factors, and life measures, besides alcohol and matter abuse, and such factors may probably cause indication of mental illness. The world lifespan generality of disturbed mind condition based anxiety is roughly fifteen percent, however, the prevalence of episodes with an extremity level not

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*Corresponding Author: karmorepy@rknec.edu
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meeting the wants for a depressive identification are much more. Actigraph record action of motor movement are thought of as an unbiased technique for observant depression, though this subject is far from thoroughly studied at intervals in medical specialty research. Machine learning models have been developed that can recognize words and speech intonation that could indicate depression based anxiety.

Though speech functions have been shown to be very useful in predicting anxiety and stress, following research will examine more robust classification models to brace clinical depression diagnosis [M. Deshpande, 2019]. Language analysis could also be combined with motion analysis as a technology - a supported diagnostic tool to identify children at risk of anxiety without suspecting that something is wrong. The technology would also be combined with motion analysis to help diagnose sadness in children more accurately, and would support diagnostic tools that help identify them as vulnerable. The risk of anxiety and depression before they are suspected of doing anything wrong [Islam, 2018].

Literature Survey: Researchers have developed a brand new neural network for deep learning that may establish speech patterns that indicate mental illness. In an essay to be bestowed at the Inter speech conference, the Massachusetts Institute of Technology researchers describe their methodology of discovering speech patterns that indicate anxiety, stress and sadness. This is often the primary time that such a large-scale, powerful, profound learning rule has been shared. We have a tendency to introduced gender-based vowel level analysis to push language recognition supported disturbed mindset [Cacheda Fidel, 2019]. In the first part of the experiment, Researchers have tried to validate the validity of a deep learning model for classification using EEG images. In the second approach, a metal severity model was accustomed predict mental disturbed state supported thresholds.

Researchers remove the silence from the recordings using algorithms for voice activation in the MATLAB voice box toolkit and tested it with monitored learning methods. The methodology had split into a spread of audio and connected tasks corresponding to speech recognition, speech translation to speech translation and speech recognition to speech recognition [Havigerová Jana M, 2019]. Researchers analyzed a number of different models that are developed in recent years for the automated detection of anxiety and stress level which leads mental illness. First, analysis of binary supply regression shows that speech operates contribute considerably to predicting mental illness. These results show that speech function is able to predict anxiety and shows that additional refined models for clinical identification are often developed on this basis. The researchers have develop comprehensive voice biomarkers for anxiety more accurate diagnosis of mental illness, will verify the suitable treatment choices for folks at risk. However, current ways of detective work depression are human -intense, and their results rely upon the expertise of the doctor. However, this methodology of detecting depression is human intensive and its outcome depends on the expertise of doctors [Lin Chenhao, 2020].

However, the employment of voice operates offers the simplest way to automates the detection of disturbed mind states and increase screening capacity, as voice samples and questionnaires are often crammed in. Language is clinically simple to capture and its combination with anxiety has been extensively analyzed and considered, though the particular prognostic result of speech has not been studied. However, voice data can predict depression and totally different emotions and mood, which implies that depression detected by speech function, is reliable and has potential in clinical situations. The voice is believed to possess been utilized in the past to forestall and treat disturbed mind condition [Kumar Ravi, 2020].

Although AI may ultimately play a task in treating diagnosed disturbed mind conditions, most AI research regarding mentally disturbed state is targeted on mistreatment machine learning to assist with initial identification and current monitoring. However, detective work for disturbed mind condition on-line and on social media are often a significant challenge, as there are varied hurdles to overcome, from knowledge assortment to learning the parameters of a model from scant or advanced data. Therefore, in our initial phase, we have a tendency to used applied math ways to research whether or not speech data will considerably predict disturbed mind condition. We have a tendency to train our own CNN - LSTM neural network on the very fact that current ways of mood analysis don't seem to be ready to directly infer disturbed mind condition, and thus trained it mistreatment knowledge from voice samples and questionnaires [Verma Bhanu, 2020].

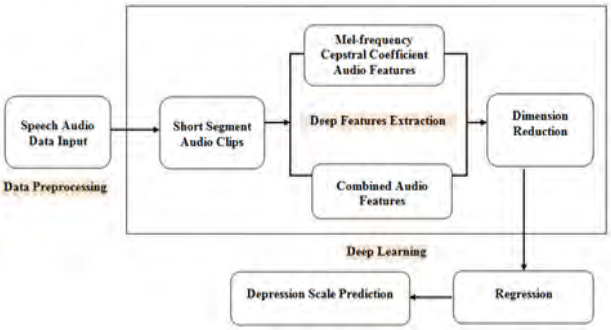
Design Methodology:

A. Dataset representing stress & anxiety: For this experiment, we have used a dataset prepared by the University of Stanford which contains more than three hundred audio clips with each audio clip containing a recorded interactive session by patient-computer of duration ranging from minimum fifty six seconds to maximum sixteen minutes [Malviya Aastik, 2020]. The dataset contains audio segments of patients ranging from age of sixteen sixty four with mean age calculated to be thirty three point five years, with a deviation of fifteen point three years. The anxiety-based BDI-II scale ranges from zero to sixty three where each range has its significance. The range of zero to ten is considered to be normal with no anxiety, range of eleven to sixteen is considered to be mild mood disturbance or stress, range of seventeen to twenty is considered as borderline clinical anxiety, range of twenty one to thirty is considered as moderate anxiety, range of thirty one to forty is severe anxiety, and over forty is extreme nervousness. The highest score recorded from the dataset for anxiety is forty seven which indicates that the dataset includes patients coming under each category [Zheng Wenbo,

2020]. The dataset undergoes audio signal processing technique using deep learning algorithms to calculate the anxiety BDI-II score if a patient.

B. System Overview: The automated audio signal processing based anxiety detection model takes visible input as audio signals from the dataset used.

Figure 1: Block Architectural diagram for Audio Signal Processing using Deep Feature extraction Process



Initially, data pre-processing techniques were carried out on the dataset as the dataset was not as per the model requirements. The audio data was damped into small audio segments and deep audio feature extraction and dimensionality reduction techniques were eventually enforced to all the audio segments for converting the input parameters into feature vectors and reducing their dimensions. Using the victimization regression technique and reducing spatiality throughout the feature vector capturing the dynamic patterns for calculating the anxiety scale assessment. From the fragmented audio segments, Mel frequency cepstral constant (MFCC) and combined audio features are extracted using deep neural networks. In the deep characteristic process, the temporal facts for each pattern are broken down into short audio segments which may be pre-processed with the help of using scaling and subtracting the given suggested segment. These segments are further pushed into deep networks for feature extraction using neural networks. Initially, the deep characteristics are extracted from the audio segments and then ranked and normalized according to the FDH set of rules into a pattern of 0s and 1s converting the output into a single row vector.

C. Audio Signal Processing: The dataset contains overall two thousand two hundred seventy eight features which are further used to investigate the most dominant feature and calculate the BDI-II anxiety level. The descriptors for audio features are provided by the University of Stanford which is further used to sort limited labelled data and calculate Mel-frequency cepstral coefficients (MFCC). The features extracted are then compared to the performance of the baseline results. The validation dataset is then tested with each feature vector where the top performing descriptors and paired with each other are kept and used. The extracted short-term and mid-term features are fed as input to support vector machine and Random forest algorithm. Short term feature matrices of fifty seconds audio segment extracts thirty four short-term features using PyAudioAnalysis.

Figure 2: Flow chart for Audio Signal Processing using Deep Feature extraction process

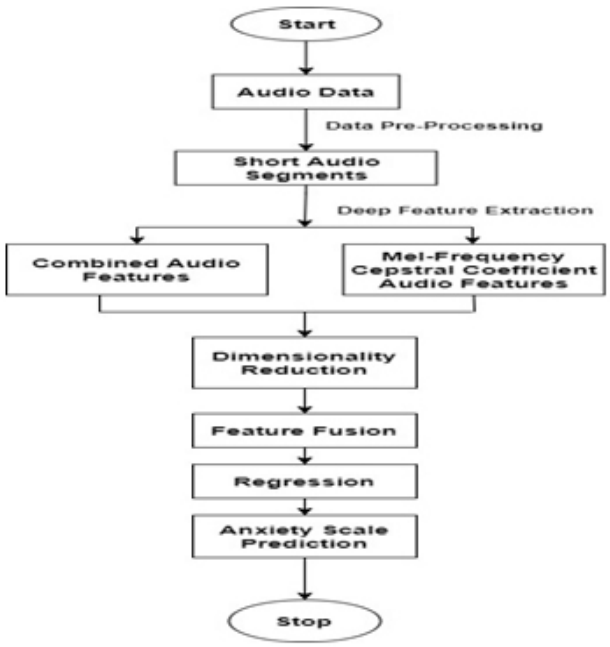
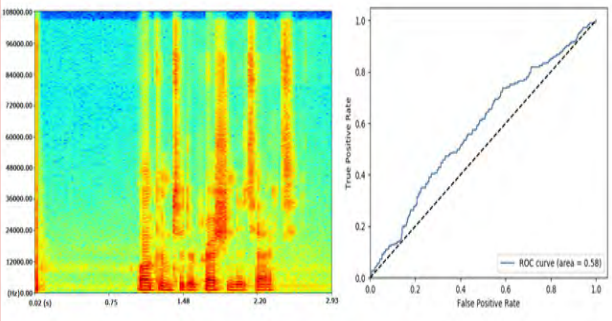


Figure 3: Spectrogram created for extracting deep features from audio segments and ROC curve plot for ResNet Architecture



RESULTS AND DISCUSSION

We performed all our experiments and tested our model using Google Collaboratory platform using NVIDIA Tesla K80 graphics card. For training the neural networks, we used PyTorch and Matlab for evaluating and loading the pre-trained network architectures by varying the training parameter values. We have used parameters such as accuracy value, precision value, F1-Score value and recall value for rating and analyzing the performance of our analysis model. We have divided the dataset for training, testing and validation. From three hundred audios, we have used two fifty audios for training the model, forty for testing and ten for validation.

The MatConvNet architecture is used for extracting deep features. This tool has been opted for the experiments because it permits full management over deep networks with access to data across any layer together with simple visualization. The experimental setup included stages like data preparation, data pre-processing, convolutional neural network training and fine tuning of procedures to obtain accurate results for calculating the anxiety of a patient. We have evaluated five convolutional neural network ResNet architectures like ResNet-18, 34, 50,101,152 in the deep feature extraction process and checked the impact over classification results by generating high resolution based spectrograms. After experimenting on larger input spectrograms we found that they significantly do not improve the computation results. We confirmed that generating a group of larger input segments wouldn't considerably improve the results. We tend to additionally perform check Time Augmentation (TTA).

Table 1. Table for Performance of Deep net Feature on Development set and Test set on dataset

Partition	Methods	Segment type	RMSE Score	MAE Score
Training		Waveform	9.2589	7.6549
		Spectrogram	9.0124	7.8523
Testing	Deep Learning	Waveform	10.2365	8.3698
		Spectrogram	9.4589	8.1278

Table 2. Table for the Classification Report

	Precision	Recall	Support	F1-score
True	0.98	0.80	5	0.89
False	0.91	0.97	10	0.95
Average	0.94	0.93	15	0.93

The Test time argumentation created predictions supporting the initial spectrogram and waveform from our dataset with four partitions of it helped in improving the model accuracy and precision. The calculated mean prognosis from all the segments is eighty seven point six percent. The planned technique created a promising classification accuracy of around eighty percent for a ResNet-34 model and eighty four point two percent for ResNet-50 model trains on spectrograms of 224X224 pixels. During the training stage waveform, RMSE and MAE values were 9.2589 and 7.6549 respectively which were low as compared to other models stating that the precision and accuracy are low. The average precision value for the model was found to be ninety-four percent, accuracy as ninety three percent, F1-score as ninety three percent and support as fifteen. According to the performance metrics ResNet-50 has performed more accurately as it was successfully able to categorize two thirty three voice samples of patients correctly into the scale and failed to categorize.

CONCLUSION

Healthy Mind is furthermore important in our life. Mental imbalance causes severe problems which was difficult to diagnose as well as difficult to cure. After performing deep literature survey, it is found that speech and voice are great Medias to measure its level. In this paper, we have developed an Artificial Intelligent based model for automated anxiety and stress scale prediction based on vocal expressions in recorded video clips using audio feature extraction to get precise results with deep features extracted like combined audio features and MFCCs as this methodology is much beneficial and accurate. The audio clip is extracted from the video dataset and converted in small audio segments. The extracted features later undergo dimensionality reduction and using regression the BDI-II scale is calculated for anxiety. The overall result for the anxiety prediction model on the testing partition show more accuracy and precision than the baseline, and performs much better than other pre-existing models. The precision was found to be ninety-one percent, recall as ninety seven percent, F1-score as ninety three percent and support as fifteen as a classification model.

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Depression Prediction Analysis using Deep Learning: A Survey

Pratiksha Meshram[1] and Radha Krishna Rambola[2]
[1]*Assistant Professor, 2 Associate Professor & HoD, CS Dept.*
[1,2]*Department of Information Technology and Computer Engineering, SVKM's NMIMS, Mukesh Patel School of Technology Management & Engineering, India*

ABSTRACT

Depression is the leading cause of disability for people. It badly affects on physical health of people. Now a day it is observed from children having more than twelve edge to onwards. Machine learning helps doctors predict who might be at risk for a particular disorder. Machine learning, including pre-treatment symptom scores and electroencephalographic characteristics, predicts whether depressive symptoms will improve with antidepressants, and that means they can help them improve. This paper proposes the deep literature review of depression analysis based on offline and online sources using advanced technology. The research work divided into three parts, The First part focuses on the problem definition and second contains deep literature review based on online and offline resource and third part contains the proposed plan of work.

KEY WORDS: DEPRESSION ANALYSIS, DEPRESSION PREDICTION, MENTAL ILLNESS HEALTH DISORDERS, DEEP LEARNING, BDI (BECK DEPRESSION INVENTORY).

INTRODUCTION

Now a day with an advanced technology, Neuroscientists and clinicians around the world uses machine learning to develop treatment plans for patients and identify key markers of mental illness before they begin. Researchers have combined data from supercomputers to identify patterns in neuron imaging data that can help predict the onset and severity of depression, anxiety and other mental disorders in patients. The machine-learning model can be trained to predict what type of depression a patient is likely to experience, how severe the depression will be, and how long it will last over a period of time. This is based on providing input functions for machine learning models, such as age, gender, race, ethnicity, age group, education level, health status and other factors.

Mental illness is a great cause behind degrading health condition which changes a person's disturbed mind condition, psychological changes emotions, or physical behavior [Chang Su, 2001][Jan, Asim, et al., 2018]. Data science and machine learning provides great tool to help existing doctors, psychiatrists and therapists support their patients. Machine learning provides psychiatrists and mental health professionals with the opportunity to identify different types of disorders and develop a better understanding of their symptoms. They could help identify important behavioral biomarkers that help mentally ill people decide which patients are most likely to develop a particular mental disorder [Zhou, Xiuzhuang, et al, 2018]. Depression is typically identified based on its types Major Depressive Disorder, Persistent Depressive Disorder, Seasonal Affective Disorder, Premenstrual Dysphonic Disorder, Postpartum Depressive Disorder,

ARTICLE INFORMATION

**Corresponding Author: pratiksha.kaya@gmail.com*
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Depressive Disorder Due to Another Medical Condition and Other Specified Depressive Disorder e.g. Bipolar Disorder.

Related Work: Before performing literature review it is categorize based on relevant articles of four groups. First is literature survey based on articles and publications second is literature survey based on data sets and third is literature survey based on real world data which was obtain by taking interviews of doctors, psychologists and psychiatrists. Video and Voice recordings of patients were used to extract paralinguistic features that were used to predict depression. The scientists analyzed the activity of the entire brain using machine learning, observing only those neural regions that are said to be relevant for predicting antidepressant benefits. Another review performed is based on case studies, diagnosis and prognosis based on the clinical data of various patients, Deep analysis of genetics and genomics data taken for consideration for understanding mental health conditions of various patients, Video and voice expression related data analysis for disease detection. Finally, we discuss challenges in using machine learning algorithms to improve our understanding of mental health conditions and suggest several promising directions for their applications in analysis of depression analysis.

A. Literature survey based on articles and papers: Some biomarkers decided and are recorded in the Lifelines database, so they can be described as cases of mental illness or healthy cases of machine learning prediction. Moreover, it is well known in the machine learning community that publicly available data sets have the potential to promote research on a particular subject, such as predicting depression through language use. Researchers perform literature review on mental health outcome. Mental illnesses are a basic problem behind an individual's physical health. Several Artificial Intelligent methods used in traditional as well as recent researches for studying the mental health state of patients. For diagnosis patients mental health condition psychiatrists and psychologists uses several software tools for decision-making based on patients' historical data.

Patient's historical data contains his or her medical records, their behavioral data, social media usage, etc. Researchers in their paper perform review on existing research on various applications of Deep Learning algorithms in mental health outcome research [Chang Su, 2001]. Researcher proposed Artificial Intelligent approach to monitor depression. This AI based approach is responsible to predict the depression from vocal and visual expression. The speech audio is extracted from video data where short segments are produced. MFCC's are extracted using regression technique to predict depression scale. FDHH is proposing to capture temporal movement on the feature space. FDHH plus Audio features were fused using regression techniques for predicting BDI Scales. CNN is used to extract deep features from image along with hand crafted features (EOH, LPQ, LBP etc.) and for joint tuning PLS and Linear regression were combined [Jan, Asim, et al., 2018].

Researchers in their paper describes about algorithms for facial feature extractions from visual system. A visual feature extraction system covers CNN, DCNN, LDA and neural Network. Researcher specifies ranking of algorithms by performing comparative analysis, where some data sources also explained [Pampouchidou, 2019]. Researcher focuses on development of mental health monitoring mechanism which uses mobile base for collection of data and Machine learning methods. It collects data from the sensors and predicts information like mood, physical activity and location. Automatic continuous monitoring takes place of different condition involving stressful condition, severe anxiety and depression. Researcher focused on mental disorder conditions.

Researcher does not include an exhaustive review [Enrique Garcia-Ceja, 2018]. Researcher describes that facial appearance plays an important role in depression analysis and could be responsible of indicating depressive disorder. Deep regression network is used to learn depression representation having visual expression. In this paper CNN equipped with a global avg. pooling layer having facial data depression is trained first. This data is responsible for identifying point of input images. DepressNet is used with multiple models of different face areas like foreheads, eyes and lips were combined to develop and improve the overall performance. DAM induced by their learned deep model may help disclose the visual depression pattern on faces and understand the insights of automated depression diagnosis. The fusion obtained of Facial appearance & dynamics outperformed MAE is 7.47 and RMSE is 9.55 [Zhou, Xiuzhuang, et al, 2018].

In another paper researcher works on mental health disorder by concluding that it not only affects emotional level but also degrades physical as well as psychological mind state of person. The daily routine of him is lack of enthusiasm He experiences lonely and lack of interest and sad life. They proposes multimodal feature. It employs joint tuning layer for fusing the features using SVM & Neural network (AVEC 2017). Facial Action Coding System FACS) for capturing emotions, Action units, Gaze and pose. The result obtained were crossed the baseline by 17% on audio features & 24.5% on video features. RMSE=5.535 & MAE=4.737 [Dham, Shubham, 2017]. Researcher declared about the Traditional developed clinical diagnosis methods that they are subjective, complex, complicated and they need extensive involvement of an experts. Methodology proposes in researcher works uses fusion of frames. Convolution Neural Network (CNN) is operating on multichannel behavioral signals.

The result of depression severity is predicted based on regression. Spectral features & hand crafted features containing Action units and gaze directions which are extracted & fused using CNN. Binary classification is done for depression prediction & regression for depression severity both methods improved significantly compared to previous state of art [Song Siyang, 2018].

Researchers find out the limitations in the recording technology for the measurement of EEG activity in experimental and clinical applications. One of the main advantages of machine learning is that the algorithm can be improved by using data sets with different data types such as brain scans, brain waves, EEG data and other data. EEG signals with dry electrodes on forehead provide wide-ranging information related to variety of cognitive dysfunctions and disorders. Researcher includes advanced sensing technology and advanced signal processing algorithms for supporting people with their health related needs such as sleep monitoring, headaches prediction and depression treatment.

Different type of sleep pattern and headache level also considered while treating depressed person. Electrodes on foreheads were responsible to measure and monitored the parameters with the help of which depression can be calculated. Each of processed data is transform in to thirteen dimensional feature vector used to construct relevance vector machine for sleep stage classification using SVM & RVM. Disadvantage of this approach is it is not able to fuse the brain wave. Machine learning models can be trained on the basis of clinical trial data based on actual depression diagnoses, and can be further developed on the basis of previous predictions, in which the model confirms or corrects the actual diagnosis of previously monitored patients [Arjun P Athreya, 2019]. Another researcher focuses on detection of depression using audio and visual recordings. Some time some people experiencing depression also behaves normally without showing their stress and sorrows. Acoustic features were extracted from to detect clinical depression in Childs and adults both when acting normally & when asked to reveal their gloominess. With classifier trained on only non-conceal behavior which has given 81% accuracy & 75% sensitivity when tested on concealed data [Ashley E. Tate, 2020].

Machine learning could help predict a person's characteristics of depression, just as it predicts the occurrence and severity of other mental disorders, such as anxiety and depression. The research implemented three different machines - learning algorithms: an unsupervised algorithm that combined hierarchical clusters to create medical symptom clusters; a supervised algorithm to identify and describe key clusters with significant depression relationships; and an unsupervised approach. By using machine learning to evaluate the clinical data, the researchers were able to create a series of 3D models of depression and anxiety, as well as a three-dimensional model of suicide risk, in which they could distinguish between people who attempted suicide and those who did not, based on the patients "priority clinical data. Researchers modeled the visible and vocal cues for despair evaluation. Motion records histogram (MHH) is used to seize dynamics throughout the visible information, that's then fused with audio capabilities. PLS regression makes use of those capabilities to expect the scales of despair. Researchers had followed number of modalities, which is used to expect to have an effect on and despair reputation.

They fused collectively numerous capabilities which include neighbourhood binary pattern (LBP) and head movement from the visible modality, spectral shape, and mel-frequency cepstral coefficients (MFCCs) from the audio modality and producing lexicon from the linguistics modality. They additionally protected the baseline capabilities neighbourhood Gabor binary pattern three orthogonal planes (LGBP-TOP) furnished via way of means of the hosts. They then follow a selective function extraction technique and educate a guide vector regression system to expect the despair scales.

B. Literature survey based on data sets available: The machine learning model can be trained to identify relevant brain waves that occur before the onset of depression. For example, it can correlate brain waves identified in a particular brain system with patterns that are more likely to lead to symptoms such as anxiety, depression, anxiety disorder, or other mental disorders. They can also correlate with a pattern that is more consistent with the brain's response to stress or anxiety than with other brain systems. For example, the machine learning model can be configured to provide a risk coefficient that indicates the likelihood that a patient will develop depression for any type of depression that the patient has experienced over a period of time. The biomarkers, which are published in the Lifelines database, can identify mental illness and healthy cases for machine-learning predictions. These biomarkers are reported based on the first brain wave signal, which provides an input function for the machine learning models.

Because the Deep Learning System can use data from the self-recorded depression section of the Lifeline database on a case-by-case basis to predict which patients are at high risk of suicide from clinical notes, doctors can refer high-risk patients for treatment. Cases in the Lifelines database that do not report "self-reported depression," but use the biomarker as a predictor of whether or not patients will experience some or all of these types of depression for some time[Al Jazaery, 2018] [Arjun P Athreya, 2019].Machine learning can be applied to a curated large dataset that contains self-reported depressives, as described here. Machine learning has been applied in the form of a supervised machine learning model, configured to adapt to the patient's actual diagnosis of depression. The machine learning model was trained using the EMA Actigraph data and other data sources such as brain scans, brain currents and EEG data. In implementation, the machine learning model is configured as it is and can refine its ability to predict brain systems associated with brain waves. For this study, visual, acoustic and other data were used to classify patients with depression and their treatment [Al Jazaery, 2018].

Prediction of antidepressant response can be improved by combining clinical assessments of the severity of depression routinely used in clinical practice with machine learning and novel pharmacogenomic biomarkers. SNPs and the total score of depression trained on the machine learning methods used can predict remission and response

in the remaining two sets of data. Pharmacogenomic, coupled with machine learning, also be used to discover new pharmacogenic targets in existing data that can be used to predict antidepressant responses These new pharmogenomics biomarkers will in turn improve the functioning of the machine learning system, thereby improving the ability of machine learning algorithms to use data from the Lifelines database and other datasets to predict antidepressant responses in patients at high risk of suicide [Radha Krishna Rambola, 2017]. Researchers study provides evidence for the use of machine learning to classify depression groups based on EMA actigraph data. It seems promising to develop a more accurate and accurate prediction system for the diagnosis and treatment of depression in patients by using ema sensor data and to further explore the application of this technology to the treatment of depression.

Given the mathematical challenges under discussion, it is not surprising that the use of machine learning to predict the outcome of antidepressant treatment has attracted considerable interest in recent years. As the data sets grow in size and the number of patients increases, it becomes increasingly difficult to properly unbundle the variables associated with patient outcomes, and as a result, the data complexity increases with the size of the data set [Radha Krishna Rambola, 2017]

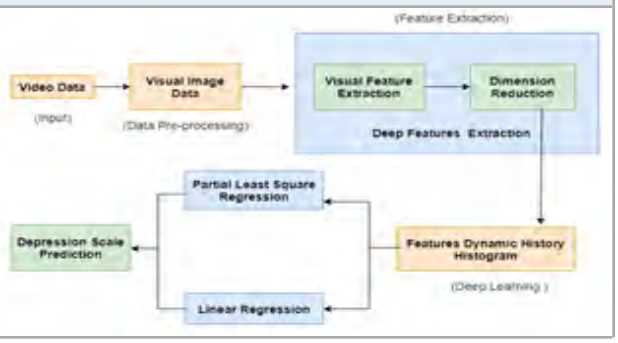
One of the most exciting developments in this area is the use of machine learning to diagnose mental illness by collecting user data from social media sites. To train the machine-learning algorithm, the researchers used clinical variables associated with suicide attempts and patients with mood disorders to train it [Al Jazaery, 2018].

C. Literature survey on Real world information: Deep and thorough literature survey is performed based on patient's condition and Doctors opinion. Information is gathered by giving visits to different clinics. Information is access and studied with the permission of Doctor. While performing depression analysis different fields of doctors opinion regarding depression is analyzed. Depression types and causes are studied in order to find out solution for prediction. Several case studies are studied regarding patient conditions to determine evaluation parameters for depression analysis.

METHODOLOGY

In our work on the problems of depression prediction and analysis, we were faced with the question of how and why with what we can predict depression. As it is based on an individual's persistent low mood, feeling of sadness, Loss of interest in particular activity, suicidal thoughts, weight loss/gain, it is a persistent problem not a passing one, average lasts for six to eight months in some cases for years. Figure 3.1 shows the architectural block diagram for proposed plan of Research work. Video will be imputed to extract frames which are responsible to record the parameters based on facial expression. Deep feature extraction takes place in this block. Dimension reduction is responsible to feature dynamic History Histogram for this action deep learning will be proposed, which again responsible for partial least square and linear regression. Depression Scale prediction block is responsible to provide output.

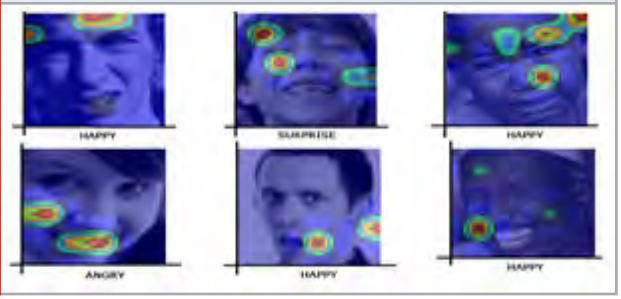
Figure 3.1: Proposed Architecture plan for Research



RESULTS AND DISCUSSION

Initial result obtained from first module is shown as below in figure 3 Feature Extraction from face using chin, eye, eye-brow and lip moment takes place via feature extraction module. We have improved the accuracy by 7%. Further there is scope of improvement by adding multiple features. Results obtained are based on parameters: Happiness, Anger, Scare, Surprise, Sad and Neutral by using Regression Technique. However we can also predict the severity of depression using BDI (Beck Depression Inventory) scale.

Figure 3: Feature Extraction from face using chin, eye, eye-brow and lip moment



CONCLUSION

Thus, we conclude that the medical illness which causes depression is a great problem which badly affects human life. Also, our model will be effectively capable of predicting depression level of patients. Consequently, our algorithm can be applied in clinical application for precise and rapid depression diagnosis, which is of incredible assistance for the front-line medical staff and is essential to control this epidemic around the world. The system contains multiple sections, which help in confirming depression levels. As the system is software based there is no requirement for human interference, unless it is a case of device failure or report of a bug. In the future, the software can be improved by switching from the database to cloud technology which can be

proven best for data handling and management issues. Much improvement can be done on security aspects by providing a 5G network which can be used for more compatibility. Predicting depression level using multimodal approaches i.e. face & clinical history information & application of deep learning techniques will improve the accuracy of existing system.

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A Supervised Model for Diabetes Divination

Sweta Jain[1]*
Assistant Professor, Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India.

ABSTRACT

Diabetes is a most significant and sensitive metabolic disorder. It can disrupt entire metabolism of the body. The undiagnosed diabetes may exaggerate the risk of many other diseases too. It can cause problems such as weakness, stress and low interest in routine work. People with diabetes are among the most susceptible to novel corona virus (COVID-19) infection and may grieve from serious lungs infections, difficulties in breathing, or even death. It is a motive of world-wide apprehension as the cases are intensifying hastily. In the current scenario with the advent and outstretched growth of Machine learning (ML), the computer assisted automatic disease diagnosis in healthcare segment is speedily growing. The present research aims to apply supervised ML practises on Pima Indian Diabetes (PID) corpus to diagnose disease for the females and assist the doctors and health care professionals. The empirical research is carried out using three different predictive models namely support vector machine (SVM) with linear, RBF, Polynomial, sigmoid functions, k-nearest neighbor (k-NN), and Random forest (RF).The random forest model has delivered an improved accuracy of 76%.The performance of three models is measured by using accuracy, precision and recall.

KEY WORDS: DIABETES, MACHINE LEARNING, SUPPORT VECTOR MACHINE (SVM), K-NEAREST NEIGHBOR, RANDOM FOREST.

INTRODUCTION

Diabetes is a cluster of severe disorders demarcated by a high blood sugar level. The unhealthy lifestyle and lack of self-care are also additional causes. The common indicators of this disease comprise recurrent urination, increased thirst, weakness and augmented appetite. If the diabetes is left uncured, it may consequence into many other severe problems or even death. It is observed that this disease is growing with a massive pace. Several Millions of the masses are affecting their life.It is noticed that this disease has its strong roots in the low and average earning populations. The healthcare services are also expensive and it may not be easily approachable in remote places like small towns and distance places. This disease may also boost the mortality rate of a country in conjunction with COVID-19.The country like India with massive young population needs strong support system for healthcare industry to provide affordable services needed for routine checkups and treatment of this deisease.As it has been noticed that this is common amongst higher and old age people, so we can provide substantial medical facility and advice in online mode for such masses in the country. Finally, it may be worth to mention that it may affect our economic expenses on healthcare budget.

Since the past two decades Machine learning and deep learning has enflamed extensive success in healthcare domain. It aimed to assist the medical professionals in computer assisted diagnostic of many diseases like breast cancer, skin cancer, lung cancer, diabetic retinopathy, brain disorders and many more. In medical diagnosis, data is sometimes limited, imbalance and incomplete. The machine learning algorithms can process multimodal,

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complex, high dimensional data, noisy and incomplete data to extract meaningful patterns from the data to analyze specific diagnosis application. The aim of the proposed research is to develop a predictive model for assistance in diabetes prediction using standard dataset.

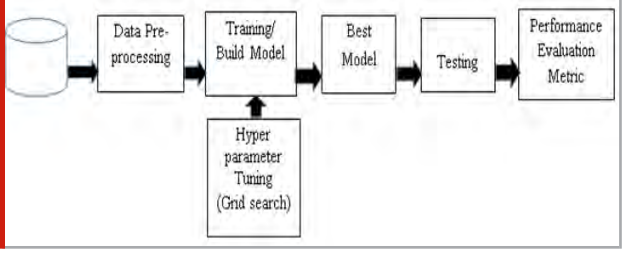
Numerous researchers have performed exploratory data analysis for diabetes perdition. The existing studies shown that the corpus is still very limited and include only female patient's details. These studies provides new insights for amplifying the correctness and delicacy of all the existing methods. None of these methods have still shown a perfection in the operation and its real life insinuations, so as to apply it for enormous and effective outcome.In the presented research the supervised model is instigated to perform exploratory data analysis and predict whether a person is diabetic (outcome=1) or not (Outcome=0).The dataset include eight predictor variables and one response variable. This corpus has a collection of all female records with age ranging between 21 to 81 years.This empirical research is made using three recurrently used models.The attributes in the corpus are representing input and output pair for each instance. This study is instigated on all the attributes. There is no evidence observed for confiscating any specific information during categorization.

Related Work: The related literature surveyed on diabetes prediction is summarized in Table1.Only representative studies are highlighted with their key findings.

Table 1. Literature Studies based on ML models are summarized.

Reference	Models	Accuracy Achieved (%)	Finding
Harleen Kaur, Vinita Kumari (2018) [1]	SVM,k-NN,ANN Multifactor dimensionality reduction (MDR)	Ranges between 83-89 for various classifier	This study highlights that MDR approach and k=13 in k-NN has Shown an enhanced effects.
Deepti Sisodia, Dilip Singh Sisodia (2018) [2]	Decision Tree(DT), SVM and Naive Bayes	Naive Bayes: 76.30 SVM :65.10 Decision Tree: 73.82	The presented models have achieved an average degree of Correctness.
Deeksha Kaul Harika Raju, B.K. Tripathy (2017) [3]	SVM, Deep Neural Networks, Hybrid Deep Learning	SVM: 77.34 DNN:78.12 Hybrid Deep Learning:80.34	This study has applied deep learning model on a limited Corpus.
Prema N S (2019) [4]	Logistic Regression,DT SVM,RF,k-NN,Naïve Bayes,Ada Boost,voting classifier	75.8 to 79.53	Highest accuracy is achieved for Ensemble model.
Dilip Kumar Choubey (2017) [5]	Naïve Bayes(NB)	78.69	Genetic Algorithm is used for attribute selection and NB is Used for classification. Computation cost is minimized.
Uswa Ali Zia (2017) [6]	Naïve Bayes,DT,k-NN	74.84 to 94.44	DT algorithms J48 and Jgraft Outperformed over other models. The result are obtained after Bootstrapping.
V. Anuja Kumari, R.Chitra (2018)[7]	SVM	78	The focus is only limited to the One of the model.

Figure 1: The Proposed System flow for Predictive Learning Model



MATERIAL AND METHODS

Dataset: This study uses an open access corpus for computer assisted analysis. This dataset has total eight independent/Predictor variables and one dependent or response variable. The main impetus of using this dataset is to accomplish predictive analysis using popular classifiers. This dataset embraces 768 female patient's instances in the age ranging between 21 and 81 years. The corpus consist of 268 diabetic records and 500 non diabetic record. This dataset is imbalance. The train test split used in the presented work is 70-30% respectively. As this dataset is imbalance, thus stratified sampling is used during train test split. System Representation: The suggested system steps are revealed in Fig.1.

Dealing with Data: It is a well-known fact that the data pre-processing is an important and relevant step for understanding the insights of the data. In real-life datasets such as medical diagnosis scenario there can be restricted data, and inequity data. To improve the predictive power of the model it is necessary to improve the data significance. It is obligatory to pre-process the data to achieve good performance of the system.

Machine Learning Algorithms: In this presented work the main idea is to apply recent advancements thriving in the technology for making better service in the society and help the masses to prevent from severe medical problems. These classifiers have been realised using python sci-kit learn library.The SVM classifier is applied with linear, polynomial, RBF, and sigmoid kernel. An experimental approach is used to determine the k value for an improved testing accuracy.

Table 2. Comparisons of performance evaluation measures of various models.

	Accuracy	Precision	Recall	F1-Score	AUC
k-NN	0.74	0.67	0.52	0.58	0.74
SVM (Linear Kernel)	0.73	0.65	0.49	0.56	0.83
SVM(Polynomial Degree=3)	0.74	0.74	0.40	0.52	0.81
SVM(RBF kernel)	0.74	0.72	0.44	0.55	0.82
SVM (Sigmoid Kernel)	0.51	0.14	0.07	0.10	0.68
Random Forest(RF)	0.76	0.70	0.54	0.61	0.83

Figure 2: k-NN (k=7)

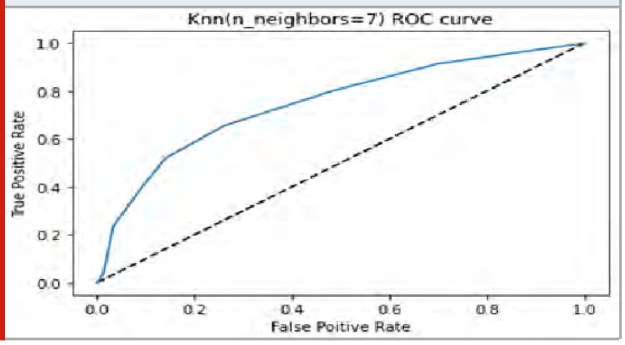


Figure 3: Testing accuracy is good for k-NN (k=7)

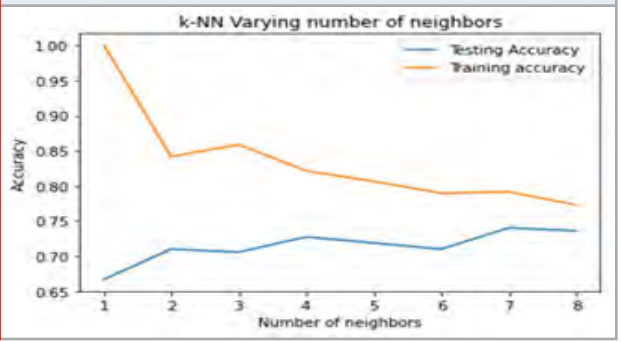


Figure 4: SVM (Linear) and RF

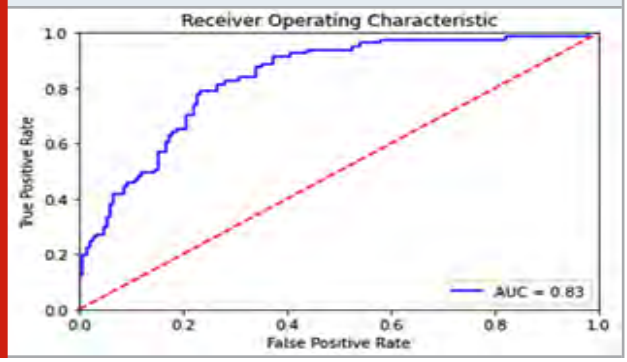
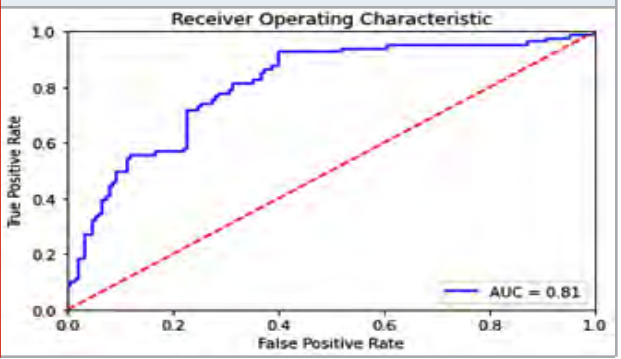


Figure 5: SVM (Polynomial)



K-NN: In this study, the instance based method is used for the categorization of affected and non-affected females. The most crucial task in its implementation is to determine the value of k.In this proposed work a grid search method is applied to find the parameter. This algorithm predicts the classification result, for a new test instance based on opinion or voting of neighbors in the nearest proximity. The algorithm uses distance measures such as Euclidean, Hamming, and Manhattan for locating the nearest neighbor. This is lethargic approach, as the Instances are simply stored in the memory in the initial step.

SVM: This model is remarkably used for the classification in the medical applications. The linear SVM uses maximum margin hyper plane for the separation of the data. The SVM can model linear as well as nonlinear data. The proposed work is implemented with Linear, polynomial (degree=3), RBF, and sigmoid kernel functions.SVM works effectively in high dimensional space. This model is still operative even if the dimension in the data is bigger than the total number of instances in the corpus.

Figure 6: SVM (RBF)

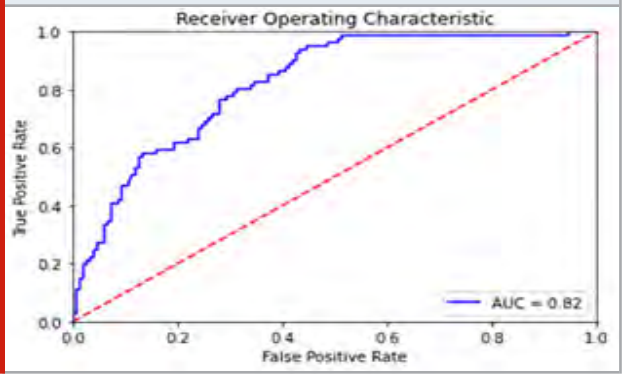
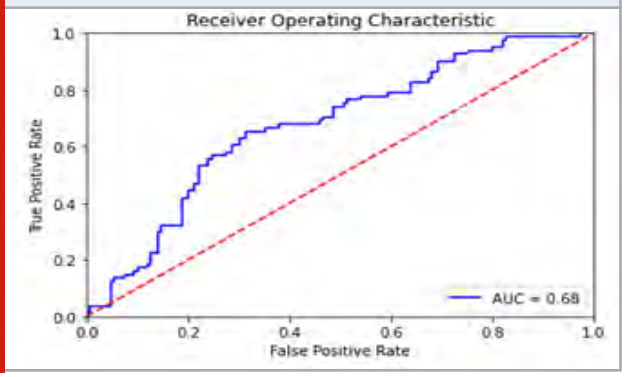


Figure 7: SVM (sigmoid)



Random Forest: This learning algorithm falls into the category of ensemble learning method. This model builds its inference by combining the impact of several decision trees. This model is used in two class categorization as well as multiple class categorization. The accuracy level of this ensemble model is generally higher.

Performance Evaluation metric

The experimented models are assessed on the well-known evaluation metric. The details are also outlined in the Table2.

RESULTS AND DISCUSSION

The empirical outputs of the proposed system are summarized in Table2.The Random Forest classifier outperformed in diabetes diagnosis.The ROC curves are highlighted for SVM, k-NN, and RF. The SVM Model with RBF and polynomial kernels have shown an improved accuracy over sigmoid kernel.

In medical diagnosis applications evaluation measures such as Precision and Recall are very important. Fig2 to Fig.7 represents the receiver operating characteristics (ROC) curve for k-NN, SVM with different kernels, and Random Forest.The Precision of SVM model with polynomial and RBF kernel is better than other models. The k-NN algorithm produced an improved testing accuracy for k=7 neighbors as shown in fig.3.The SVM with Polynomial degree=3 highlights largest precision value as compared to other models. Even if the degree of polynomial is increased to a lager value than it has been noticed that the generalization power of the model is not noteworthy.

CONCLUSION

The presented study conversed the accomplishment of three ML models to perform diabetes diagnosis using all the features in the structured dataset. It focuses on assisting the early diabetes diagnosis for females. The analysis of presented experimental research outlines that the random forest model performed better than SVM and k-NN with highest accuracy of 76%.The SVM model also achieved a nearly good accuracy with linear, polynomial and RBF kernel.The SVM with gaussian exhibited the worst accuracy. This study is limited to the diabetes prediction using structured dataset and it contains all instances of females. The new corpus may be collected for processing male patient's information. In future more prominence may be given to process high dimensional unstructured data using deep learning models.

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Bandwidth-Enhanced of Siw Cavity-Backed Slot Antenna By Perturbing Te210 Cavity Mode

Bollavathi Lokeshwar[1], Dorai Venkatasekhar[2] and Alapati Sudhakar[3]
[1]*Research Scholar, Department of ECE, Annamalai University, Annamalainagar 608002, India,*
[2]*Professor, Department of IT, Annamalai University, Annamalainagar 608002, India*
[3]*Professor, Department of ECE, R.V.R & J.C College of Engineering, Guntur 522019, India*

ABSTRACT
In this article, a technique is introduced for bandwidth enhancement of substrate integrated waveguide (SIW) based cavity-backed slotted antenna, inspired by the perturbing the cavity modes. To enhance the bandwidth, the proposed antenna uses a single cavity mode (TE210) instead of multiple cavity modes, which is the most diverse approach as compared to the other SIW cavity antennas. Due to the strong loading effect of the rectangle slot, the proposed antenna perturbs the TE210 cavity mode. As a result, two modes namely odd TE210 and even TE210 are successfully generated. Then a wideband response can be achieved by merging these modes in close proximity. The simulated findings show that the proposed design exhibits a fractional bandwidth of 12.8 % and a peak gain of more than 6 dBi. The cross-polarization radiation level of maximum – 31 dB and – 35 dB and identical polarization planes are obtained at 9.75 GHz and 10.65 GHz, respectively. Those amicable properties, e.g., light weight, ease of fabrication, cost effective, broadband response, unidirectional pattern, and high gain, make the design suitable for X-band applications.

KEY WORDS: SUBSTRATE INTEGRATED WAVEGUIDE, HYBRID MODE, WIDEBAND, IMPEDANCE BANDWIDTH.

INTRODUCTION

Substrate integrated technology (SIW) is the latest available technology that realizes the future wireless systems in planar form. The amicable benefits of this technology are the high-density integration with planar circuits and the low power losses [Kumar A et. al]. Several papers have been reported on SIW cavity-backed antennas. One of the major drawbacks of these antennas is the narrow bandwidth due to thin substrate. Low-profile planar slot antenna by using SIW technique is reported in [Luo GQ et. al], which generates the radiation by TE120 mode of the cavity at 10 GHz. Nevertheless, due to low-height, the quality factor (Q) of the cavity is increased. As a result, the bandwidth is achieved nearly 1.7% with a gain of 5.3 dBi. In [Luo GQ et. al], fractional bandwidth of 6.3 % is obtained by coupling the two hybrid modes (combinations of the TE110 and TE120 modes) of the cavity in close proximity. In [Mukherjee S et. al], TE120 mode is excited by using offset feeding technique. As a result, impedance bandwidth of 4.2% is achieved.

In [Mukherjee S et. al], the modified bow-tie slot perturbs the TE110 and TE120 modes to improve the bandwidth upto 9.4%. In [Baghernia E et. al], corner perturbation in the square cavity separates the TE120 and TE210 cavity modes, which in turn enhances the bandwidth (1.65%). In [Varnoosfadetrani MV et. al], matching slot excite the TE210 mode in the SIW cavity to attain the fractional bandwidth upto 8%. In [Dashti H et. al], TM010 mode of the patch is stimulated through proximity coupling by half-mode SIW to improve the impedance bandwidth. In [Kumar A et. al], multi-resonant slots perturb the current distributions of both TE110 and TE120 modes. As a result,

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the antenna achieves an impedance bandwidth upto 11%. Development of wideband is presented in [Heydarzadeh F et. al], where TE120 and TE210 degenerate modes of the SIW cavity are greatly coupled by cutting the corners of the conventional SIW cavity with circular shape. This design achieves 5.7 % fractional impedance bandwidth. Bandwidth enhancement using bilateral slots have been reported in [Niu BJ et. al], in which three hybrid modes have been merged within the operating band. In [Feng C et. al], to enhance the impedance bandwidth up to 8.9%, the ellipse slot is employed in the circular SIW cavity. Several attempts have been discussed for bandwidth enhancement, by introducing two shorting vias nearby the inclined slot, by using stacked cavities, by using bilateral slots, by using metallic vias.

In this paper, low-profile slot antenna using SIW technology is proposed for obtaining wideband response. The proposed antenna utilizes a single cavity mode instead of multiple modes, which is the most distinct approach as compared to other approaches reported in the references. Due to the strong loading effect of the slot, the proposed structure disturbs the current distributions of the TE210 cavity mode. As a result, two modes namely odd TE210 and even TE210 are successfully developed. Then a wideband response of 12.8% bandwidth can be obtained by merging these modes in close proximity. The simulated findings are compared with the previously reported works for more extensive study.

Antenna Design: The configuration and parameters of the proposed antenna is illustrated in Fig. 1. It consists of a SIW cavity, radiating slot and feeding circuit. The SIW cavity is fully created on a single PCB of height h, where the lateral walls of the cavity are realized by implanting metallic posts along the edges of the substrate. Rogers RT/ duroid 5880 substrate (ε_r= 2.2) is elected as the dielectric due to its exemplary features like low losses, less relative permittivity etc. The post diameter (d) and pitch (s) must pursue the prescribed criteria d/s ≥ 0.5 and d/λ0 ≤ 0. 1 to minimize the energy leakage from the gap between successive metallic posts [Lokeshwar B]. The dimensions of the SIW cavity can be approximately determined from the equation (1). The radiating slot with size of l_s x w_s is printed on the ground plane. To facilitate the planar integration, a section of 50 Ω micro-strip line is appended at the end of 50 Ω grounded co-planar waveguide (GCPW), forming a feeding circuit to excite the proposed antenna.

$$f_r(TE_{210}) = \frac{1}{2\sqrt{\mu_0\varepsilon_0\varepsilon_r}}\sqrt{\left(\frac{m}{L_{eff}}\right)^2+\left(\frac{n}{W_{eff}}\right)^2+\left(\frac{p}{h}\right)^2} \quad (1)$$

where, m,n,p are positive integers, ε_r – dielectric constant, equivalent length and width of the cavity

$$(L_{eff}\ or\ W_{eff}) = L_{cav}\ or\ W_{cav} - \frac{d^2}{0.95*s}$$

respectively, d – diameter of the post, and p – spacing between the adjacent vias (pitch).

Figure 1: Configuration of the antenna a 3D View, b Schematic layout

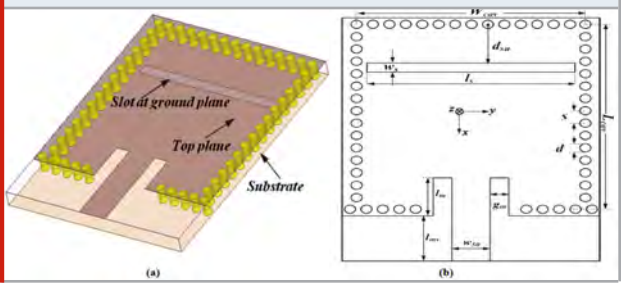


Table 1. Dimensional parameters of the proposed design

Parameter	W_{cav}	L_{cav}	w_{50}	l_{ms}	l_m	g_m
Value(mm)	20.9	22.4	3.3	5.5	4.6	1.25
Parameter	ls	ws	dsu	s	d	h
Value(mm)	19	1.4	4.55	1.5	1	1.6

3. Working Principle: In order to figure out the behavior of the rectangle slot on bandwidth enhancement, the simulation of the SIW cavity is described by using ANSYS HFSS at first. One of the approach to improve the operating bandwidth of cavity-backed antennas is to increase the height of the substrate material. That's why, a standard thickness h =1.6 mm is selected as substrate thickness. The dimensions of the SIW cavity are optimized and listed in the Table 1. Fig. 2 represents the input resistance plot (Re(Z11)) of the proposed design. When the SIW cavity alone is excited by micro-strip line feed, the dominant mode (TE_{110}) at 6.85 GHz and TE_{210} mode at 10.25 GHz are generated. The aforementioned SIW cavity modes get perturbed by printing the rectangle slot (non-resonant slot) at the ground plane. As a result, the TE110 mode shifts downward from 6.85 GHz to 6.1 GHz.

And, a new couple modes (odd TE210 and even TE210) are generated at 9.55 GHz and 10.85 GHz due to perturbations in TE210 mode. These modes are merged together by placing the slot at optimum location, which widen the bandwidth. The surface current distribution of the proposed design at different resonances is depicted in Fig. 5. It is evident that the quality factor (Q) of the hybrid mode at 9.75 GHz is less than that of the hybrid mode at 10.65 GHz, which can be noticed by comparing Fig. 3a and b. At both the resonances, surface current is mostly concentrated above the non-resonant slot with a minimal amount of field in the lower half. To know the variations in the fractional bandwidth, the slot width is changed as shown in Fig. 4. As a result, the impedance matching properties has been greatly affected. At optimum Ws = 1.4 mm, the fractional bandwidth was obtained maximum. Mathematically, fractional (percentage) bandwidth is calculated from the equation (2).

$$\% \text{ Fractional Bandwidth} = 2 \times \frac{f_H - f_L}{f_H + f_L} \times 100\ \% \quad (2)$$

Where fL – lower frequency (S11 < −10 dB) ; fL – upper frequency (S11 < -10 dB).

Figure 2: Real impedance (Z11) plot

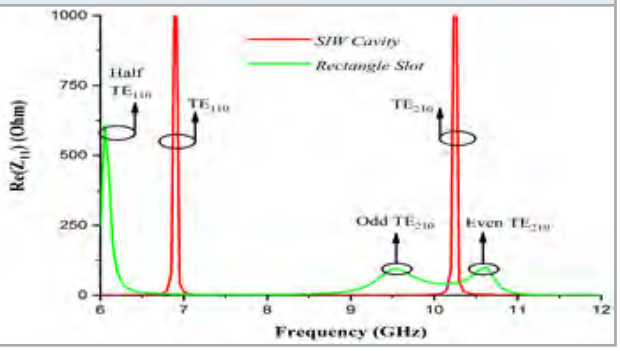


Figure 3: Surface current distribution at a 9.75 GHz and b 10.65 GHz

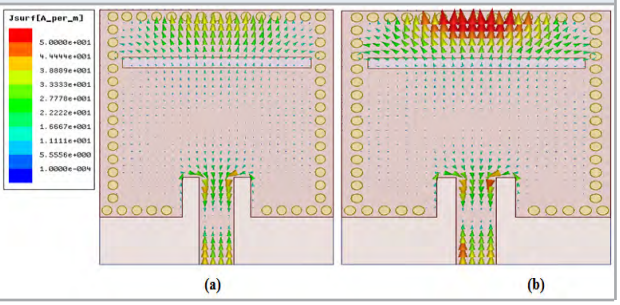
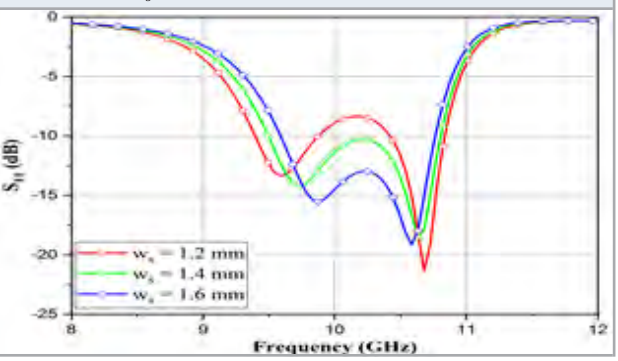


Figure 4: Changes in fractional bandwidth by varying slot width w_s



RESULTS AND DISCUSSION

The proposed design is completely designed with single substrate. The simulated result of the reflection coefficient (S11) confirms the wideband response as depicted in Fig. 5. It can be substantiated from the figure that, the simulated frequencies resonances are 9.75 GHz and 10.65 GHz. The simulated impedance bandwidths (for below −10 dB) are 1.3 GHz (12.8 %) covering from 9.5 GHz to 10.8 GHz. The simulated gain performance of the antenna is included in Fig. 7. The gain remains consistent, with a peak gain of 6.44 dBi and 7.1 dBi is achieved at 9.75 GHz and 10.65 GHz, respectively. From the gain expression (3), the gain is proportional to aperture (slot) area. It is also verified from the simulation as shown in Fig. 6.

$$G = \frac{4\pi}{\lambda^2} \varepsilon_{ap} A_p \quad (3)$$

Figure 5: Simulated reflection coefficient (S11) and gain of the proposed antenna

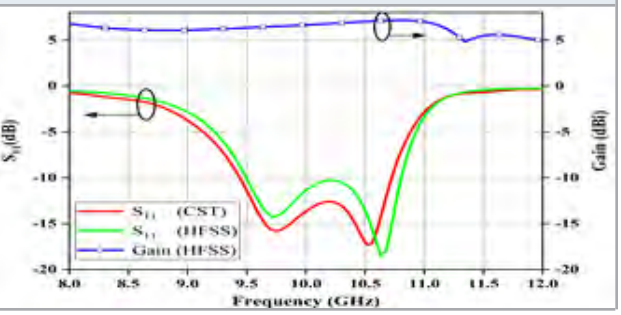


Figure 6: Analysis of gain of the proposed antenna for different values of slot width Ws

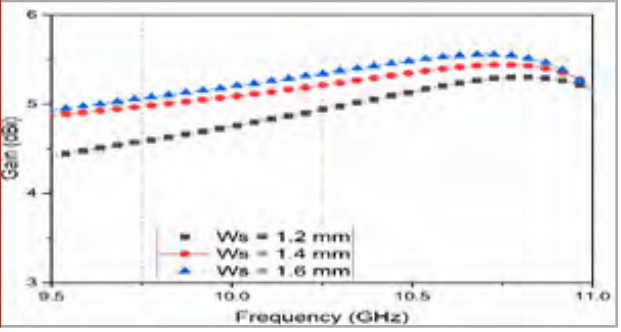
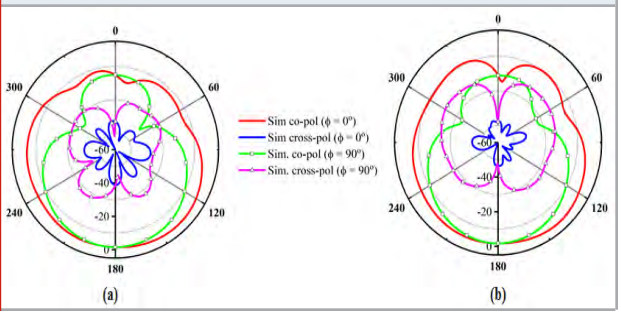


Figure 6: Radiation patterns of the wideband antenna at a 9.75 GHz b 10.65 GHz



The simulated far-field pattern of the antenna in two cut-planes, which are corresponding to XZ-plane (φ = 0o) and YZ-plane (φ = 90o) at two frequencies are shown in Fig. 8. It is found from the simulated results that, the peak cross-polarization level in the XZ-plane and YZ-plane is –31 dB and –21 dB, respectively at a lower resonant frequency in the broadside direction. At 10.65 GHz, the peak cross-pol level is –35 dB and –20 dB in the XZ-plane and YZ-plane, respectively. The

simulated front-to-back ratio (FTBR) of the proposed design is about 14 dB and 18 dB respectively at 9.75 GHz and 10.65 GHz. To indicate the essence of the proposed study, a comparison of different parameters of the proposed design and the previously published designs are listed in Table 2. It may be observed that the proposed antenna showcase the flexibility in tuning impedance bandwidth and renders a better bandwidth performance at two frequencies as compared to works presented in Table 2 by using single cavity mode.

Table 2. Comparison among proposed antenna and some previously reported SIW CBSA

Properties	Year	Freq. band	FBW (%)	Gain (dBi)	Structure	h (mm)
Mukherjee S and Biswas A et. al	2012	X	6.3	6	Simple	0.5
Mukherjee and Biswas A S et. al	2014	X	9.4	3.7	Complex	0.787
Kumar A and Raghavan S	2017	Ku	11	8	Complex	1.57
Heydarzadeh F and Neshati MH	2018	Ku	5.7	6.4	Complex	1.57
Chaturvedi D	2020	C	5.2	7.15	Complex	1.524
Ali HA and Massoni E et. al	2018	S	3.72	4.42	Complex	1.52
This work	2020	X	12.8	7.1	Simple	1.57

CONCLUSION

A low-profile bandwidth-enhanced planar slot antenna using SIW technology is designed and analyzed in this article. The proposed design is loaded with a simple rectangle slot for radiating the electromagnetic waves. The radiating slot is engraved near to the upper wall of the SIW cavity, which perturb the TE210 mode to achieve bandwidth enlargement. Radiation performance and effects of parameter have been investigated. The simulation findings show a maximum gain of 7.1 dBi and fractional bandwidth of 12.8 %. The proposed design still retains many benefits such as lighter weight, less fabrication cost, and easy integration with planar circuits.

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An Approach to Reduce Vehicular Traffic Data Dissemination Delay using VDDRA (Vehicular Destined Resolution Algorithm)

Lokesh M. Heda[1]* and Vishal R. Rathee[2]
[1-2]*Department of Electronics Engineering, Shri Ramdeobaba College of Engineering & Management, Nagpur, India*

ABSTRACT

Recent advances made in Vehicular Adhoc Network indicate its capability of improved passenger safety by efficiently handling vehicular traffic. It demonstrates capability to handle a large capacity of vehicles on roads ferrying within city limits mostly consisting of light weight vehicles. Albeit on national highways this load is not because of light vehicles but because of heavily loaded vehicles that ultimately creates a highly accident prone area, VANET (Vehicular Adhoc Network) still demonstrates it's powerless. VANET needs only sufficient bandwidth and updated yet reliable, traffic and current road situation data through various Adhoc points to work. This accumulation and transmission of data is a very complex task as the nodes are mobile in nature and communication network is also very much affected by environmental conditions. This paper comprehensively discusses various research challenges in this information transmission technique. An approach for improving the quality of data transmission at various nodes in the network is also presented.

KEY WORDS: ROUTING, DISSEMINATION, MOBILE NODES, ETC.

INTRODUCTION

With the advancements in computer and communication networks, study on VANET (Vehicular Adhoc Network) a technology for connecting daily life movements with the advance networks has also gained momentum. In conventional transportation technique i.e. roads, the commutation time is highly dependent on traffic conditions and road conditions that may or may not be favourable as well as predictable under certain circumstances. Thus, VANET could play a very important role in this as well, as it is a communication network created with the help commuting vehicles wherein the vehicle can be of any type and size. As shown in figure (1) mobile node communication network can be developed using commuting vehicles and road infrastructure.

In this network one mobile node (moving/stable vehicle) can communicate with another mobile node (moving/stable) which is in its radio transmission range. Also the node can communicate with road side transmission infrastructures. This "VANET" demonstrates an ability to make a transport system an Intelligent Transport System (ITS). This intelligent system is widely dependent on acquired infrastructure and mobile nodes which can use a very large bandwidth of electromagnetic waves. These sensors are deployed at various intersections of roads/rails. Radio Frequency sensors can also be used to detect and transfer information by integrating them in cameras to detect the movement of vehicles. A mobile node will consist of various communication devices like cell phones to receive or transmit data. Hence a cellular network can be used to transmit traffic data to a particular user if required.

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*Corresponding Author: hedalm1@rknec.edu
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Figure 1: Working of Vehicular Adhoc network

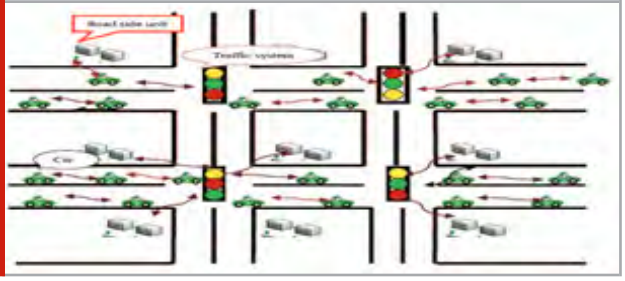
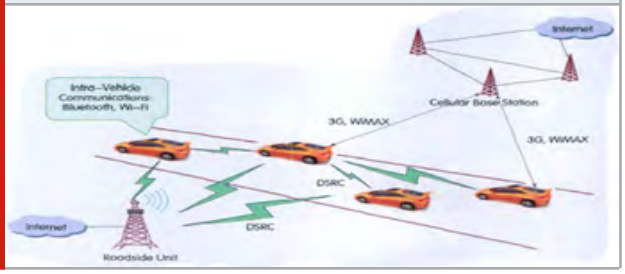


Figure 2: Hybrid VANET Structure



The main applications of VANET can be categorized as: Safety applications: pre-collision warning, electronic road signs, traffic light violation warning, online vehicle diagnosis and road condition detection, etc. Various other applications of VANETs are in Government oriented traffic managements systems, Congestion detection in high traffic regions, Traffic Route planning systems, National highway trolling systems, Public Transportation system, etc.

2. Recent Wi-Fi Technologies and VANET: VANET involves efficient use of wireless networks and hence by using an advanced Bluetooth technology one node/ communicating device can be connected to another device through vehicular functionality just like an audio system. An example is a driver who can connect to another vehicle driver whether stationary or moving. WAN, Wireless MAN, WiMAX standards have been introduced in IEEE standard 802.11 for fast and accurate transmission of data between vehicles usually cellular network. Future predicts advanced architecture of VANET that can become hybrid structures as shown in figure (2)

As shown in figure 2 this structure is capable of providing a very long distance communication using mobile networks such as WIMAX. Dedicated Short-Range Communication (DSRC) and wireless-fidelity (Wi-Fi) are capable of facilitating short range communication using vehicular network and has advantages of being less costly and dynamically connective.

3. Research Challenges in VANET: Implementing VANET presents a lot of challenges but prominent amongst them are the complex issues that occur in VANET networks. A complex challenge in implementing VANET is restructuring of a network layer protocol so as to support VANET. The unique properties of vehicular network are to be explored to solve various other design challenges which in turn can also solve various ITS (Intelligent Transport System) problems.

3.1. Link Layer Challenges: The main issue to be dealt in this layer is of adapting to current vehicular environmental condition i.e. being dynamic while being responsiveness, reliable and scalable. Also MAC Management is inefficiently lengthy here. Appropriate Link layer protocol can improve drastically the data packet forwarding performance in VANET.

3.2. Application Layer Challenges: In application layer challenges lie in representing, discovering, storing and updating information in the complete network. Addressing and naming of data packet is a main issue in application layer. The naming and addressing strategy has a significant impact on other framework conventions, such as data revelation and routing. Because vehicles are exceptionally mobile, another challenge is to dynamically map vehicle IDs to position-based addresses. This issue is particularly important for applications incorporating hybrid design.

3.3. Dynamic Data Dissemination: VANET being a data-centric network, data transfer or data collection through it is a very challenging task as the network portability is completely dependent on the traffic on data network. Any error in data received or transferred by the source or destination is not desirable. Information dissemination can be classified into two levels.

3.3.1 Macroscopic Data Dissemination: This type of dissemination deals with the transmission of data from one mobile node to another mobile node within a specified geographical area. Here the source or destination can be single mobile node or a group of known/unknown mobile nodes. This type of data dissemination should reduce data transfer delay, reduce delivery overhead but enhance the future enquiry success rate. This type of data transmission presents a specific research challenge that of routing of data in network, storage of data to be transferred or received and data segregation .

3.3.2 Microscopic Data Dissemination: This type of dissemination deals with data delivery by one or more than one hop. The data dissemination is processed through Wi-Fi links. It also deals with local multiple-hop communication in which multi-hop works as a co-coordinator between local vehicles and the specified direction of data transfer. For this it uses vehicular traffic based algorithm to transfer the data packet to

the specified vehicle by following a specific path or direction.

4. Proposed Methodology (VDDRA): Figure (3) presents block diagram of proposed Vehicle Destined Data Resolution Algorithm (VDDRA) that can be used to reduce data dissemination delays and other problems.

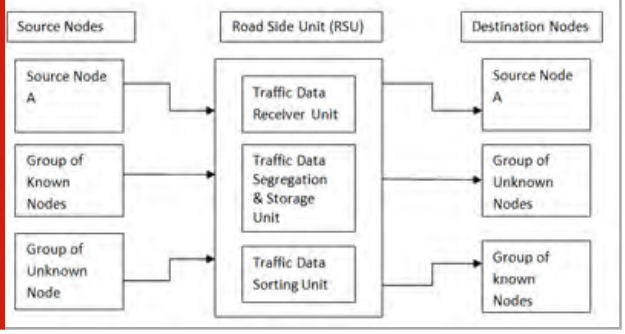
In Macroscopic data dissemination method one node can transfer traffic data to one or a group of known or unknown nodes. A node in VANET can be a mobile node and may become out of reach while the data transfer is being done thereby causing unnecessary delay.

Table 1. Comparative Analysis of Already Existing Methods

Sr.No	Name of Method	Technique Used	Advantage	Disadvantage
1.	Traffic Dynamic Data Dissemination Protocol (TDDDP)	It works on Broadcast Data Suppression technique based on time slot scheme to disseminate data between mobile nodes & Buffer a & Carry forward mechanism for choosing appropriate mobile node to fill the gap interconnection between various disconnected mobile network.	1. Data Disseminations is very fast. 2. Always has a connected network for data transfer.	1. Extra storage space is required for data buffering before dissemination.
2.	Network Opportunistic Data Dissemination Method	Centric data dissemination method is used where a Cluster head node will broadcast data periodically and all the mobile nodes passing through the network range will receive the data.	1.This technique is most suitable for highly dynamic traffic network. 2. No Infrastructure is required.	1. Periodically data updation is required in cluster head node. 2. As all the nodes will receive and store data, extra data dissemination overhead management is required. 3.Efficient Periodic updating in highly traffic area is required otherwise collision of data may occurred a lot.
3.	Data Push Based Data Dissemination technique	Central Data Dissemination method is applied here. It works on 3 steps: 1.Collects the data from network in the center head system 2. Then a list of data items is created that is to be delivered in the network. 3.Then data consist of Header information (source id, source-location, data forwarding information, data packet generation time etc) is transmitted to the road side unit(RSU)	1. Central data management is very easy to handle. 2.False Data packet transmission is easy to detect. 3.Error detection and elimination is very easy.	1. Central management required extra management system. 2. If center head crashes over-all the network performance will get affected.

4.	Buffering and data pouring Data dissemination (BDPDD) Method	This technique is based on Relay and broadcasting station. It works on scheme called as Data Pouring (DP-Scheme) which selects the very high density traffic consisting road and then transmitting the data not only that roads but also on nearby cross roads.	1. Rely station present in specific area has ability to update themselves by their own ,hence no extra overhead is there in center head. 2. Central data transmission is very easy to manage. 3.Data disseminated is stored in IBER (Station) hence data recovery during network failure is very easy.	1. Rely stations includes extra cost in network management. 2. Buffer is required to stored data delivered by center head.
5.	Data Dissemination based of Data Pulling method	This technique is used by only some specific users for getting some specific response form the mobile node. Data dissemination is managed by center head and all mobile nodes moving in the road with in a network range. Bacon message transmission scheme is used here known as token message transmission. All vehicle in the network must be fully equipped with digital devices, maps,traffic details.	1. Advance digital devices give more reliability and capability to operate accurately in very high traffic density. 2. It has Good Performance capability. 3.Central data management gives easy management of network in high network density.	1. Use of advance digital devices add more network cost. 2. Beacon message transmission needs more memory to store data packets.

Figure 3: Block Diagram of Proposed Methodology



In our proposed methodology as shown in figure 4, a group of known/unknown nodes will disseminate traffic information to some destined mobile nodes moving in coverage area to initiate communication between them and then to the desired destined node/nodes. The basic requirement for this would only be a very high speed network and proper identity of nodes. Hence this proposed methodology may be applied to road side units whose identity are known or can be marked easily as compared to moving vehicles wherein it needs to be incorporated which is a tedious task but possible.

CONCLUSION

Research advancements in Vehicular Adhoc network (VANET) gives more promising solutions to solve many problems related to traffic and accidents in current situation. Appropriate study and advancements in it could be the next promising area paving a path for futuristic ITS. Vehicular Adhoc network however has various data dissemination protocols with their advantage and disadvantages. Our proposed data dissemination method Vehicle Destined Data Resolution Algorithm (VDDRA) when implemented completely in future will overcome the disadvantage of data transmission delay and central data management cost. In our proposed system the data will be transmitted only when the mobile node will present in coverage area else data will not be disseminated in the network, thereby regularizing routing of traffic information as well as traffic congestion as well. Thus proposed VDDRA (Vehicle Destined Data Resolution

Algorithm) will reduce the traffic data dissemination between the various vehicular communication nodes.

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EMG Based Emotion Recognition in Indian Classical Dance

Shraddha A. Mithbavkar[1] and Milind S. Shah[2]
[1]*Assistant Professor, Department of Electronics Engineering, Datta Meghe College of Engineering, Navi Mumbai, India*
[2]*Professor, Department of Electronics and Telecommunication Engineering, Fr. C. Rodrigues Institute of Technology, Navi Mumbai, India*

ABSTRACT

In Indian classical dance, expressing nine emotions (Navras) through facial expression plays a significant role. However, scientifically measuring the correct emotion is the major challenge. This research work introduces the recognition of "Navras" in "Kathak" using an Electromyogram (EMG) signal. In this research, for emotion recognition, a unique combination of EMG signal acquired from facial expression and head movement is used. From EMG signals, three time-domain features, namely Root Mean Square (RMS) mean, RMS maximum, and RMS variance features are calculated. The Least Square Support Vector Machine (LSSVM) classifier is applied for the classification of nine emotions. LSSVM classifier achieved 69.63% and 80.3% classification accuracy without and with head motion condition, respectively, considering nine emotions for three subjects.

KEY WORDS: EMOTION RECOGNITION, EMG, LEAST-SQUARE SUPPORT VECTOR MACHINE CLASSIFIER, KATHAK.

INTRODUCTION

In Indian classical dance like Kathak and Bharatanatyam, expressing nine emotion (Navras), namely Shringar (loving smile), Hasya (humorous), Karuna (tragic), Raudra (fierce), Veer (heroic), Bhayanaka (fearful), Bibhatsa (disgusted), Adbhut (amazed), and Shant (peaceful) through facial expression plays a significant role. In dance examination, currently, the teacher does the evaluation. To provide automation in the evaluation process, the measurement of accurate emotion in a scientific way is the major challenge. Many researchers contribute their work in the recognition of Navras in Indian classical dance. Srimani et al. took images of dancers posing Navras in Bharatanatyam and use image processing to analyze Navras concerning kurtosis with makeup and without makeup condition. The authors observed 85% similarity in variation with makeup condition and 95% similarity in variation without makeup. However, emotion identification is not made. Kishore et al. classified Indian classical dance action with 93% accuracy using the video processing method without emotion recognition.

Srimani et al. and Kishore et al. used the image processing and video processing method, which also has a restriction of the proper light condition and camera alignment. Mohanty et al. collected data using a Microsoft Kinect camera in different body postures of a dancer in a controlled and uncontrolled background environment. The author used a Support Vector Machine (SVM) and Convolution Neural Network (CNN) to find the classification accuracy of eight emotions and succeed 95.2% accuracy in real-world conditions. Microsoft Kinect camera can be used for major motion and posture by considering the skeletal structure of a person, but small variation in facial expression could not be detected. Hence, emotion recognition needs to be done without restricting the movement of the dancer.

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**Corresponding Author: shraddha0306@gmail.com*
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In an emotional state, the brain signal tightens a muscle, which developed voltage on it. Electromyogram (EMG) signals detected muscle movement. Hence, EMG based Navras recognition needs to be explored. In EMG based emotion recognition, signals are acquired from facial muscles. This research introduces Navras recognition through facial expression and head motion using the EMG signal. The basic process flow of the system is shown in Figure 1. EMG signals collected from facial and neck muscles are applied to a signal preprocessor. The Signal preprocessor amplifies, filters, and converts a signal in digital form. This signal is applied to the feature extractor to collect features. This feature is applied to classifiers for the recognition of the emotion.

Figure 1: Basic process flow of EMG based Navras recognition

In the case of EMG-based emotion recognition, Picard et al. classified eight emotions, namely reverence, joy, grief, anger, hate, romantic love, platonic love, and no emotion of a single subject. The author achieved 46% classification accuracy using K Nearest Neighbor (KNN) classifier with mean, standard deviation, mean absolute value features. Cheng et al. used a single-subject EMG signal from the Augsburg Bio-Signal Toolbox dataset (AUBT) of four emotions, namely anger, pleasure, sadness, and joy using the Back Propagation Neural Network (BPNN) improved by the Levenberg-Marquardt (LM) algorithm. The author achieved 75% classification accuracy. Yang et al. used a single-subject EMG signal from the AUBT dataset and recognized emotion with 91.66% using the Least Squares Support Vector Machine (LSSVM). Yang et al. and Cheng et al. recognized only four emotions, namely anger, pleasure, sadness, and joy. Jerritta et al. detected six emotions: afraid, disgusted, happy, sad, neutral, and surprised using a single-channel EMG acquisition unit.

The author achieved 69.50% classification accuracy using the KNN classifier and skewness and kurtosis features. Kehri et al. used a wavelet packet transform and SVM and achieved 91.66% classification accuracy of three emotions. From all the above literature, it is recapitulated that EMG based emotion recognition achieved overall accuracy in the range 46% to 91.66%. 46% classification accuracy was achieved for eight emotions, and 91.66% classification accuracy was achieved for three emotions with a single subject. Hence, there is a scope of improvement in classification accuracy concerning more emotions and subjects. All the above research used facial EMG signals for classification, but the head movement was not considered in this process. Current research uses face and neck muscles to identify emotion through head movement and facial expression.

2. Research Methodology: This research includes data collection, feature extraction, classification process.

a. Data Collection: EMG signals were collected from three Kathak students. All participants are qualified Kathak training level 4th and above. Before the data acquisition process, participants gave consent by filling up the form. Also, a detailed procedure of signal acquisition was explained to them before capturing emotion. To reduce the impedance level of the skin, the participant applied alcohol on the forehead, chick, and neck. Open BCI Cyton 8 channel bio-sensing board with a Wi-Fi shield is used to acquire an EMG signal. Out of eight channels, four channels are used to collect the EMG signal. The unit acquired an EMG signal with a 1000Hz sampling frequency. Ag-AgCl dry electrodes are used to sense EMG signals. The placement of the channel on the face and neck muscles of the subject is shown in Figure 2. Negative emotions, like anger, sadness, surprise, and disgust, activate the corrugators' supercilii muscle and the frontalis muscle. Positive emotions, like happiness and smile, activate the zygomaticus major. Hence, three channels are placed on corrugators' supercilii muscle, frontalis muscle, and zygomaticus major.

Figure 2: Placement of channels on the face and neck muscles of the subject

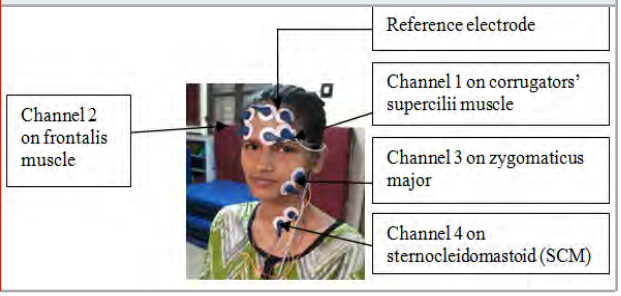

Figure 3: Images of nine emotions, namely Shringar (a), Hasya (b), Karuna (c), Raudra (d), Veer (e), Bhayanaka (f), Bibhatsa (g), Adbhut (h), and Shant (i) shown by Mrs. Pallavi Mhaiskar (Kathak Expert).

Tan et al. correlated the sternocleidomastoid (SCM) electromyography signal with head rotation angle. SCM muscle showed a significant role in neck movements. Hence, the fourth channel is placed on the SCM muscle. Two electrodes are placed at a 20mm distance. Participants performed 5 seconds dance step to show emotion. As shown in Figure 3, participants expressed nine emotions, namely Shringar (loving smile), Hasya (humorous), Karuna (tragic), Raudra (fierce), Veer (Heroic), Bhayanaka (fearful), Bibhatsa (disgust), Adbhut (amazed), and Shant (peaceful). EMG signals were acquired twenty times for nine emotions.

b. Feature Extraction: In this research, EMG signal preprocessing is done using MATLAB. Applied framing to a signal with 256 ms frame size. Hamedi et al. mentioned in their research work, facial EMG signals give the best and steady information in the 256 ms segment; so, 19 frames are formed for each EMG signal. RMS was calculated for each frame. Then found RMS mean, RMS maximum, and RMS variance from 19 frames. Chen et al. mentioned in their research work that RMS contains the middling power of a signal, and it is simple for quick training and operating of the classifier. RMS maximum shows the maximum value, RMS mean shows the average value, and RMS variance shows a variation in the RMS level of each signal. It helps determine a minute change in emotions. The mathematical definition of features: RMS mean, RMS variance, and RMS maximum are given in Table 1. In this equation, xj is the present point, j is the index of the present point xj, L is the length of the frame, and k is the current frame of signal.

Table 1. The mathematical definition of features RMS mean, RMS variance, and RMS maximum

$RMS_k mean$	$RMS_k variance$	$RMS_k maximum$
$= mean\left(\sqrt{\frac{1}{L}\sum_{j=1}^{L} x_j^2}\right)$	$= variance\left(\sqrt{\frac{1}{L}\sum_{j=1}^{L} x_j^2}\right)$	$= maximum\left(\sqrt{\frac{1}{L}\sum_{j=1}^{L} x_j^2}\right)$

c. Classification: This research uses the LSSVM for classification. The LSSVM is an improved version of the SVM. Equality constraint is used in classification. Quadratic programming changes into linear equation form. Hence, convergence accuracy is improved. Classification is done with a one vs. one coding scheme and RBF kernel.

RESULTS AND DISCUSSION

After extracting features from 540 EMG signals per channel, the complete dataset is separated into five divisions. One division is considered for testing, and the other divisions are considered for training. This process is repeated five times by considering different testing division and found the middling classification accuracy. Classification accuracy was calculated with and without head condition for individual participants and all three participants together. Table 2 and Table 3 show the average performance of the LSSVM for a different participant without and with head motion. In case of without head motion, consider only channel 1 to channel 3 EMG signals. These channels are connected to corrugators' supercilii muscle, frontalis muscle, and zygomaticus major.

In the case of with head motion condition, four channels are connected. The fourth channel is connected to the SCM. Classification accuracy of individual emotions and overall classification accuracy is found.

Figure 4 shows the performance bar graph of the LSSVM classifier of individual emotions for all participants' conditions. All emotions improved their classification accuracies by incorporating head motion. Adbhut and Hasya emotions improved classification accuracy by 8% and 8.3%, respectively, by incorporating head motion. Shringar emotion shows only 1.03% improvement in classification accuracy by incorporating head motions.

Table 2. Performance of LS SVM Classifier for a Different Participant without Head Motion

	Classification accuracies of nine emotions									
Participant number	Adbhut	Bhayanaka	Hasya	Karuna	Raudra	Shringar	Shant	Veer	Bibhatsa	Overall Accuracy
1	92.7	97.4	97.5	100	94.4	97.4	98.7	98.6	93.8	84.98%
2	89.7	99.3	96.78	98.7	97.3	98.7	93.14	94.7	97.3	83.3%
3	97.58	99.4	99.4	97.62	98.2	100	99.4	99.4	99.4	95.55%
All Participant	87.58	91.14	89.88	90.48	90.88	97.8	93.94	93.38	89.3	69.63%

Table 4 shows that without head motion condition and with head motion condition, classification accuracy achieved is 69.63% and 80.3%, respectively. Hence, it is observed that head movement improves 15.3% classification accuracy compared to accuracy observed without head movement. It signifies that head movement plays a vital role in emotion recognition. It is observed that individual participant classification accuracy is significantly more than classification accuracy for all participants. In previous research work, Jerritta et al. recognized a maximum of six emotions in an emotional environment with an accuracy of 69.5%. Current research achieved 80.3% classification with nine emotions, which are 15.53% more than previous research.

Table 3. Performance of LSSVM Classifier for a Different Participant with Head Motion

	Classification accuracies of nine emotions									
Participant number	Adbhut	Bhayanaka	Hasya	Karuna	Raudra	Shringar	Shant	Veer	Bibhatsa	Overall Accuracy
1	97.24	97.3	98.8	100	98.6	97.4	97.8	99.2	95	91.08%
2	99.34	98.9	97.58	98.9	100	99.3	95.9	97	97.64	91.66%
3	98.88	98.88	98.88	99.4	99.4	100	99.4	99.4	99.4	96.66%
All Participant	94.78	94.36	97.42	93.82	93.02	98.88	96.22	97.26	95.26	80.3%

Figure 4: Performance bar graph of LSSVM classifier of individual emotions for all participants' conditions

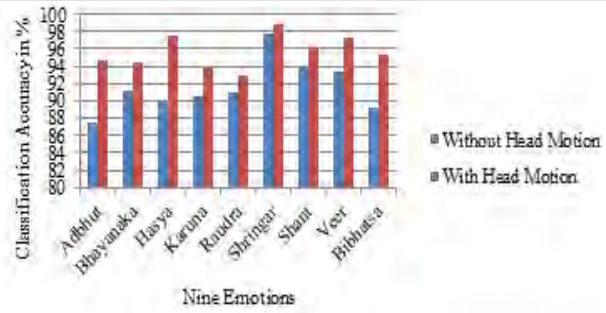

Table 4. Improvement in Emotion Classification with Head Motion

Sr. No	Participant number	Classification accuracy Without head motion (%)	Classification accuracy With head motion (%)	Improvement in classification accuracy(%)
1	1	84.98	91.08	6.69%
2	2	83.3	91.66	9.12%
3	3	95.55	96.66	1.16%
4	All Participant (1,2,3)	69.63	80.3	15.3%

CONCLUSION

In Indian classical dance, to automate the evaluation process of dance examination, it is needed to acquire and process Navras scientifically. This research work introduced the recognition of Navras in Kathak using the EMG signal. This research used a unique combination of EMG based facial expression and head movement for emotion recognition. LSSVM classifier trained with RMS mean, RMS maximum and RMS variance features classified Navras with 69.63% classification accuracy considering without head movement and 80.3% classification accuracy considering head movement. Hence, it is observed that head movement significantly improves classification accuracy compared to accuracy observed without head movement.

Future Scope: In this research work, signals are collected from only three participants. The plan is to collect EMG signals from ten participants during the Kathak dance step and classify nine emotions. In the current research, the classification accuracy of individual participants is comparatively more, and the classification accuracy of all participants is less. Future research planning explores the deep neural network to improve the classification accuracy of all participants together.

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An Approach To Predict Coronavirus Disease (Covid-19) In India Using Arima Model

Swati Hira
[1]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur India*

ABSTRACT

Novel coronavirus (COVID-19) is started from Wuhan (City in China) and is rapidly spreading among people living in other countries. Today around 215 countries are affected by COVID-19 disease. WHO announced approximately number of confirmed cases are 30.4 worldwide including 943,433 deaths. In India as of 18 September 2020 total number of confirmed cases 5.31M. To more efficiently manage this spread, there is an immediate need to track and forecast the prevalence of COVID-19. Analysis of time series models is an effective way to predict this COVID-19 outbreak and take the appropriate action to react to this epidemic. The ARIMA models were developed in this study to predict the COVID-19 epidemiological trend of Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, and Uttar Pradesh in India. The data of COVID-19 is collected for period of 12 March 2020 to 10 September 2020 WHO. Various ARIMA time-series models were created with different parameters. After analysis ARIMA (1, 2, 0) is chosen as an appropriate model for COVID-19 prevalence. The findings of the study will reveal insight into understanding the pattern of the epidemic and also provide an understanding of the epidemiological phases of these states. In addition Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, and Uttar Pradesh analysis of COVID-19 prevalence pattern will help to take precautions and formulate strategies for this epidemic.

INTRODUCTION

In December 2019 the novel coronavirus disease (COVID-19) originated as a new species which is not previously found in humans. New COVID-19 virus increases the serious pneumonia infections and has spread widely from Wuhan City, across China, and now to more than 215 countries. Now it is becoming a worldwide serious public health issue. This infection causes deadly impacts, particularly on the older and those with ceaseless ailments .The disease spread quickly and has a complex structure.

Due to variations in detection capacities and epidemiological surveillance cases vary between states, but as of now this disease has spread worldwide. Since for this category of virus no treatment available yet, there is an urgent need of healthcare services, which helps to control the spreading of this virus. Mathematical modelling tools are available to estimates the cases and to plan the amount of additional resources and necessary services was expected to tackle this epidemic. It is important for healthcare systems to predict the projected burden of illness to coordinate medical treatment related services required to provide outbreak solution. Now a days, numerous statistical and mathematical methods in use to analyse COVID-19 cases. For example multivariate linear regression, time series models, grey forecasting models, simulation models, and back propagation neural networks. Various indicators affect this epidemic spread. Because of this, Tendencies and randomness mark the general distribution of the outbreak. Hence, the statistical methods listed are inadequate to examine the randomness, of the outbreak and the generalization of these models are complex.

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The ARIMA statistical model is used by several health care systems and also in other areas because of its easy to use and data description feature. This models also deployed successfully to predict various infectious diseases as influenza fatality and malaria prevalence hepatitis. In addition, ARIMA models are extensively used to analyse time series of epidemic diseases for example haemorrhagic and dengue fever, and tuberculosis. ARIMA models used to demonstrate time series dependency structure, their varying trends, seasonal variations and randomness. So it is easy to describe to people and also motivate us to make use of this method in decision making process. In current studies various models were applied to predict COVID- 19 disease incidence and prevalence.

For example, researcher has developed a mathematical function to estimate and analyse the current trend of outbreak corona virus in China. Authors created and evaluated this outbreak to forecast cumulative confirmed cases. Researcher describe the temporal characteristic of this pandemic in countries like China, Italy, and France. Author has compared the two standard frameworks as SIR and SEIR to estimate the COVID-19 in Wuhan city. The national and global transmission of COVID-19 to estimate its impact on the different regions of Wuhan and its nearby area is analyzed by author. Author provide the improved system based on Fuzzy techniques names as ANFIS and applied Swarm Intelligence technique for confirmed cases identification. One more algorithm is created by author for estimation of COVID patient death rate in real time.

So we can say that, various studies are available in the previous work to analyse and estimate the COVID-19 transmission in China. However, United States has become the virus epicenter and affect the US continent more than China. As of September 18, 2020, 85,650 deaths recorded in India. Therefore, it is momentous to predict the COVID-19 situation prevalence pattern, in the top 5 corona infected states in India. The objective of our study is to estimate the COVID-19 prevalence of Indian states: Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, Uttar Pradesh, where the virus is spreading with high rate and causing disastrous results. The time period between 12 March 2020 and 10 September 2020 is considered for analysis purpose and analysed using various ARIMA models. These predictive models will help to predict future need of healthcare systems and additional resources for the patients in various countries.

METHODS

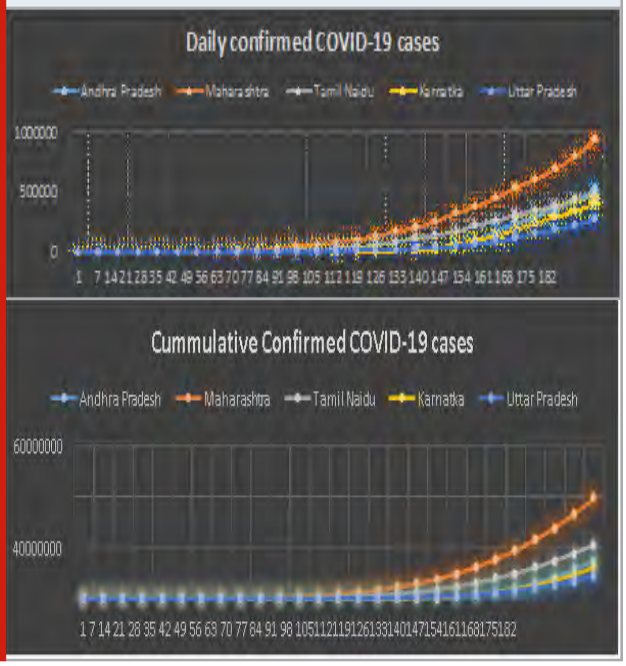
2.1 Data selection: The COVID-19 prevalence data is collected from the WHO website Python programming is used to perform statistical test. Table 1 shows the complete statistical description of the COVID-19 data for top 5 effected states in India between 12 March 2020 to 10 September 2020. This study makes use of a time series having 182 days to estimate COVID-19 prevalence in 5 states as Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, and Uttar Pradesh over the coming 2 months.

Table 1. Statistics summary of COVID-19 in Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, Uttar Pradesh

States	Average:	Standard Deviation:	Skew:	Excess Kurtosis:	Median:	Minimum:	Maximum:	1st Quartile:	3rd Quartile:
Prevalence									
Andhra Pradesh	83835.32	144691	1.72	1.65	5269	1	527512	1137	92484.5
Maharashtra	219885	267357.8	1.19	0.25	94041	11	967349	7848	371083.5
Tamil Naidu	117605.1	147473	1.09	-0.21	36841	1	480524	1853	210230
Karnataka	69414.34	114208.6	1.67	1.58	6041	4	421730	506	93541.5
Uttar Pradesh	50542.32	75478.56	1.64	1.53	11610	11	285041	1899	65365
Incidence									
Andhra Pradesh	793.0109	1302.322	1.67	1.46	78	0	4634	31	1013
Maharashtra	7633.262	8504.851	0.89	-0.55	3438	0	27787	332.5	13522.5
Tamil Naidu	1873.596	2530.583	1.18	-0.05	326	0	8090	23.5	3451.5
Karnataka	1200.667	1918.598	1.54	1.06	69	0	6808	19	1837
Uttar Pradesh	892.7978	1143.933	1.33	0.62	321	0	4112	30	1406.5

From Figure. 1, we can observe that the COVID-19 outbreak confirmed cases in Maharashtra are highest in number than other states. As per the records Maharashtra reported 11 COVID-19 cases on 12 March 2020. In Maharashtra, the count of confirmed cases of COVID-19 is 40238946. The south western located city Mumbai was most affected. The neighboring regions of Mumbai as Navi Mumbai, Pune and Nagpur is also effected by COVID 19 badly. The overall prevalence of COVID-19 in India shown in Fig1. The hardest-hit state in Maharashtra. Tamil Nadu and Andhra Pradesh are the second and third badly affected states in India. Confirmed cases on 12-03-2020 in Andhra Pradesh and Tamil Nadu was 1 which was less as compared to other states. Now both south states are at 2 and 3rd position in Maharashtra and total confirmed cases jumped to 15341864 and 21521742.

Figure 1: COVID-19 prevalence and incidence in Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, Uttar Pradesh.



2.2. ARIMA models: A time series is explained with the timely ordered data points. Temporal analysis objective is to report accurate and important statistics information to estimate time series future data values. This ARIMA model was introduced in 1970s by author Box and Jenkins. The ARIMA time series models is most commonly used as it consider changing pattern, seasonal changes and random time series disturbance. This time series model is applicable in different kinds of data, including pattern, cyclic and seasonality.

Table 2. Parameter estimation of different ARIMA models

State	Best Model	Parameter	Coefficient	STD Error	LLC	P-stat	z-stat
Andhra Pradesh	ARIMA(1,2,0)	AR(1)	-0.1559	0.073	-1423	0.033	-2.128
	ARIMA(0,2,1)	MA(1)	-0.2564	0.098	-1421	0.009	-2.621
	ARIMA (1,2,1)	AR(1)	0.3692	0.134	-1419	0.006	2.762
		MA(1)	-0.6170	0.102		0.000	-6.027
Maharashtara	ARIMA(1,2,0)	AR(1)	-0.2011	0.074	-1535.757	0.007	-2.709
	ARIMA(0,2,1)	MA(1)	-0.5517	0.087	-1529.294	0.000	-6.310
	ARIMA (1,2,1)	AR(1)	0.3177	0.103	-1524.593	0.002	3.099
		MA(1)	-0.7336	0.064		0.000	-11.464
TamilNadu	ARIMA(1,2,0)	AR(1)	0.1634	0.073	-1201.054	0.026	2.231
	ARIMA(0,2,1)	MA(1)	0.1938	0.080	-1200.627	0.015	2.436
	ARIMA (1,2,1)	AR(1)	-0.8273	0.043	-1196.644	0.000	-19.109
		MA(1)	1.0000	0.027		0.000	37.395
Karnataka	ARIMA(1,2,0)	AR(1)	-0.1941	0.074	-1426.851	0.009	-2.623
Uttar Pradesh	ARIMA(1,2,0)	AR(1)	-0.4084	0.068	-1287.220	0.000	-6.048

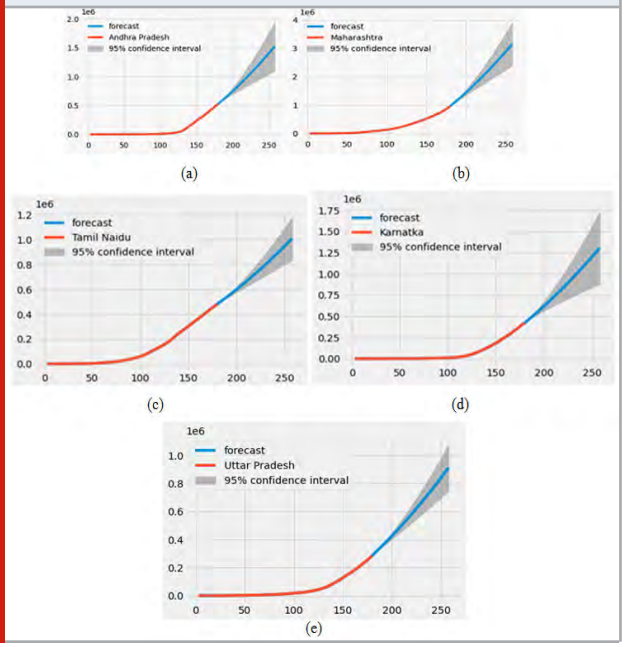
It is versatile and can also be applied to model time series temporal dependency nature. ARIMA model is described as an ARIMA (p,d,q) where p indicates the order of auto regression, d indicates the degree of difference, and q indicates the order of moving average.

RESULTS AND DISCUSSION

3.1. COVID-19 prevalence forecasting by applying ARIMA model: The basic four iterative steps involved in ARIMA model are: model assessment, parameters estimation, symptomatic evaluation, and prediction. The model categorize the time series as stationary and seasonal. Stationary nature shows constant behavior over time i.e. mean, variance, and autocorrelation which helps to retrieve accurate results. The seasonality and stationarity of a time series can be observed with Time series plot, Autocorrelation Function (ACF), and Partial Autocorrelation Function (PACF) graphs. Beside the best ARIMA models, other models were also constructed, and compared to observe their performances. In order to pick ARIMA models as the best models, statistically relevant parameters were chosen and the ARIMA (1, 2,0) models is selected which fitted the COVID-19 data fairly well (Table 2). The associated p-values of used parameters

are less than 0.05, which indicates the significance of selected model. The fitted and predicted values are presented in Fig. 3.

Figure 3: Time-series plots for the best ARIMA models



DISCUSSION

In order to prevent and monitor the spread of epidemics, successful strategies are required. The COVID-19 time series trend must be calculated for the allocation of medical services, to improve production and also to start and increase the import/export activity among countries. Hence an effective forecasting model needs to be established that can benefit governments in decision making during emergency situation and facilitate the required medical resources.

Because of its simplicity and systematic structure, and reasonable forecasting efficiency, ARIMA model is one of the most widely used time series forecasting models. The work performed in this paper discussed about the recent COVID-19 situation in 5 Indian states as Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, Uttar Pradesh. The ability of our Indian health system to appropriately and immediately satisfy the infected patient's basic health requirements is of great concern. Especially in Maharashtra, the infected patients trend increases exponentially since 12 March and no decreasing trend of new cases is observed and the plateau seems to take more days to hit. This trend would result in intensive care units being at their highest capacities. Otherwise, psychological and social issues would be unmanageable and result as disaster.

CONCLUSION

It is necessary for health departments to forecast Disease incidence with a view to developing monitoring programmers Resources and reallocate them. Disease prediction using ARIMA models play an important role. In this analysis, models of the ARIMA time series were applied to the overall COVID-19 prevalence of five Indian states affected by COVID- 19: Maharashtra, Tami Nadu, Andhra Pradesh, Karnataka, and Uttar Pradesh in India. The results of this work will help politicians and health care policies to offer good plan and resources to cope with the crisis over the world in the coming days and weeks, including nurses, beds and intensive care facilities. The data should be modified in real time to allow for more accurate comparison and future perspectives.

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Joint Beamforming and Nullforming with PSO in Distributed MIMO :An Optimization Approach

Jagdish D. Kene[1], Mridula S. Korde[2], Deepali M. Kotambkar[3] and Ajinkya P. Nilawar[4]

[1]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, State, India*

[2]*Associate Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra State, India*

[3]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra State, India*

[4]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra State, India*

ABSTRACT

Distributed Multiple Input Multiple Output (DMIMO) systems pose significant challenges in implementation. The ones posed by distributed nullforming particularly call for special consideration. Our research interest is to treat the problem of multicasting a common message signal from a distributed array of wireless transceivers by beamforming to a set of beam targets, while simultaneously protecting a set of null targets by nullforming to them. In this work, it can be done by formulating the Joint beamforming and nullforming (JBNF) problem into an optimization problem. We introduce an adaptive algorithm in which each transmitter utilizes its own channel gains and the information gathered from a relay node that perfectly knows the channel responses between all the terminals. According to this, the transmitters and receivers, are designed for attempting to minimize the total transmit power subject to scalability constraints. Since this optimization problem is not convex, the use of the Particle swarm optimization (PSO) technique is proposed to find the optimum solution. The proposed method does not increase the network overheads with the number of transmitters which yields the proposed system design more efficient.

KEY WORDS: BEAMFORMING, NULLFORMING, MIMO, PSO, SINR.

INTRODUCTION

With the speedy development of communication technologies, wireless networks have emerged as a vital part of the modern society (Hameed and Khawar). This increases the demand for high voice, data speeds and reduces the network charges, however the increase in system interference caused as a result of the inadequate broadcast spectrum which degrades the signal quality and brings the essentiality to familiarize aubiquitous technology namely Beamforming (H. Dai et. al.). Beamforming can be utilized both within the transmitting and the receiving end to attain the spatial selectivity (D. Palomar et.al.). It adjusts the antenna weights to mitigate fading channel or interference effects, to enhance the characteristic of the signal (H. Bejar et. al.). The beamforming is attained by maximizing the output power of the array within the path of the desired signal and minimizing the output authorization of the antenna array within the track of the interfering signal. The interfering signal is minimized by the course of inserting nulls within the explicit track called null forming (R. Farrokh et. al.).

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**Corresponding Author: kenejd@rknec.edu*

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Joint beam forming and null forming (JBNF) are spatial filtering techniques wherein a group of dispersed transmitters in a wireless network graciously transmits the nonentity message signal to the other nodes within the network (A. Kumar). JBNF furthermore has the characteristic of better scalability, excessive energy efficiency, asymptotic scalability, noise without drift, etc. (M. Rahman et. al.) (R. Bitmead). A MIMO (Multiple Input Multiple Output) channel is a component of spectral efficient technology can be constructed as a matrix with Independent and Identically Distributed (IID) hang-up Gaussian entries, which will furnish multiple spatial dimensions for single communications (S. Zhang et.at.). Distributed MIMO (D-MIMO) will also be in a position to represent the generalization of Distributed Antenna Systems (DAS) (H. Zhang et. al.) The dispersed MIMO is not only handy for wireless sensor networks in the wireless channel but also used for networks of solitary antenna nodes (S. Jafar et al.). D-MIMO system integrates the precedence of point-to-point MIMO and DAS, and has the capability to utilize mutually the spatial micro and macro diversities (D. Wang). Recently D-MIMO can be deed as a remedy for the indiscriminate paradigm for multiple antenna communications (H. Dai et.al.).

There are many algorithms adapted to find the join beam forming and null forming problem analogous to the method proposed in (H. Chen et.al.) which can introduce the incorporation of antenna array beamforming with multi user detection which is used to toughen the detection efficiency for wireless communications under multipath interference. The method proposed in (W. Wei et. al.) provides an algorithm for null forming. This algorithm can effectively improve the performance of antenna pattern through a crafty transformation of array directing vectors and signal correlation matrix respectively. In an adaptive beamforming algorithm is proposed with the aid of utilizing the Minimum Mean Square Error (MMSE), power minimization and maximum Signal to Interference plus Noise Ratio (SINR) (N. Noordin et. al.).

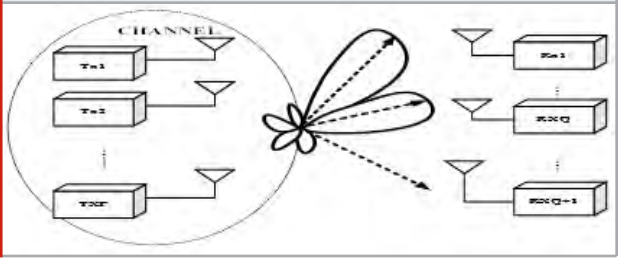
The scheme projected in (Y. Eldar et.al.) is employed to discuss the snag of beamforming for signal estimation which is used to analyze the signal amplitude and resulted as the estimated consequential signal which is far from the true signal. The null forming algorithm with auditory sub bands have introduced in (H. Zhang et. al.) is intended with an infinite duration impulse response (IIR) filter to correlate the disparity of the microphone pair. The scalable algorithm designed in (A. Kumar et. al.) typically aim at minimizing the mean square error (MSE) but not on maximizing the signal to Interference plus noise ratio (SINR). It is important to design an efficient algorithm which overcomes the problem of multicasting with high SINR and reduced MSE and it is challenging in distributed MIMO systems. On these considerations we set the following as goals in this research work:

- To consider the JBNF problem in distributed MIMO with the objective of maximizing SINR and minimizing the MSE between the achieved and desired modulating amplitudes at the receivers.
- To introduce an adaptive algorithm in which each transmitter utilizes its own channel gains and the information gathered from a relay node that knows perfectly all the channel responses between all the terminals.
- To use Particle swarm optimization (PSO) techniques to minimize the total transmit power subject to scalability constraints.
- The remainder of this research paper is outlined as follows: Section 2 presents an overview of deep knowledge of the proposed work. The simulation results of the proposed work is presented in section 3 followed by the conclusion of the proposed work in section 4.

2. Optimal Joint Beamforming and Nullforming in Distributed MIMO: In this section we have presented the JBNF problem statement with the system model and the optimal solution suggested for the same.

a. System Model & Assumptions: Let we consider the problem of distributed joint beamforming and nullforming as shown in figure 1. The system with P number of transmitters and Q number of receivers with 1, 2,....Q_1 beam targets and Q_1 + 1.....Q null targets are considered in this research work. Let we consider xij is the complex gain from the ith transmitter to the jth receiver and xj be the jth column of X, corresponding to the channel vector to receiver j then the P x Q channel matrix can be defined as $X = [x_1\ x_2\ .....xQ]$. Each single antenna in the transmitter side has to broadcast a common message signal M_s targeting each single antenna in the receiver side and forming nulls at another set of receivers in parallel.

Figure 1: JBNF Problem



The transmitters form a virtual antenna array and choose phases and amplitudes to shape the array's pattern such that beams and nulls are created at desired locations. By simultaneously transmitting beams and nulls, coherent combining gains can be achieved toward intended receivers while protecting unintended receivers.

b. Problem Statement: Designing a novel algorithm that overcomes the problem of multicasting with high SINR and reduced MSE is challenging in distributed MIMO systems. Conventional scalable algorithms typically aim at minimizing the mean square error (MSE) but not on maximizing the signal to interference noise ratio (SINR). It can be done by formulating the JBNF problem into an

optimization problem. So that the primary objective of this work is set to:

$$\{A(t)\} = \max[SINR(w)] + \max\left[\frac{1}{MSE\{A(t)\}}\right] \quad (1)$$

Where amplitude of the input signal is $A(t)$. In addition to that in this work we aim to adapt $\delta[k]$ in a distributed fashion so that $\delta^{X}[k]x_j$ are driven towards nonzero values σ_j for beam targets $1 \le j \le P_1$ and towards zero for null targets $P_1+1 \le j \le P$ Set $\sigma_j = 0, \forall j\{P_1+1,...,P\}$ and $\sigma = [\sigma_1,...,\sigma_P]^T$ So that the quadratic cost function can be defined as:

$$C_w = \|\psi[k] - \sigma\|^2 = \|X^X \delta[k] - \sigma\|^2 \quad (2)$$

In order to reduce the quadratic cost function , the JBNF problem can be rewritten by accommodating noise as follows:

$$C_w(\delta) = E_w\left[\|\psi - \sigma\right.$$
$$= E_w\left[\|X^X \delta\right. \quad (3)$$

Minimum value of Eqn. (3) is equivalent to

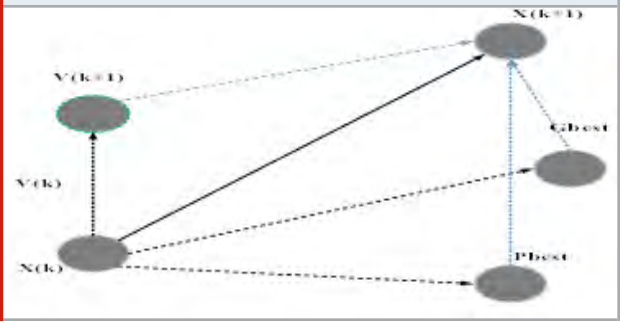
$$\min C_w = |X^X \delta - \sigma|^2 \quad (4)$$

The JBNF problem was made more convex by Particle Swarm Optimization (PSO) algorithm, which is inspired by bird group behavior (Zhang et. al.). The PSO algorithm is easy to implement and more efficient. It has been widely used in multi objective optimization, pattern recognition, signal processing and other fields. It has faster computing speed and good global search capability. Owing to this, it is particularly suitable for large scale mathematical optimization problems. This algorithm also has adaptive capability and it is useful for solving optimization problems in dynamic environments. In the PSO algorithm, each particle is viewed as a no weight and volumetric dot in d dimensional search space, and flies at a certain speed. Assumption that one group has N particles, Xi is particle of i's current position, Vi is particle of i's current flight speed, Pbesti is particle of i's best experienced position, Gbestn is group's best location. Each particle's flight speed and direction are determined by its position and velocity. From these parameters, an optimized fitness function determines solution's merits. The standard PSO algorithm can be described as:

$$V_i(k+1) = \varpi V_i(k) + c_1 rand_1(.) \times (Pbest_i - X_i(k)) + c_2 rand_2(.) \times (Gbest_k - X_i(k)) \quad (5)$$

$$X_i(k+1) = X_i(k) + V_i(k+1), i = 1,2,.... N \quad (6)$$

Figure 2: PSO Optimization



Where $rand_1(.)$ and $rand_2(.)$ are the random numbers ranging from 0 to 1, c_1 and are the weighting factors, is the inertia weight ϖ . At the point, all particles that fly over the D-dimensional solution space are liable to modernized rules for new positions, awaiting the global optimal position is established. Figure 2 demonstrates an exploration method of PSO using the velocity and location appraise rules given in (4) and (5). The inertia weight can be calculated as:

$$\varpi = \varpi_{max} - \frac{\varpi_{max} - \varpi_{min}}{I_{max}} \times I \quad (7)$$

Where ϖ_{max}, ϖ_{min} is the lower and upper inertia weights I_{max}, is the highest number of iteration, is the present iteration *I*. With all the above constraints the overall objective function for PSO is defined as:

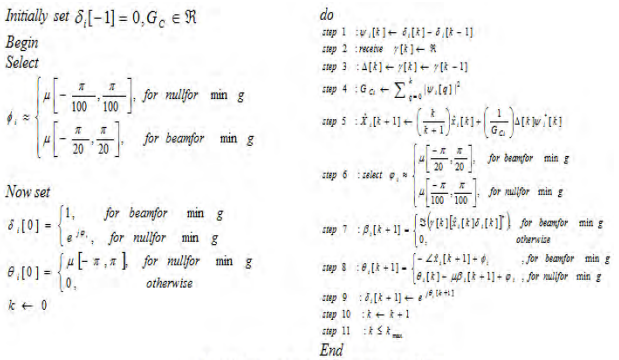
With all the above constraints the overall objective function for PSO is defined as:

$$OF(PSO) = \min[C_w] + \max\left[\frac{SINR(w)}{MSE\{A(t)\}}\right] \quad (8)$$

In this paper, authors concentrate on achieving both beam targets and null targets which differentiates our work from most of the conventional approaches.

c. Adaptive Algorithm for JBNF: To achieve the desired goal to adopt $\delta[k]$ in a distributed fashion while in JBNF we introduce an adaptive algorithm in which each transmitter utilizes its own channel gains G_c and the information gathered from a relay node that perfectly knows the channel responses between all the terminals. The algorithmic steps of the proposed adaptive algorithm to solve the JBNF problem are explained in algorithm1. The proposed adaptive algorithm adapts $\delta[k]$ at slot k+1, only by the knowledge gathered from the relay

node and by its own channel gain. In specific to adopt $\delta[k]$, transmitter i does not need the channel gains of other transmitters which improves the performance of the proposed algorithm, thus reduces the computational complexity.



Algorithm1: Adaptive Algorithm for JBNF

3. Simulation Results: In this section, we have presented the simulation results of the proposed work which is implemented and validated using MATLAB. We consider a JBNF system with 40 transmitters and 5 receivers of which 2 are beam targets and the remaining 3 receivers are null targets. All channel gains are modeled in the range of (0,1), and the noise level is taken to be−40 dB at each receiver. We encode the real and imaginary parts of source signal into double precision floating point numbers with each requiring 64 bits for a total feedback of 128 bits per iteration.

The beam formed during the transmission converges at an optimum level which is shown in figure 3. From figure 3, it is observed that the optimum beam formed in the range of -90o to +90o. With the objective of minimizing MSE, the optimum beam formed during data transmission in MIMO converges at a minimum level. Figure 4 shows the performance comparison of the proposed work in terms of received signal power obtained for all the five receivers present in reception side. The similar simulation environment and setup is used to perform this comparison. Figure 4(a) shows the variation of received signal power with Nt= 2, Nt= 3 and Nt= 4 respectively. We observe that for 6 bits, the curves overlap for receiver 3, receiver 4 and receiver 5 furthermore leads to an error floor. Figure 4(b) shows the variation of received signal power with delay=1e-3, 2e-3 and 3e-3 respectively. Comparing the results of the five receivers, we see that the introduction of an interference with receivers 3, 4 and 5 operating with 6 bits results in a similar MSE values as that of a receiver without optimization. Considering that the above setup reduces the interfere contributions, these results suggest that the proposed system with optimization can perform close to theoretical MIMO while consuming a fraction of the power compared to other existing works presented without optimization.

Figure 3: Optimum Beam Forming

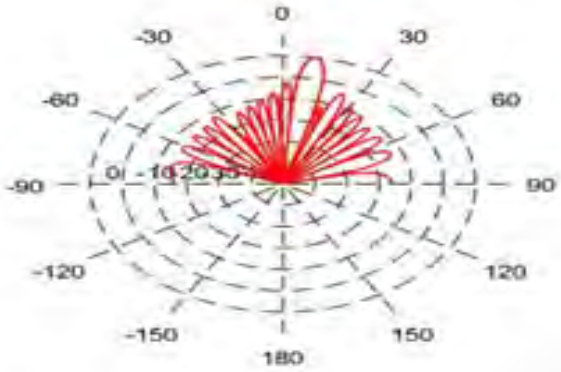
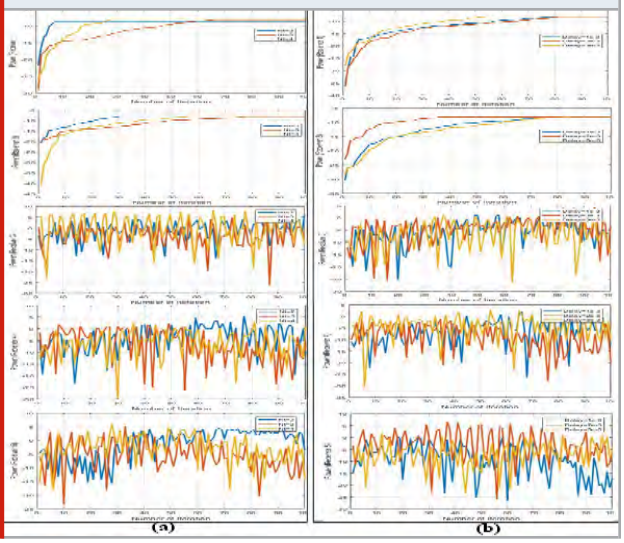


Figure 4: Performance Comparison (a) Received signal power with Nt = 2, 3 and 4 respectively (b) Received signal power with varying delay



CONCLUSION

A novel distributed joint beamforming and nullforming based on PSO algorithm was proposed in this paper. Our algorithm achieves simultaneous beams and nulls in a quadratic framework guaranteeing rapid convergence. The proposed work aims at maximizing the SINR with minimizing MSE. It scales to large transmit arrays, as it only requires aggregate broadcast feedback from the receivers and the convergence rate improves with the number of transmitters. The optimum beamformed by PSO ensures the fulfilment of the objective of this work. The simulation results enclosed in this paper also proves the significance of the proposed work.

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Replication Data Concepts For Distributed Database Systems

Dr. Rashmi Welekar[1]
[1]Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India.

ABSTRACT

Replication structures are research areas of all distributed databases. We provide an overview in this paper for comparing the replication strategies for such database systems. The problems considered are data consistency and scalability. These problems preserve continuity with all its replicas spread across multiple nodes between the actual real time event in the external world and the images. A framework for a replicated real time database is discussed and all time constraints are preserved. To broaden the concept of modeling a large database, a general outline is presented which aims to improve the consistency of the data.

KEY WORDS: DATABASE REPLICATION, DESIGN OF REPLICATED DATABASE , REPLICATION PROTOCOLS, TYPES OF REPLICATION.

INTRODUCTION

To improve the reliability of data, tolerance of faults or accessibility of data among hardware or software parts and to share data replication can be used. Data reproduction can occur when the same data is stored on several storage devices. The method of replication copies directory data from a server directory to another directory. Server can copy a directory tree or subtree using replication (stored in its own database). The master copy is with the directory server which copies all updates of all replica automatically. When the same computational function is performed several times. A computer job is usually reproduced inside space, i.e. done on different computers, or reproduced on one device repeatedly. The access to an entity repeated is generally compatible with one entity access. The replication should be obvious to an outsidel user. Furthermore, a duplicate failure is covered as far as possible in a failure scenario. Many database replication techniques are discussed. At least three different methods of replicating the database can be done.

A database is generated by combining the contents of more than one database in merging replication. The methodology to replicate is to distribute data from publisher to subscriber . The publisher and subscriber can make the changes in any state. The changes later can be merged within sites. Combine replication allows multiple sites to operate independently and then combine updates to one consistent outcome. This method involves default and custom dispute resolution options .These options can be specified by setting a merge publication. When a issue arise, the merge agent uses a resolution to decide the data which can be incorporated and disseminated. Another copy of data are kept on one more server or other database on the same computer on one database server in snapshot replication. This approach works by transferring data periodically in large amount. This is typically implemented where the subscription services are read-only and where the system can operate without modified data for some time.

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Latency is referred to as the working without updated data. Replication of the snapshot occurs works while going through the recorded database. The files are created in the distributor work folder. Original copies of a database are obtained and then regular updates are obtained as the data changes in transactional replication. Each committed process is repeated as it occurs to the subscriber during transaction replication. You can monitor the replication mechanism so that transactions can be stored and sent in time or all changes will be transmitted as they happen. For environments with lower latency and higher bandwidth connections you use this method of replication.

This approach needs a stable connectivity, in case if the server cannot be connected for replication and is not maintained the transaction log would grow rapidly. Transactional replication starts by making the initial copy transactional replication. This copy is then modified by the transactions copied later. You will determine how much the snapshot should be updated or not updated after the first copy. When copied, the original snapshot can read the existing data base transaction log and newly generated transaction can be saved in a DDMBS.

Fundamentals in Database Replication: "Replication" which represents an information sharing process to make sure that the technique behind Database to improve fault tolerance, reliability and accessibility replication between all components is done in an seamless way. Data replication may be possible if the same data is stored on various storage or replication devices when the same computing process is performed many times. Various servers can be used to keep instances of data items and a variety of locations in distributed database systems. DRTDBS has an significant capacity to replicate data which can result in greater availability and higher throughput. Data replication, however, presents problems of its own. Access to a dataset is no longer solely managed by a single computer, but is instead distributed on the servers, any time the copy of the data is stored. The reciprocal integrity of shared data must be ensured; the ACID properties of the database must be fulfilled. To share data between various machines data replication facility can be used.

Distributed system can be interpreted as a Server implemented collection of services invoked by client processes. The service definition specifies the number of calls made by customers. All processes in servers have an invocation modified local state. To alter the condition of server atomically invocations are considered, i.e. the state changes resulting from an invocation are not partially applied. It is the server that is responsible for isolating contending invocations, and normally uses a local synchronization mechanism. If a replica executes an application and if a newer state is generated, it is a multi-primary system (also called Multi-master). Even if the Data Replication process is used to generate copies of the same or partial data, it should not be confused with the backup methods as replicas will always be changed and miss previous states. While backup saves a long time unchanged copy of the data.

Active and Passive replication is commonly used in distributed databases. For active replication strategy every server processes the requests from clients which can also be named as state machine replication. All the processes in this case need to be deterministic i.e. if request queue and first state is given then the output sequence will be same produced by all servers and they end up in same last state. But this requirement is very hard to be implemented in real world. In passive replication scenario only primary server will process the client request. Once it is done then changes the contents of backup server. After that is sends response to client. If this primary server fails then backup server can become primary but in this process response to client will be delayed. Its simplicity (e.g. the same code everywhere) and consistency failure are the key benefit of allowed replication. The customer is completely secret as the requests are still handled like the other replicas when the replicas fail. The biggest downside to this strategy is the weakness to determinism.

Replication technologies in distributed systems coordinate and analyze the variety of methods and structures to replicate entities in disruptive computing environments that achieve high availability. Such entities range from passive untyped data objects, simple and hard artifacts, to various communication types and processes. Distributed Systems Replication Techniques includes concepts and introductory materials that are useful for beginners, basic concepts and methodologies, business and practical set up, bibliography, a recommendation short guide.

System for Replicated Database and its Design Aspects: Database replication is a method to build and keep multiple copies of same database and to adjust the sharing of data or database design of different locations among databases and there is no need to copy the whole instance. For the most database replication sc, one database scenarios one server holds the database primary copy and another database server holds slave copying. A single database is shared with two or more copies. The original database is called a Template Master and a replica is called a copy of the database. The distributed real-time database determines temporally the relationship between its objects and the external world. Here a distributed, replicated data bases system in real time is being studied which consists of a group of central, high-speed network replicated memory databases. The types of a distributed database server framework are:

1. The servers in the database which store replicated data copies
2. The log transfer management that accurately records and send the transaction logs to the replication server. This can be sent from a primary database.
3. Replication servers that recognize and submit to the database containing replicated data records of the log transmission managers.
4. The storage servers that store the information from

the replication servers of the device catalog.

Problems in Distributed Replicated Database Systems (DRDBS): Various problems concerning the production of DRDBS to keep its need; the key issues discussed in this paper are data coherence and scalability. Some of the key issues are also discussed. Both such systems need to collect and update information in good time, but often when required data is not accessible from a particular location; so it may take too long to retrieve it from a remote site before data is invalid, which may lead to a large number of transactions meeting the deadline for transaction so breach of the required time limit. Within a centralized network there are two main approaches: negative and positive. The conclusion can be made that the negative approaches promote sudden coherence, but the positive method guarantee only a potential coherence.

The next two articles evaluate these definitions.
1) Immediate consistency: These methods ensure that all instances of database objects used by a transaction are compatible when a transaction is carried out, i.e. consistency. Many other methods are available, the most commonly used method is 2 Phase commit protocol.

2) Eventual consistency: The definition of ultimate consistency is based on positive consistency preservation techniques. The aim is to adjust immediate continuity for greater predictability, availability and efficiency on any transaction commitment. This ensures that an operation will save changes to a local replica of an object in a logical database without moving the changes to stations with extra replicas. While relational database systems adapt well to ACID-compatible applications, they are not suitable for applications experiencing rapid user surges. Of example, whether the customer is aware of an offer successfully or not, an RDBMS can suffice in the trading application. This is a fundamental necessity. In any case, the entire transaction is dropped because of a failure of a database instance.

While thinking about design, set scale of replication. Decide if a list, subset of a list, or more than one table data should be repeated. This is a balance between the quantity of data, the total table size and the nature of the relation that changes. Use the right amount of information to relay. If the update time and current time is more than write set in a transaction then it will be hard for the transaction tom reach commit state before the deadline. Such transaction can be stopped and we can save time.

CONCLUSION

Replication data concepts are discussed in this paper. A standardized scheme has been developed to model replicated distributed database systems for distributed systems. Restrictions are imposed on both data and transactions. For modeling comprehensive database systems, the open framework has been absolutely important. The obstacles for new researchers are the design problems posed in this paper. The issues are studied and protocols are built to enhance the efficiency of replicated database for distributed real-time databases.

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Smart System for Boiler Automation

Rashmi Welekar[1]*, Sonal Rajurkar[2] and Urvashi Kodwani[3]
1Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India,
[2]Vellore Institute of Technology, India,
[3]Barclays Global services Companey Private Ltd.,India.

ABSTRACT

To monitor the health of boiler, various parameters like temperature, pressure, water level indication and water hardness testing are important. By measuring these parameters and comparing it with a reference value one can signify whether the boiler is working properly or not. Because of improper supply of coal and irregular cleaning of boiler the temperature increases and explosion takes place. This research mainly focusses in monitoring the condition of boiler by automating temperature values and generating proper warning and alarm system for the same.

KEY WORDS: INTERNET OF THINGS, BOILER AUTOMATION SYSTEM, TEMPERATURE MONITORING IN BOILER, SENSORS.

INTRODUCTION

A boiler is an enclosed vessel that is used for combustion purpose and helps in transferring of heat to water till it gets converted to hot steam or water. This steam is then used by the industry for further processes. The problem arises when the temperature and pressure of these boilers exceeds beyond threshold value and they explode. Hence it becomes important to keep a track of temperature and pressure so that boiler explosions are avoided and human lives and damage cost to the industries are reduced. The temperature increases because the amount of coal or burning substance provided is not in proper amount and hence it eventually increases temperature in boiler. Pressure increases if the amount of water in boiler is not present in appropriate quantity and it becomes necessary to keep a track of water level. If some parts of the boiler are corroded, then they are not able to withstand the pressure and hence explode. Also, variation in pressure is caused by steam leakage. The pressure level decreases due to steam leakage and hence it becomes necessary to monitor these things.

In literature we studied the root cause of different boiler explosion and also the methods to prevent it. The original burners in the boiler were recently exchanged with low NOx burners and the new burner system was to be proposed. In this journal we got the knowledge about how to improve efficiency of boilers and what are its parameters. As per the recent trends, more priority is given to the energy conversation policies over energy supply policies. The efficient management of process system will result in energy savings, improved process efficiency, lesser maintenance and operating cost, and greater environmental safety. The focus of the present work is to study the effect of system modification for improving energy efficiency. When it comes to performance measurement in any power plant industry, computing boiler efficiency is considered as one of the most important criteria. There are research papers in literature which shows analysis of boiler losses and methods to improve its heat rate accordingly.

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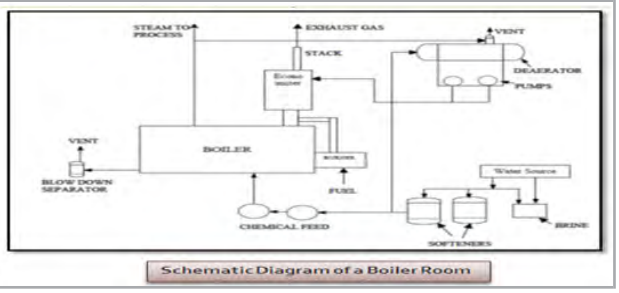
This journal tells us about the description of steam boiler and its related features. The produced steam is supplied to the industrial process work at low pressure in cotton mills. Study of literature helped us to get information of variation of boiler efficiency by increasing excess of air. The main goal of that research study is to highlight the areas with maximum energy losses in any thermal power stations and overcome the issue with flexible solution with the help of energy and energy analysis as the tools. The book helped us to get more knowledge about modern boiler types and its applications in real world scenario. Boilers are generally classified based on their combustion method, applications or on their type of steam/water circulation. This chapter will present mainly water tube boiler types, categorized by their combustion process and application.

This book helped to learn how to conserve energy and use it in economical manner. The aim is to reduce the energy losses in the boiler and to increase its efficiency. The brief introduction of general energy conservation techniques in boilers is presented here. Work in literature also provides information about analysis and performance of high pressure boilers along with its accessories. The main objective of some of the project work is to analyze the efficiency of economizer, super heater & air pre heater by varying the various parameters in boiler section.

METHODOLOGY

Gas and oil-fired boilers both use controlled fuel combustion to heat water. The primary boiler components involved in this process are the burner, heat exchanger, combustion chamber, and controls. The burner combines the fuel and oxygen together and provides a site for combustion using the ignition system. This process occurs in the combustion chamber and the produced heat is transferred through the heat exchanger to water. The switches control the firing rate of the ignition burner, fuel supply, air supply, exhaust draft, water temperature, vapor pressure and boiler pressure.

Figure 1: Schematic Diagram of Boiler Room



The produced hot water by a boiler is pumped through pipes located at different places in the building and is delivered to the equipment that includes hot water coils in air handling units, service hot water heating equipment and terminal units. The steam generated from the Steam boilers flows from high pressure areas to that of low pressure areas with the help of pumps available. Now this steam can be used directly by the equipment's for the further process.

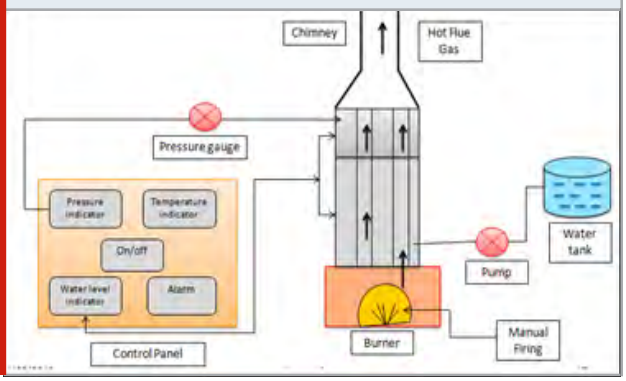
The boiler system comprises of: a feed water system, steam system and fuel system. The resultant of conversion of water to steam in boiler is termed as feed water. It maintains the water level in the boiler and takes required actions to meet the steam demand. Various valves are located around the boiler which provide access for maintenance and repair. For safety reasons, the system is fully equipped with safety valves and gauges. Throughout the system, steam pressure is maintained using valves and steam pressure gauges. Other than boiler system there is presence of fuel system which regulates the generation of heat. This system includes all equipment used to provide fuel to generate the necessary heat. The requirement of the equipment in the fuel system is totally dependent on the type of fuel used in the system.

The two sources of feed water are:

1. Condensate or condensed steam returned from the processes and
2. Makeup water (treated raw water) is exported from outside the boiler. For higher boiler efficiencies, one of the most important part named as economizer preheats the feed water using the waste heat in the flue gas.

Keeping in mind the problems faced by the manufacturing industries like boiler explosion, steam leakage, we proposed a solution that will help in monitoring the system and hence reducing the factory along with human damages. The following figure represents the proposed model. The model comprises of the control panel, boiler, pump, Temperature gauge, Pressure gauge and LCD display. The experimental setup is explained as follows:

Figure 2: Proposed model



- **Control Panel:** The control panel consists of pressure and temperature indicator which will indicate the pressure and temperature of boiler. It consists of on/off switch which automatically turns on/off according to water level. Then it has boiler on/off switch through which boiler is operated. It consists of two alarm which will warn if temperature and pressure exceeds a threshold value.
- **Boiler:** The boiler consists of three parts namely male

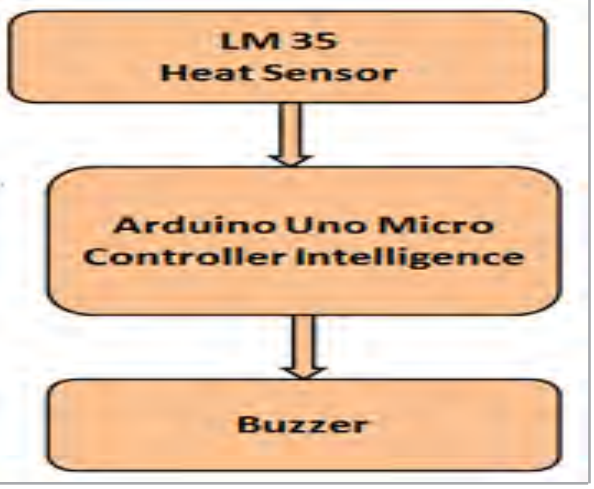
part, female part and economizer. Coal Pieces are inserted inside female part. There are several holes for regulation of air and fire. Water is inserted through valve provided in the male part which surrounds the air tubes. It consists of tubes which regulate steam. Economizer is used in steam power plants to capture the waste heat from boiler stack gases (flue gas) and release those gases via chimney.

- **Pump:** The pump will regulate water from water tank according to the quantity of water present in the boiler. If water level is below required value, then pump gets on and water is provided to the boiler.
- **Gauge:** The temperature and pressure gauge will be required to continuously monitor temperature and pressure of the boiler
- **LCD Display:** LCD display will be provided to show temperature and pressure in the boiler.

RESULTS AND DISCUSSION

Arduino is used as a main unit, LM35 is used as a monitoring unit and buzzer is used as a warning unit. Measuring the temperature by using two LM35 and comparing the temperature of both lm35 and display and buzzer is used for warning. The particular range is set by using potentiometer i.e. maximum temperature can be set, if the temperature exceeds than that the buzzer will turned ON else it is OFF. It measures from -10 degree Celsius to +85 degree Celsius for accurate result. The LM35 sensor is used because of its low cost, easy availability, effective working range, accuracy. These two sensors will collect data from their respective surroundings and this data is given to Arduino for processing. Arduino uno is the micro controller used for adding intelligence to the circuit. Arduino UNO is selected because it is cheap, open source programmable micro controller. The two temperatures are then compared and if the surrounding temperature between 30 to 45 degrees then the maximum permutable range of heat given out by compressor should be in the range of 55 to 70 degrees depending on the temperature the indoor unit is set.

Figure 3: Block Diagram



The LM35 is an analog sensor for temperature. This implies that an analog signal is the output of LM35. Analog signals are not explicitly recognized by microcontrollers as their data. Before we can feed it to a microcontroller 's input, we need to convert this analog output signal to digital. We can use an ADC (Analog to Digital Converter) for this reason. We need to use an external ADC to convert the analog output from LM35 to digital if we are using a simple microcontroller like 8051. Then we feed the ADC (converted digital value) output to the 8051 input. But modern day boards like Arduino come with inbuilt ADC. Our Arduino Uno has a 10-bit ADC (6 channel) built-in within it. We can use the built-in Arduino ADC to convert the LM35 analog output to digital output. Since Arduino Uno has a 6 channel inbuilt ADC, there are 6 analog input pins numbered from A0 to A5. Connect analog out of LM35 to any of these analog input pins of Arduino. The temperature monitoring system is thus made and tested successfully. It showed the proper temperature variation and warned the user if temperature was about to hit the threshold and when it hits the threshold. Thus it worked successfully.

CONCLUSION

In boiler monitoring system we have designed a unit to monitor the temperature of boiler. As the temperature or heat is a main parameter which makes any boiler explode hence we have kept track of temperature. As found in research papers there are some standard values of temperature. If the temperature exceeds more than the given threshold value, then boiler tends to explode. One more unit is there in system by which we can set the warning temperature value for boiler output. If temperature exceeds more than a set value it will warn the user of a system by blowing buzzer. This system helps the user to detect a problem so that the boiler is switched off at appropriate time.

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Causality Between Determinants of Gdp & Forecasting Using Econometric Modelling – Vecm Approach

Vikram K. Joshi
[1]*Assistant Professor – DMT, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

The study examines the causality of GDP, exchange rate, inflation and index of industrial production in India over the period 2012:Q1 to 2019:Q4. The causality is examined using the Vector Error Correction Model (VECM). An open source software Gretl is used for analysis of data. The study confirms the existence of unidirectional causality from exchange rate, inflation and industrial production to GDP in the long run. There exists a bidirectional causality between gross domestic product and industrial production, and unidirectional causality between GDP and exchange rate and GDP and inflation in the short run.

KEY WORDS: GROSS DOMESTIC PRODUCT, INDEX OF INDUSTRIAL PRODUCTION, EXCHANGE RATE, CONSUMER PRICE INDEX, VECM.

INTRODUCTION

A high degree of industrialization or increase in the share of manufacturing in GDP is a key feature of modern economic growth. (Kuznets, 1973). In many studies, Index of Industrial Production (IIP) is widely used as a proxy for estimating the current state of GDP as IIP is measured on monthly basis and GDP is measured on quarterly basis in many countries (Sédillot and Pain, 2003). But in most economies, th
e share of services has increased significantly in GDP in recent years and hence raised the question whether the relationship between IIP and GDP is still significant (Fulop and Gyorgy, 2012) or there exists a channel of causation between them and some other variables. Gokmenoglu et al (2015), observed a long-run relationship between industrial production, GDP, inflation and Oil price in Turkey. Joshi V. K. (2016) studied the impact of exchange rate, money supply and inflation on index of industrial production in India and found that there exists a bidirectional causality between inflation (WPI) and index of industrial production in the long run and unidirectional causality between index of industrial production and exchange rate and inflation (WPI) and exchange rate.

Razzaque et al (2017) made the empirical assessment of relationship between exchange rate and economic growth and found that depreciation in real exchange rate in Bangladesh led to rise in aggregate output. They asserted that rising inflationary pressure must also be given due consideration. Habib et al (2016) also investigated the relationship between the real exchange rate and economic growth for a panel of 150 countries using five-year average data in the post Bretton Woods period and found the significant relationship between the two in developing countries only. Thus, in the present study attempt is made to study the short run and long run causality between GDP and IIP, ExRate and CPI (inflation) in India and evaluate how IIP, ExRate and CPI impacts the GDP in India and formulate the model of estimation

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for forecasting GDP with precision. The rest of the paper is organized as below: Section 2 discusses materials and methods, Section 3 deals with results and discussion and section 4 concludes.

MATERIAL AND METHODS

The present study intends to study the causality between GDP and IIP, ExRate and CPI (inflation) and evaluate whether IIP, ExRate and CPI impacts the GDP in India. The initial model assumption made to begin with the study is given as:

$$l\_GDP = \alpha_0 + \alpha_1\, l\_IIPt + \alpha_2\, l\_ExRatet + \alpha_3\, l\_CPIt + \varepsilon_t \quad \{1\}$$

Where, GDP is the gross domestic product (NAS:2011-12), IIP is the index of industrial production (base 2011-12), ExRate is the real exchange rate, and CPI is used as proxy for inflation consumer price index (base 2012) taken from Database on Indian Economy, RBI, India. All the variables are expressed in logarithm as they are growth variables and their corresponding coefficients are the elasticity coefficients associated with them. For the present study, quarterly data from April 2012:Q1 to March 2019:Q4, i.e., 34 quarters is used as the base years were almost the same during this period. The variables, GDP, IIP, ExRate and CPI are selected due to high correlation coefficient between them. Through various literatures the other variables affecting GDP were also identified which includes FDI, FII, money supply, exports, imports, etc. But these variables are highly correlated with some or the other variables which are incorporated in the present study and hence not included in the present study.

To test the stationarity of each series, the Augmented Dickey-Fuller (1979) unit root test is employed. The existence of non-stationarity in levels and stationarity in differences implies the chance of co-integration between the variables and possibility of the long-run relationship between the variables. To investigate the causality between the variables, Johansen's (1988) cointegration approach comprising of two likelihood ratio tests (λ_{trace} and λ_{max}) and Vector Error Correction Model (VECM) (Johansen, 1988) is used which is given as under:

$$D\,Xt = \sum \Gamma i\; D\,X_{t-i} + \Pi\, X_{t-1} + \varepsilon_t \quad \text{-------}$$

$\{2\}$ $\varepsilon_{i,t}$ follows distr $(0, Ht)$

Where Xt is the 4 x 1 vector of l_GDP, l_IIP, l_ExRate and l_CPI respectively, D is the first difference operator, ε_t is a 4 x 1 residual vector indicating (ε_{GDP},t , ε_{IIP},t , ε_{ExRate},t , ε_{CPI},t) that follows an unspecified conditional distribution with mean zero and time-varying covariance matrix, Ht . The VECM measurement comprises of an adjustment to changes in Xt in both the short and long-run using the expected parameters Γ_i and Π, respectively. The VECM description of the above Equation (2), may be given as follows:

$$D(l\_GDP_t) = \sum a_{l\_GDP,i}\, D(l\_GDP_{t-i}) + \sum b_{l\_GDP,i}\, D(l\_IIP_{t-i}) + \sum c_{l\_GDP,i}\, D(l\_ExRate_{t-i}) + \sum d_{l\_GDP,i}\, D(l\_CPI_{t-i}) + a_{l\_GDP}\, z_{t-1} + \varepsilon_{l\_GDP,t} \quad \text{--------} \quad (3)$$

$$D(l\_IIP_t) = \sum a_{l\_IIP,i}\, D(l\_IIP_{t-i}) + \sum b_{l\_IIP,i}\, D(l\_GDP_{t-i}) + \sum c_{l\_IIP,i}\, D(l\_ExRate_{t-i}) + \sum d_{l\_IIP,i}\, D(l\_CPI_{t-i}) + a_{l\_IIP}\, z_{t-1} + \varepsilon_{l\_IIP,t} \quad \text{--------} \quad (4)$$

$$D(l\_ExRate_t) = \sum a_{l\_ExRate,i}\, D(l\_ExRate_{t-i}) + \sum b_{l\_ExRate,i}\, D(l\_GDP_{t-i}) + \sum c_{l\_ExRate,i}\, D(l\_IIP_{t-i}) + \sum d_{l\_ExRate,i}\, D(l\_CPI_{t-i}) + a_{l\_ExRate}\, z_{t-1} + \varepsilon_{l\_ExRate,t} \quad \text{--------} \quad (5)$$

$$D(l\_CPI_t) = \sum a_{l\_CPI,i}\, D(l\_CPI_{t-i}) + \sum b_{l\_CPI,i}\, D(l\_GDP_{t-i}) + \sum c_{l\_CPI,i}\, D(l\_IIP_{t-i}) + \sum d_{l\_CPI,i}\, D(l\_CPI_{t-i}) + a_{l\_CPI}\, z_{t-1} + \varepsilon_{l\_CPI,t} \quad \text{--------} \quad (6)$$

where a's, b's, c's and d's are the coefficients in the short-run, zt-1 = $\beta' X_{t-1}$ is the error- correction term that captures the impact of deviations of the previous period on the dependent variable from long-run equilibrium perspective in equation (2), and ε's indicates the residuals. The Wald test is used to test the hypothesis of short term causality on the joint significance of the lagged estimated coefficients of $D(l\_GDP_{t-i})$, $D(l\_IIP_{t-i})$, $D(l\_ExRate_{t-i})$, and $D(l\_CPI_{t-i})$.

RESULTS AND DISCUSSIONS

1. Correlation Estimates: The correlation between the variables taken for the study is shown below in table 1:

It can be seen that there exists a high and positive correlation between the gross domestic production and other selected variables. Also, there exists high and positive correlation between other variables. The correlation between GDP and IIP is 0.9723, between GDP and ExRate is 0.8955, between GDP and CPIis 0.9777,

between IIP and ExRate is 0.8682, between IIP and CPI is 0.9370 and between ExRate and CPI it is 0.9398.

Table 1. Correlation Matrix

	l_GDP	l_IIP	l_ExRate	l_CPI
l_GDP	1.0000	0.9723	0.8955	0.9777
l_IIP		1.0000	0.8681	0.9370
l_ExRate			1.0000	0.9398
l_CPI				1.0000

Source: Author's computation using Gretl – an open source software.

2. Test for Stationarity: The Augmented Dickey-Fuller test (ADF) is used to test the stationarity of the GDP, IIP, ExRate, and CPI. The Table 2 below shows the results of unit root test for stationarity:

Table 2. Unit Root Test

Series	Augmented Dickey-Fuller test statistic (with constant & 2 lags)			
	Level	p-value	1st Difference	p-value
l_GDP	-1.42985	0.5692	-6.23969	3.108e-008
l_IIP	-1.33907	0.6135	-8.76135	2.597e-015
l_ExRate	-1.75821	0.3933	-4.8963	3.312e-005
l_CPI	-3.28589	0.01555	--	--

Source: Author's computation using Gretl – an open source software.

It can be seen that the variables GDP, IIP and ExRate becomes stationary for the first difference and the variable CPI is stationary at level. Hence it is concluded that all the series LogGDP, LogIIP, LogExRate except LogCPI are non-stationary indicating the chances of cointegration between them. This implies that some or all the variables are either integrated with order one I(1) or order two I(2).

Table 3. Johansen Co-integration Test – r is the number of Cointegrating Vectors

Null	Alternativer	λ - Trace	p-value	λ - max	p-value
None *	1	74.651	0.0163	38.894	0.0006
At most 1	2	35.757	0.0722	20.610	0.0578
At most 2	3	15.147	0.1079	14.920	0.0373
At most 3	4	0.22742	0.6710	0.22742	0.6335

* denotes rejection of the hypothesis at the 0.05 level.
Source: Author's computation using Gretl – an open source software.

3. Testing for Co-integration: To determine the order of cointegration, the Johansen's cointegration test is applied. The Table 3 below shows the results of λ_{trace} and λ_{max}:

It can be seen that λ_{-trace} and λ_{-max} (eigen statistics) are significant at 5% level of significance, hence the null hypothesis of no cointegration (none) is rejected. This implies that all the four variables are cointegrated with order 1, which also indicates the possibility of long term causality between them. Thus, a certain variable can be targeted to bring about the desired changes in the other variables in the structure as a policy matter.

4. Vector Error Correction Model Approximation: The existence of cointegration between the variables compels one to use a valid error correction model to capture the short run and long run causality between the variables. (Granger Representation Theorem). The table 4 below gives the summary output of Vector Error Correction Model (VECM):

As seen in table 4, the error correction terms have correct sign in equation 3, 4 and 5, but only first equation's EC term is significant at 1% level of significance. Thus, the index of industrial production (IIP), exchange rate (ExRate) and inflation (CPI) cause gross domestic product (GDP) in the long run. As error correction terms of other equations are not significant, the channel of causation in the long run cannot be determined. Thus, in the long run, IIP, ExRate and CPI (inflation) cause GDP. To study the direction of causality in the short run Wald test of causality is performed and is shown below in table 5. As seen in table 5, the index of industrial production exchange rate and inflation cause gross domestic product in the short run in the equation of GDP. In the short run, the GDP cause IIP, but the exchange rate and inflation does not cause IIP.

Table 4. Estimated VECM with 4 lags

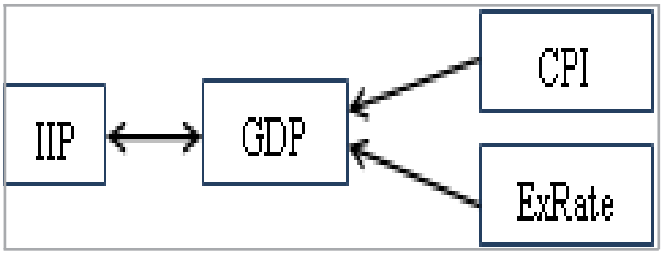
Equation	D(l_GDP))	D(l_IIP)	D(l_ExRate)	D(l_CPI)
EC	−0.139145***	−0.00788852	−0.00292710	0.0344160
	[−5.005]	[−0.07905]	[−0.02672]	[0.6144]
	(0.0002)	(0.9381)	(0.9791)	(0.5488)
C	1.39878***	0.0458866	0.0201588	−0.332395
	[5.053]	[0.04618]	[0.01848]	[−0.5960]
	(0.0002)	(0.9638)	(0.9855)	(0.5607)
D(l_GDP(-1))	−0.249929	1.70828**	−0.815937	−0.419838
	[−1.454]	[0.617203]	[−1.204]	[−1.212]
	(0.1681)	(0.0151)	(0.2485)	(0.2456)
D(l_GDP(-2))	−0.540413***	−0.0707112	0.962512**	0.158903
	[−5.098]	[−0.1858]	[2.304]	[0.7439]
	(0.0002)	(0.8553)	(0.0371)	(0.4692)
D(l_GDP(-3))	0.00309917	1.40301***	0.249705	0.0697622
	[0.02695]	[3.399]	[0.5510]	[0.3011]
	(0.9789)	(0.0043)	(0.5903)	(0.7678)
D(l_IIP(-1))	0.475580***	−0.449858	−0.0700679	−0.0483200
	[6.581]	[−1.734]	[−0.2460]	[−0.3319]
	(1.23e-05)	(0.1048)	(0.8092)	(0.7449)
D(l_IIP(-2))	0.202831**	−0.760343**	0.300739	0.140295
	[2.351]	[−2.456]	[0.8846]	[0.8072]
	(0.0339)	(0.0277)	(0.3913)	(0.4331)
D(l_IIP(-3))	0.132972**	−0.307204*	0.00844564	0.0504368
	[2.763]	[−1.778]	[0.04453]	[0.5202]
	(0.0152)	(0.0970)	(0.9651)	(0.6111)
D(l_ExRate(-1))	0.148963***	0.0512926	0.183883	−0.0500705
	[3.150]	[0.3022]	[0.9867]	[−0.5255]
	(0.0071)	(0.7670)	(0.3406)	(0.6075)
D(l_ExRate(-2))	−0.00529211	−0.0536639	0.315503	0.0141766
	[−0.1104]	[−0.3118]	[1.670]	[0.1467]
	(0.9137)	(0.7598)	(0.1172)	(0.8854)
D(l_ExRate(-3))	0.0677562	0.146576	−0.527285***	−0.0448219
	[1.534]	[0.9245]	[−3.029]	[−0.5036]
	(0.1473)	(0.3709)	(0.0090)	(0.6224)
D(l_CPI(-1))	−0.197480**	−0.243529	0.396637	0.301474
	[−2.249]	[−0.7726]	[1.146]	[1.704]
	(0.0412)	(0.4526)	(0.2710)	(0.1105)
D(l_CPI(-2))	−0.127645	0.796092**	0.423831	−0.0911207
	[−1.293]	[2.246]	[1.089]	[−0.4579]
	(0.2171)	(0.0414)	(0.2945)	(0.6540)
D(l_CPI(-3))	−0.196716*	−0.412177	−0.151381	0.347744
	[−1.789]	[−1.044]	[−0.3493]	[1.569]
	(0.0953)	(0.3141)	(0.7321)	(0.1389)
R2	0.950139	0.863042	0.797860	0.726765
Durbin-Watson	1.794869	1.500998	2.352640	1.691355

[ ] – indicates t –ratio. ( ) – indicates p – value.
* signifies 10 % level of significance. ** signifies 5 % level of significance.
*** signifies 1 % level of significance.
Source: Author's computation using Gretl – an open source software.

Table 5. Wald Test F-Statistics with 4 lags

	D(l_GDP)) ↓	D(l_IIP) ↓	D(l_ExRate) ↓	D(l_CPI) ↓
D(l_GDP))	--	3.6014		
[0.0412]	2.3201			
[0.1216]	2.0462			
[0.1570]				
D(l_IIP)	8.9879 [0.0018]	--	0.37486	
[0.8219]	1.2227			
[0.3561]				
D(l_ExRate)	2.7111 [0.0857]	1.0233		
[0.4374]	--	0.11300 [0.9753]		
D(l_CPI)	3.4123 [0.0478]	2.0785		
[0.1523]	0.74807			
[0.5794]	--			

[ ] – indicates p – value.
Source: Author's computation using Gretl – an open source software.



Year/ Quarter	L_GDP	Forecast	Quarter Year/	L_GDP	Forecast	
2016:2	14.842266	14.842525	2019:1	15.011766	15.012587	
2016:3	14.857769	14.857037	2019:2	15.002788	15.004303	
2016:4	14.880894	14.881234	2019:3	15.014939	15.016519	
2017:1	14.898060	14.903365	2019:4	15.038418	15.043095	
2017:2	14.901575	14.892017		Forecast	Std Error	95% Interval
2017:3	14.926110	14.920203	2020:1	15.056696	0.003356	15.050119 - 15.063273
2017:4	14.954449	14.950215	2020:2	15.071127	0.005449	15.060448 - 15.081806
2018:1	14.965249	14.968539	2020:3	15.091744	0.006363	15.079272 - 15.104215
2018:2	14.960379	14.961627	2020:4	15.117697	0.008750	15.100547 - 15.134847
2018:3	14.980823	14.983265	2021:1	15.135309	0.010554	15.114623 - 15.155994
2018:4	15.008465	15.005310	2021:2	15.146562	0.012155	15.122737 - 15.170386

Source: Author's computation using Gretl – an open source software.

Thus, in the short run, it seems that there exists bidirectional causality between GDP and IIP. The exchange rate equation shows that, the GDP, IIP and inflation doesn't cause exchange rate in the short run. Similarly, in the last equation of inflation, no variable (the GDP, index of industrial production and exchange rate) cause inflation in the short run. Thus, there exists a bidirectional causality between GDP and IIP, and unidirectional causality between CPI & GDP and ExRate & GDP. Thus, CPI causes GDP and ExRate causes GDP in the short run and is summarized as below:

To validate the model, the predicted values are obtained for the some sample data values and out of the sample period. The results are presented as below: From the above table, it can be seen that VECM predicts the GDP

with very low deviation and out of sample forecasts also seems to be reliable as the standard error is very low. Thus, under the conditions of non-stationary and cointegrating series, VECM is considered as the most appropriate model which not only predicts, but shows the causality effect as well.

CONCLUSION

The study shows the existence of long run unidirectional causality between exchange rate, industrial production and inflation towards gross domestic production and short run bidirectional causality between industrial production and gross domestic product and unidirectional causality between exchange rate and GDP & inflation and GDP towards GDP in India. This confirms with the study by Mlambo, 2020 according to which exchange rate and inflation significantly impacts manufacturing sector in SACU (South African Custom Union) countries. The present study shows the bidirectional causality between industrial production and GDP in the short run in India. Also the VECM model effectively captured the long run causality of industrial production, exchange rate and inflation for forecasting GDP in India.

From the policy perspective, the monetary policy of India is inflation-targetting rather than growth targeting. But the short run and long run economic growth perspective cannot be ignored. Looking at the present state of economic growth it is the need of an hour to look towards economic growth targets so that economic development becomes more prominent. The exchange rate volatility directly affects the exports and imports of the country and inflation determines the buying capacity of the market, and hence are very important from the perspective of industrial output and aggregate output of the market. Thus, at planned level of inflation and exchange rate, VECM model can give the direction of GDP achievable in near future to the policy makers.

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Face Mask And Crowd Detection Using Pytorch and Multi-Task Cascade Convolutional Neural Network

Mukul Shende[1], Amit Dravyakar[2], Mayur Karemore[3] , Lucky Khobragade[4] and Davesh Bondre[5]

[1,2,3,4,5]*Department of Information Technology, Priyadarshini College of Engineering, Nagpur, India*

ABSTRACT

The whole world is facing the biggest problem of health due to the rapid transmission of coronavirus disease-2019 (COVID-19). According to the World Health Organization (WHO), the best way to prevent the spread of COVID-19 is wearing a mask and keep the distance. But there is huge neglect of the guidelines by people which is resulting in daily increase in an infected patient. It is very difficult to monitor the people manually in these areas. So, in this paper, we propose an idea to monitor people using the automation process to identify the people who are wearing the mask and who are not. Many new trained models are being devised using pre-existing datasets to make the algorithm as accurate as possible. These models have made it possible to extract even the pixel details. We aim to style a binary face classifier which may detect any face present within the frame regardless of its alignment. The proposed idea or module built by pre-trained model and using computer vision libraries in python. The proposed model trained and tested on Real-world Masked Face Recognition Data set (RMFRD). By this project, we can calculate the number of people who are not wearing the mask and don't follow social distancing. By using the pre-trained libraries, this module will be robust and will have a high accuracy rate.

KEY WORDS: CONVOLUTIONAL NEURAL NETWORK, COMPUTER VISION, CORONAVIRUS, CROWD DETECTION, FACE MASK DETECTION.

INTRODUCTION

There are many types of equipment for mask detection using various libraries in python. Now to detect whether an individual is wearing a mask or not, we'll use the mask Detection Technique that uses PyTorch. Face Mask Detection Platform uses standard PC vision libraries to see if an individual wears a mask or not. The application can be related to any old or latest IP cameras to distinguish people with/without a mask. We will see the important aspects of the model works very well not only for images having a face mask. The idea also focuses on removing the erroneous predictions which are bound to occur. Detection of face mask is performed with the help of with image processing libraries in Python. The libraries are pre-trained for the identification of masks and it gives a result with the high rate of accuracy, and this module is robust for Detection it uses ROI (Region of Interest) that means it uses the necessary points to detect the Mask. We know that there are surveillance cameras everywhere in public places. The manual detection is a very stressful job for anyone so for automating it we use this Module to Detect and it is also used to calculate the number of people. Large amounts of approaches are proposed for mask detection. The early studies on mask detection chiefly centered around utilizing customary AI algorithm to prepare successful classifiers for face mask acknowledgement and detection. Such approaches

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are great to some extent but the detection accuracy is relatively low.

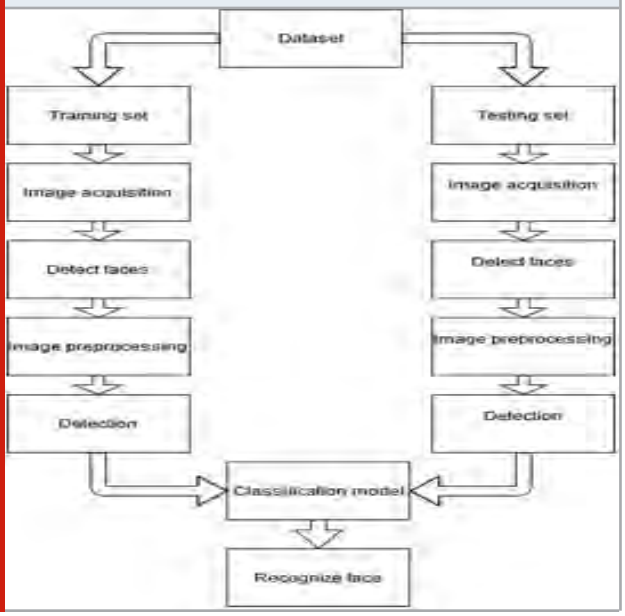
In recent years, face detection methods based on the deep convolutional neural network have been widely studied, which are more robust and efficient than other existing methods. These strategies fundamentally actualize face identification and consequently, the area of the face bounding box, which can have a few downsides like the removed face highlights have clamour, spatial quantization is unpleasant and can't be precisely situated. These limitations will affect the following face-detection related applications. Therefore, it is necessary to study mask detection using CNN method. The module uses a Convolution algorithm which makes it more robust and accurate and advancement of this module.

As module gets input from the CCTV camera, the resolution is very low thus CNN helps to identify the face at a lower resolution. It can likewise recognize individuals without a mask by creating an alert or a warning to information security or authorities. They can see who has not covered faces with masks through software, and they can alarm them. As we use data sets to train the module to discover the face mask on the face so that data set covers a various image that includes faces with masks, faces without masks, faces with and without masks in one image and confusing images without masks and this will make this module versatile and robust.

METHODOLOGY

Our approach consists of four core principles:
A. Acquisition of image
B. Extracting features from frame and face detection
C. Determining is the person wearing a mask or not
D. Lastly calculate the crowd density in the frame

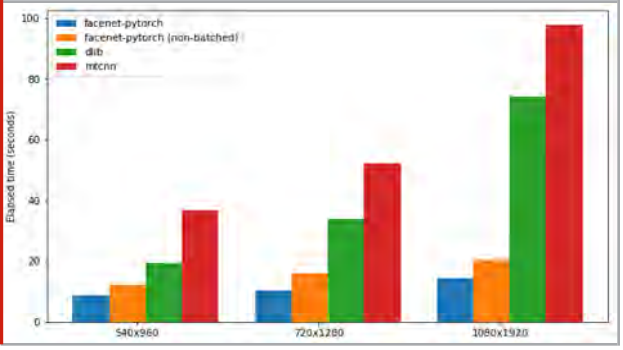
Figure 1: Mask face and crowd detection flowchart



A. Image Acquisition: Image acquisition is the first generally key stage regarding the face recognition method in a subtle way. We collected masked and non-mask images from publicly available databases. These images will be used to train our module for the detection of the masked individuals and to increase the accuracy.

B. Face detection: The most essential part of our work is to detect the face in the image, without it we cannot process further. FaceNet developed on 22 deep convolutional network layers. Its output is directly trained on these deep layers to obtain a compact 128-dimensional embedding. After rectification the connected layer to be utilized as the face descriptor. These descriptors turn into a homogeneous attribute-predicated descriptor utilizing the embedding module. To prepare a unique feature vector from a template, the max operator has been applied to the features. For the particular task of face apperception and verification, the network must be fine-tuned for expecting a significant boost. A very substantial amplitude of masked and non-masked face images is acclimated to this work to re-train the FaceNet model.

Figure 2: Performance comparison between face detection packages



We tested with both webcam and IP camera, contrary to popular belief. Both show equivalent calculation time in a big way. This face detection for all intents and purposes is fast with 2 frames processed per second without any optimization, which definitely is quite significant. And process streams near for all intents and purposes real-time with NNPACK or generally real-time with a GPU in a generally big way.

C. Image post-processing: After face detection, crop and re-sizing methods are applied to input images. The bounding box founded in the face detection level is produced by the MTCNN model. The bounding box is then used to crop the face portion from the input images. A particular model normalized parameter is specified in the model architecture details. According to the FaceNet architecture details all the cropped images are re-sized. Few downsides like the retrieved face highlights have spatial quantization is hard and can't be precisely situated. These downsides will straightforwardly influence the subsequent ensuing face-

related applications. Therefore, it is necessary to study mask detection using CNN method.

D. Data set construction: To build our data set, we utilized our pictures and the Region-Based Convolutional Neural Network (R-CNN). It is a group of CNN models intended for detecting object, created by Ross Girshick, there are maybe four primary varieties of the methodology, bringing about the current apex called Mask R-CNN. The Mask R-CNN is intended to figure out how to anticipate both bounding boxes for objects and for masks for those recognized. The data set we gather consists of 660 images 300 of mask and 360 on non-mask images. The age, gender, and height of persons vary for the image to image. It also comprises of different backgrounds and conditions. We partition our data-sets images into test and train set. Each train set contains 80% of all dataset as test set is roughly 20% of the complete data set. We also use publicly available data-sets and models for prediction and compare our results.

Figure 3: Images from the masked/unmasked data set

E. Crowd and mask detection: Results obtained from the MTCNN model which used to detect faces and extract features used for the detection of crowded areas where attention may be needed. The MTCNN algorithm works in three steps and uses one neural network for each in a big way. The first part particularly is a proposal network, which essentially is quite significant. It will predict potential face positions and their bounding boxes like an attention network in Faster R-CNN, which for all intents and purposes is fairly significant. The result of this step is a sort of a large number of face detection's and lots of false detection's, which for the most part is fairly significant. The second part uses images and outputs of the first prediction, or so they for all intents and purposes thought. It makes a refinement of the result to eliminate most of the false detections and aggregate bounding boxes, which is quite significant. The pretty last part refines even much more the predictions and adds facial landmarks predictions (in the basically original MTCNN implementation), Our data set model can predict if a person wearing a mask or not in a good performance range. To calculate the crowd density of a place we check if 5-6 detection boxes overlap at a single place, we can call it as crowed place and calculate the total persons present in a frame, we simply add the number of persons wearing masks and the number of persons not wearing masks.

RESULTS

For implementing real-time and correct computer vision applications on this associated system, we want to effectively optimize models throughout the model training. To train the model not solely correct but light-weight and performance efficiency in the real-time scenario. Pruning the model helps scale back the general size of the model which can lead to higher performance. This should be evaded losing accuracy as compared to the first model. All the experiments have been performed on the combination of pre-trained and added data set containing about 700 images. Out of these, 80% of images were used for training and validation while the remaining where used for testing the model. It also represents detected faces inside a highlighted rectangle concerning the prediction accuracy. Furthermore, the proposed model has also shown great leads to recognizing non-frontal faces. Alongside this, it's also ready to detect multiple facial masks during a single frame. The after processing of the model provides an outsize hike to the general accuracy. The present best accuracy of the mask and crowd counting model is 83.23%.

CONCLUSION

In people that they were wearing a mask or not and if they are following social distancing in public areas. This will be contributing to public health care. By this project the workload of local authorities and police department reduces and several human errors can be corrected by this project. In this model, we used PyTorch to check the people wearing a mask or not. This proposed model also gives the result or output by processing the images and real-time videos streaming (CCTV camera). We can say how accurately our model work. Besides, the system is straightforward to deploy into any existing system of a business while keeping the security and privacy of users' data. Thus, the mask detection framework goes to be the advanced answer for some enterprises, particularly retail, medical services, and public areas. After this pandemic, this technology is used for detecting accidents on road and for crowd management in the public places. This document we have proposed a novel face mask detector, this will help to cut the fatigue of local authorities to check manually.

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Traces Detection Of Coronavirus Patients

Jigyasu Prakash[1], Kalyani Joshi[2], Manali Bhavsar[3], Suyash Sinha[4], Yash Sharangpani[5] and Shailendra Aote[6]
[1,2,3,4,5,6]*Computer Science Department, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India.*

ABSTRACT

COVID-19 is a disease caused by a new strain of coronavirus. With the rapid increase in the spread of COVID-19, many people are getting affected by it. As the disease cannot be detected until the affected person doesn't take the COVID-19 test, the person remains unaware that he has been infected by the coronavirus. The person would travel, go to shops, do other activities as well thereby infecting the other people and a potential threat to society. Thus it becomes difficult to trace all the people who have been infected. It is necessary to report all the close contacts of the infected person in the last 14 days. With the increase in the COVID-19 cases, it is very difficult to manually monitor and track down all the contacts of a COVID-19 positive patient. This calls for an autonomous application that will provide information about the person's traces, the people with whom he came in contact with and the places he visited in the last 14 days. This application will help in collecting the data for traces of a COVID-19 positive patient.

KEY WORDS: FACE API JS, COVID-19, FACE RECOGNITION, AADHAAR BASED FACE RECOGNITION, INTERNET OF THINGS (IOT),MERN.

INTRODUCTION

COVID-19 is an infectious disease caused by severe respiratory syndrome (SARS-CoV-2). This disease mainly spread between the people of proximity. It spreads via contaminated droplets during breathing, coughing, sneezing, and talking. COVID-19 is spreading in the world at alarming rates and is difficult to keep the records of the traces manually. To date, there is no specific medicine for treating this disease. The best way to prevent illness is to avoid being exposed to the virus. The system for detecting the traces of COVID-19 positive patients is developed to control the spread of the disease. It consists of five modules - detecting the person from the video footage, recognizing that person, making a trace entry in the database, obtaining the traces with the timeline, and visualization of traces.

The hardware requirement for this application is a camera with at least resolution of 720 x 480 pixels, it can either be a mobile camera or CCTV camera deployed at public places like shops to capture the data on which the application will run. The application uses the face recognition algorithm for recognizing the face of the person who visits the shop. The trace of the person is marked against the Aadhaar card number of that person along with the current time and date in the database. The Aadhaar card database is used for face recognition. If the person who visited the shop tests COVID positive after some days then the last 15 days traces of the person can be obtained by entering the Aadhaar card number of the person in the web browser. The system for detecting the traces of COVID positive patients will be useful to take preventive measures at the places where the infected person has visited in the last 15 days. This will help to control the pace of spreading of the disease and will decrease the count of the infected people.

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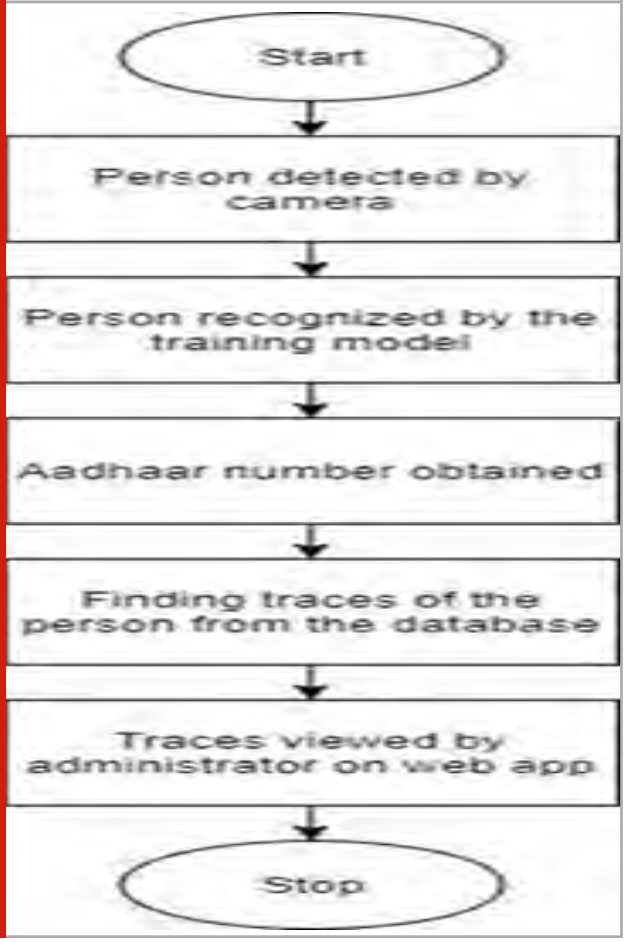
System Overview

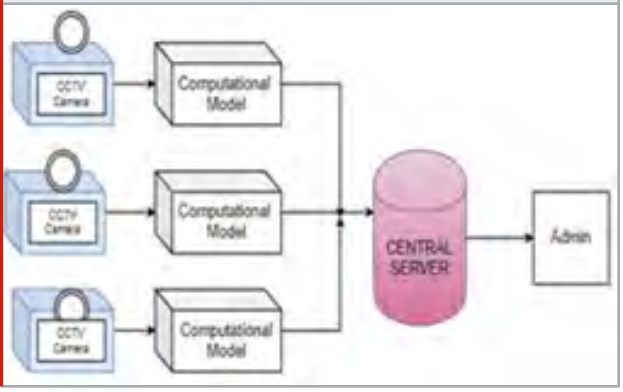
A) Detecting the person:
Video footage is captured by the camera.
B) Recognizing the person:
Implemented using Face API JS which is internally based on Tensorflow.
C) Obtaining Aadhaar number and sending it to the central server: REST API is used to send the data to the Express server.
D) Obtaining traces:
Based on the Aadhaar number, the query is executed on MongoDB to fetch the traces.
E) Visualization of thetraces
Traces are visualized using the admin panel which is made using ReactJS.

Figure 1: Flowchart of the system which shows overall working



The language used in this project is JavaScript. It is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. JavaScript can also be used in the backend by using the Node.js framework. The Node.js framework allows a developer to handle data updates from the front end and build scalable network applications that can process multiple simultaneous user requests. MongoDB is used as the database. It is an open-source document database and a leading NoSQL database. It is written in C++. The data format of MongoDB is similar to JSON. MongoDB is highlyscalable.

Figure 2

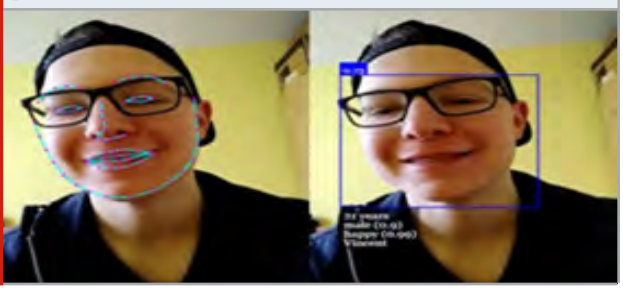


The key idea behind the working of the project is to store the traces of each person so that in the future if a person gets infected by COVID19. Authorities can find out the person's last 15 days trace easily and can take appropriate action to reduce the spread of COVID19.To achieve this goal whenever a person enters a shop or any public place. With the help of CCTV footage or the mobile phone of the shop owner, the person is detected and his Aadhaar card number is stored in the central server. In the future, if a person gets infected by COVID19 his Aadhaar number will be entered on the website and the person's traces for the last 15 days will be showcased.

System Implementation

A. FaceRecognition: The first step is the implementation of a face recognition module to detect the person in the video footage of cameras that are placed at the entrance of different public places like shops, malls, etc. This module will recognize all the persons present in the video feed of the camera and independently will be accounted. A minified JSON object is collected at the server and will mark the trace entry in the database. The person will be recognized by the training model. For detecting faces successfully a Face API JS is implemented over Tensorflow JS core API.

Figure 3: Input and output image showing a bounded box around the person and the recognized name of the person.

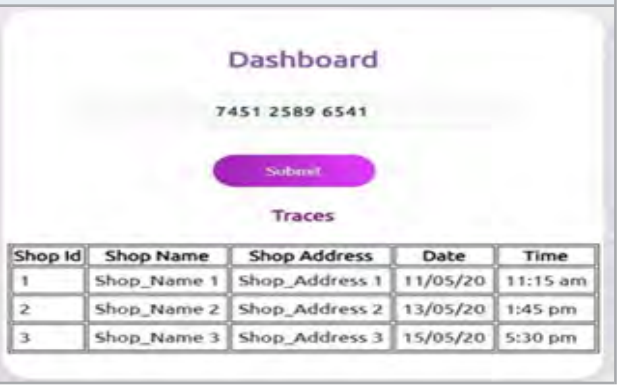


B. Obtaining the Aadhaarnumber: Fetching the Aadhaar number of the recognized person is a crucial step. The further processing is completely dependent on the Aadhaar number of the person. The Aadhaar number can be obtained by REST API which is used for fetching and updating data at the database end i.e. MongoDB using Express server. This data is further sent to the central server using the Express server.

C. Finding traces of theperson: With the help of the Aadhaar number, the details of the visits of that particular person in the last 15 days can be obtained. Based on the Aadhaar number, the query is executed on MongoDB using the REST API to fetch the traces of the person. The database also contains information about the date and time of the person's past visits to various shops which are also fetched.

D. Viewing Traces: The web administrator has the access to view the details of traces of a person and privileges to query Aadhaar details. The admin panel is designed by using React JS. The admin dashboard has a data field to enter the Aadhaar number of the person whose traces have to be obtained. An admin dashboard-Aadhaar query is executed and all the data present in the database against that Aadhaar number is displayed to admin. The details include the date, time, and places where the person has visited.

Figure 4: Dashboard displaying the traces of COVID-19 patient.



RESULTS

An algorithm is implemented to detect the past traces of the person if the person detects positive in the Corona Virus test. The system for detecting the traces of COVID positive patients will help to find the traces of the infected person and will help to analyze and control the spread at the places where the patients are increasing. This system helps to take preventive measures at the places where there are chances of the spread of the disease.

CONCLUSION

The system for detecting the traces of COVID-19 positive patients aims to control the spread of COVID-19. This system will complement the existing official government COVID-19 trackers and will be of great help to the government especially when the corona patient does not have access to the existing government COVID-19 trackers app. The main objective of this paper is to give in-depth information on the system for detecting the traces of COVID positive patients, the technology and the algorithm behind the whole working of the system, and how the whole system is beneficial for control of the spread of COVID and take preventive measures.

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Monitoring the Alone Living Elderly People at Home Using Surveillance System

Aashlesh Dhumane[1], Tasmeen Ali[2] and Jignyasa Sanghavi[3]
[1,2,3]*Shri Ramdeobaba College of Engineering and Management, Nagpur, M.S. India*

ABSTRACT

The revised version of World Population Prospects (2019) predicts that till 2050 one in sixth person will be above the age of 65. The problem of aging in population is faced by all over the world. The health care of this population becomes very crucial issue for the Nation. Monitoring these people via video surveillance system can be one of the affordable solutions to this problem. Video Surveillance can act as long distant eye for the family members staying away from family. This paper provides the affordable solution for elder person monitoring through home surveillance system. Since major accidents at home with elder person happen due to fall, our proposed system detects fall of person. The background subtraction becomes preprocessing step, human being detection, contour detection, classification and then alert generation if fall happens is the flow of our system. The system is tested on 30 videos and it gives accuracy of 90%.

KEY WORDS: FALL DETECTION; SMART HEALTHCARE; MONITORING ELDERLY PEOPLE; ASSISTIVE HOME MONITORING SYSTEM.

INTRODUCTION

The data provided by National Council on Aging gives the statistics of Aged population of United States of America. According to that every year, 25% population is forming the group where age is above 65 years. Fall is the most leading cause of injuries in this group of patients. Due to advancement in science and technology many methods are used to save the elderly people from the injuries. Some of the researchers have developed smart wearable gadgets to monitor the old people which are frequently used now days. Video surveillance systems have always been used for personal security and for asset security as the solution is cheaper and affordable by common man.

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Previously, Image or Video processing domain was limited to industrial use, medical imaging, satellite imaging, etc. but in the last decade new field of Computer Vision has emerged which extended version of Image/Video is processing. The Computer Vision is extensively present in day to day life like traffic control, security systems, vision-based surveillance, etc. The smart homecare services has come to boom with the concept of smart cities. Assistive home monitoring systems are used for monitoring the patients. Smart floor, smart shoes, etc. are used in many countries as assistive technology. However they are very expensive.

Video Surveillance system has many applications like monitoring criminal activities; safeguarding home, work place and all the valuables. Video surveillance system can also be used for monitoring the safety of alone living elderly people, tracking their daily activities, monitoring the health or abrupt accidents like fall, attack, stroke, etc. at home itself. In comparison with ever growing population, the health practioners are very less and so there should be some mechanism for monitoring the elderly through technology. One of them is Smart homes, which is combination of IoT, Big Data and Artificial

Intelligence. Alexa enabled facility is commonly used at smart homes now a days. These smart homes can be used by elderly people for living comfortable and quality life. It can be also used for monitoring their health. The main cause of accidents seen in elder people is fall due to weakness or sickness. Recently, the research on smart healthcare has led to innovative solutions of smart wearable devices. These devices are developed by some of the researchers which are described in further section and are used for fall detection. These devices are used to track heart rate, temperature, pulse rate, etc. to monitor their health condition. These wearable proves to be good solution but often elder people forget to wear them, or forget to charge them, and also it is expensive to maintain these wearables.

Related Work: Many researches on smart healthcare devices and applications are seen from last decade. Some of the research is describe below with respect to monitoring fall detection in elderly people. In 2018, Thiago B. Rodriguesa et.al has proposed the smart system using inertial sensors. These sensors collect data about the acceleration and angular velocity of the elder person. Using Machine learning algorithms, extracted data from sensors was trained and classified into four classes of different fall states. Comparison with various other models proved the good performance of the system.

Wann-Yun Shieh et.al worked on multi-camera video surveillance system for implementing automatic falling-detection system for elderly patient. All cameras are used for monitoring and fetching the data from it. The falling pattern recognition algorithm is used for automatic classification of fall incidence. As soon as fall is detected via algorithm alert message is send to the concerned person. The authors have claimed 90% accuracy of this system. Diana Yacchiremaa et.al proposed IoT based wearable device which can collect data from movements of Elderly people. It proved to be good combination of smart IoT, cloud computing, machine learning and big data. The researchers tried to design a system which can detect the fall of elderly patient. On detection of fall alert messages are sent to group of registered people. Record of all the falls is maintained on cloud of each patient so that it can be useful for analysis and treatment by health professionals.

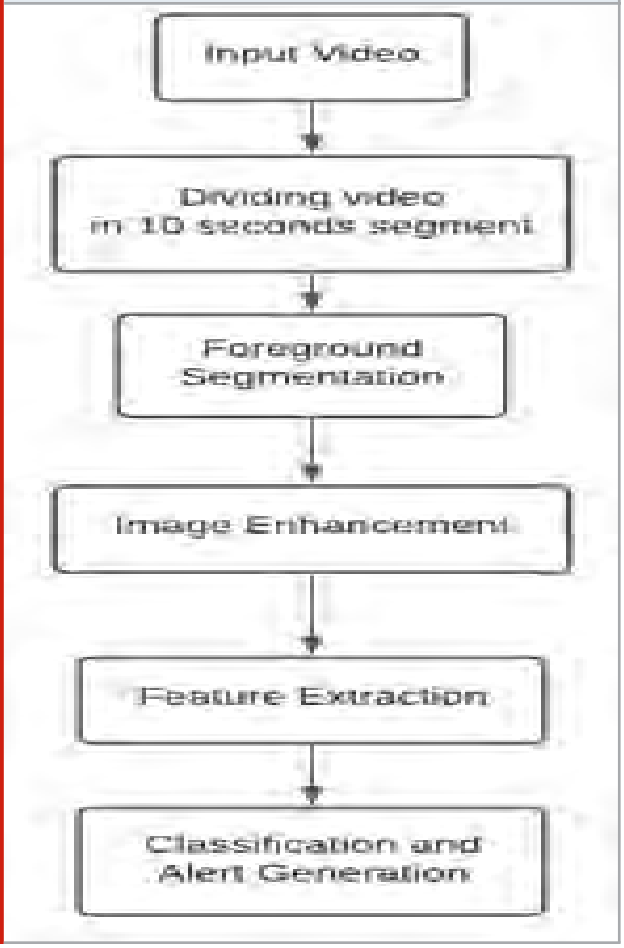
Lei Yanga et.al worked with Kinect cameras for image acquisition which can generate 3D depth images. Analysis of these images initiated with disparity map created by horizontal and vertical projection histogram statistics. Fall incident was detected by calculating centroid and angle of human body with respect to floor plane In 2010, Eric Campo et.al has proposed the behavior monitoring system for the elderly people using Trajectory analysis through multisensors installed in home environment. They tried to give solution via both supervised learning and unsupervised learning and found in their research supervised learning gives better results in specific time. The repetitive patterns of elderly patient in their trajectories were analysed for the study of the patients locomotor profile.

METHODOLOGY

The following figure shows the basic flow of our system. The proposed system is divided into following steps:

- Dividing input video into segments of 10 seconds
- Foreground Segmentation
- Image Enhancement
- Feature Extraction
- Classification and Alert Generation

Figure 1: Workflow of Proposed System



Dataset: This system takes input as surveillance video of Home environment at present in future live real time video can be given as input. The video dataset is taken from UR Fall Detection Dataset by Michal Kepski from Interdisciplinary Centre for Computational Modelling University of Rzeszow. It contained 70 videos from which 30 are fall videos and 40 are daily activities video. From this 30 Videos were used for testing the system.

Video Segments: The input video is divided into segments of 10 seconds for the proper analysis and processing. All the further processes are performed on each segment and the fall is detected based on complete analysis.

Foreground Segmentation: Since the video surveillance system is applied for home environment. The background will remain same for maximum times. So to segment the human being in the video we use motion in video. Gaussian Mixture-based Background/Foreground Segmentation Algorithm is used for background subtraction.

Image Enhancement: The video frames are separated and for high contrast all the frames are converted to gray scale. Since background is subtracted in first step, the human being will be visible in the form of white dots in gray scale image.

Feature Extraction: In this phase region of interest is selected from the complete frame via contours and features are extracted through bounding box.

Contours: Contours form the structural outline of any object with some similarity and different from background which can be used to identify the shape of object. The contours in image processing are generally used for shape analysis and object detection and recognition. After background subtraction, the human being in gray scale frame is found to be white dots which are connected via contours and this is considered as area of interest from the frame.

Figure 2: NO FALL Result

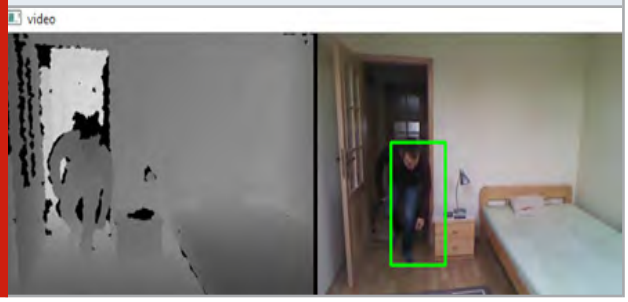
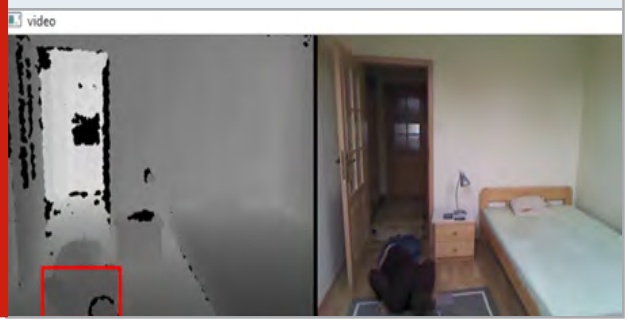


Figure 3: Fall detected Result



Bounding Box creation: After getting contours for human being in the video, Bounding Box is created on the contours of each frame. The bounding box is used to highlight the region of interest from the frame. The properties of bounding box consist of width and height of the box which is used for classification in successive frames.

Classification and Alert Generation: Using the property of bounding box, the system will compare the height (h) and width (w) of the contour area. If h<w the counter will be incremented by 1 for each frame and if the counter value reaches greater than 100 then it will send the alert message to the group of concerned people. Otherwise if the h>w then it will reset the counter to zero and the system classifies as NO Fall.

RESULTS AND DISCUSSION

The screenshot of result is shown in figure 2 and figure 3. When the system classifies as NO Fall the bounding box of green color is generated around the human being in the video frames to highlight there is no fall so no danger. When the system classifies as Fall detected the bounding box of Red color is generated to highlight the danger and alert is generated. This system is tested on 30 videos and has achieved the accuracy of 90%.

CONCLUSION AND FUTURE SCOPE

Aging problem faced worldwide has grown the industry of Smart healthcare. Smart healthcare started with e-health, m-health and now to smart wearable devices and smart health applications. The good monitoring will have less risk to severe injuries to the elderly people and proper action taken at proper time will increase their quality of life. With this motive we proposed an affordable system which will monitor the elder people and if fall is detected it will generate the alert and send message to concerned group of people. In future scope, this can be further extended to android application which will be connecting to health professional also. The alert will be generated to personal healthcare professionals so that fast treatment can be provided to the patient. Daily monitoring of the person can also be provided via application.

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A Survey on Image Steganography Techniques

*Bhumika Neole[1], Pallavi Parlewar[2],Prerana Jain[3], Akshita Samant[4], Vedant Khire[5], Radhika Sainani[6]

[1]*Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[2]Associate Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Inda
[3,4,5,6]Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, Inda

ABSTRACT

Steganography refers to the exchange of hidden data. It deals with the study of invisible communication between the sender and the receiver. In today's modern world transferring secured data over a network is the main concern, hence for secured communication steganography is used. The data that is to be sent is concealed behind a text, image, or an audio file. The attacker or the eavesdropper, who observes the object with embedded data, will not notice it and thus would not try to decrypt the hidden data. Steganography is useful in many areas like efficient confidential communication, protection from data modification, and media database systems. It preserves the confidentiality of the information, which ensures that during communication there will be no alteration in the content of the information. Steganography can be classified into image steganography, audio/video steganography, or text steganography. This paper gives an overview of image steganography and its various techniques to hide the data behind the image. The techniques are discussed and analysed based on their ability to hide the information securely.

KEY WORDS: HIDDEN DATA, SECURED COMMUNICATION, IMAGE STEGANOGRAPHY, DISCRETE COSINE TRANSFORM (DCT), DISCRETE WAVELET TRANSFORM (DWT).

INTRODUCTION

Steganography is an important tool required to hide data. It differs from cryptography. In cryptography we use a certain code language to hide the data, which does not assure full security. But in steganography we encrypt the data using a key, and only users with the key can see the hidden material. There are various types of steganography like image steganography, text steganography, audio steganography etc. As their names suggest, we can hide data using texts images and audios.

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In image steganography a cover image is used to hide the original image and the overall result image is said to be a stego image. There are various steganography techniques. They are majorly divided into spatial and frequency domain. The techniques mentioned in this paper are LSB, Masking and filtering, Spread Spectrum, pixel value difference, Statistical method, Distortion techniques, DCT and DWT.

LSB method involves modification of LSB layer of cover image, since the magnitude of change is very small it is not visible to human eye and the stego image looks similar to cover image though it has data embedded on it. In masking and filtering, significant pixels on the cover image are chosen where the secret message will be embedded, instead of hiding the data behind the cover image i.e. the information is not stored at the 'noise' level but stored inside visible areas of the image. Statistical methods change the properties of the image and it uses 1 bit message modification. Distortion techniques blur the image and insert hidden data.

Spread Spectrum is achieved by combining three different techniques: spread spectrum, error encoding and image processing. The main principle of Spread Spectrum is the integration of Hidden data into noise, which is then applied to the digital image. In pixel value difference, the cover image is split into non-overlapping blocks of two connecting pixels and the difference is altered in each section. Discrete cosine transform or DCT is a method used to transfer the image into frequency domain. The process of image hiding in frequency domain has shown better result when comparison is made with spatial domain for performing the same function. In Image Steganography, DCT is a widely used method. Discrete wavelet transform or DWT transforms the image in frequency domain. As mentioned earlier, data hiding works best in frequency domain. Unlike DCT, DWT is divided into 4 frequency bands instead of 3 as low-low, low-high, high-low and finally high-high frequency bands.

MATERIAL AND METHODS

a. Least Significant Bit (LSB): LSB or Least Significant Bit method is the simplest approach used in Image Steganography. It involves alteration of least significant bits of cover image, the changes in the LSB bit of a random pixel is not recognizable by the human visual system as the amplitude change is very small.

This approach involves following steps:
Encryption-

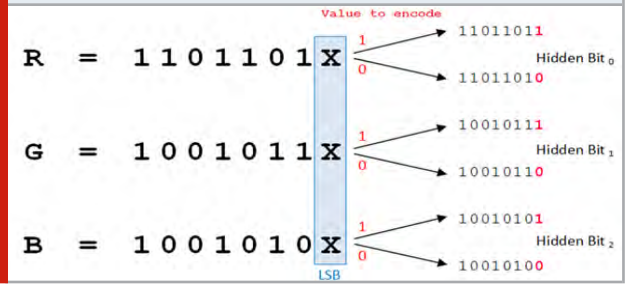
1. Selecting the cover image and the secret text message which is to be sent.
2. Converting the secret text message into binary code.
3. Find Least Significant Bit of each pixel of cover image.
4. Substitute LSB bit of image with individual bit of secret text.
5. A final stego image which looks similar to cover image is formed.

Decryption-

1. Get the stego image.
2. Evaluate the LSB bit of each pixel of stego image.
3. Recover the bits and decode the 8 bit character.
4. The secret message is decrypted.

For example:

Figure 1: LSB substitution



Since each pixel has three components Red(R), Green (G) and Blue (B), the above image (Figure 1) illustrates how LSB bit of each component can be substituted with the bit of the secret text that is to be sent. The final stego image obtained looks similar to the cover image. The LSB method has a few advantages such as no human perceptible distortions can be observed in the stego image, large amount of data can be encrypted in the cover image. This approach lacks in some of the aspects like it can be easily detected by the stego attacks i.e. data is less secure and it is also less robust in nature.

b. Masking and Filtering: This method functions close to that of watermarking technique. Though masking modifies the cover image but it is not visible to human eye. Due to this the technique is more robust in nature than LSB technique in case of a lossy compression algorithm. The pixels are chosen by specific mathematical expression hence the security of this steganography method is strengthened.

It involves the following steps:
Embedding the secret information-

1. Choose the significant pixels of cover image using a mathematical key.
2. The grey pixel values are converted
3. Transform the secret information into bits.
4. If first bit in the secret text is zero, then the first pixel value will not be changed.
5. If first bit is one, then the first pixel is made odd by adding one to the pixel value.
6. Continue this step till all the secret bits are embedded.
7. The new pixels are then put back to form the stego image.
8. Decoding the secret information-
9. Look for the specific pixels in the stego image by using the same mathematical key.
10. If the value of the pixel is odd, then the embedded bit is one.
11. If the value of the pixel is even, then the embedded bit is zero.
12. Find the entire embedded bits
13. Covert the bits into character to find the secret text.

c. Spread spectrum: The main principle of Spread Spectrum is the integration of Hidden data into noise, which is then applied to the digital image. This noise is similar to the noise in image acquisition method. When this noise is kept at low levels it is not seen by the human eye, neither is detected by the computer unless the computer have real image. For Spread Spectrum to be a blind steganography, to recover an approximation of the embedded signal applied to the cover, a sort of the original image must be obtained from the stego image. Image restoration method is used to manage it. Ultimately, since the noise is of low power and the method of restoration is not perfect. Embedded signal estimation is low which results in a high rate of embedded signal bit error (BER), which is not ideal. A low-rate error-correcting code is integrated to compensate it.

In this way an accurate blind image steganography is achieved with the help of combination of communication and image processing technique. This approach offers a technique for hiding a digital signal inside a cover image by not increasing the image dimension or dynamic span. The requirement that both sender and recipient have the same keys offers a degree of protection. In addition, relative to the cover picture, the embedded signal power is negligible, giving a low chance of noticing and leaving an observer unknowing that the hidden data exists. Disadvantages of Spread Spectrum are that its robustness is limited, increased complexity, large Bandwidth and if the pseudo random generator is not synchronised properly, the desired output is not obtained.

d. Pixel value differencing (PVD): In this process the cover image is split into non-overlapping blocks of two connecting pixels and the difference is altered in each section. The bigger difference in the original pixel value allows for a bigger improvement. The number of hidden bits that can be hidden depends on the edge or smooth region of the pixel. The difference between the neighbouring pixels is greater in the edge area, while it is smaller in the smooth area. Therefore, more data in the edge region is embedded in pixels than in the smooth area. Since this device integrates data by directly changing the difference value between two adjacent pixels instead of changes in pixel values, it offers better outcome in terms of hiding and stego image quality compared to LSB data hiding process replacement. value difference lacks in security of the data, decoding process of the method is often incorrect, reduces precision at curves and corners, sensitive to noise and time consuming.

e. Statistical methods: Statistical steganography, changes the statistical parameters of the image to hide the data. It uses 1 bit modification. The cover image is split into blocks and 1 message bit is embedded in each block. It is modified only if the size of the message is 1 otherwise there is no change in cover while restoring the original message. A test is required to differentiate between modified and unmodified blocks which make it difficult to apply. Statistical methods are hard to apply as there is need of proper testing and also a function to implement the whole procedure.

f. Distortion techniques: In distortion techniques, the image is distorted in order to send the secret message. The message is extracted by calculating the difference between original and distorted image. For example, to indicate a 0 no change is made, for 1 a random value is added. This method is not reliable as it requires the knowledge of original image and if unauthorized users have the access to the original data, they can decode the image easily using the same procedure. Distortion techniques are hardly used as it does not ensure proper security of the hidden data.

g. Discrete cosine transform method: DCT divides the image in three frequency bands like low, med and high frequency bands. DCT has some disadvantages like very low bit rate and distortion in image coefficients at higher frequency. Therefore, DCT is combined with another technique to improve its performance. An image is divided into 8x8 pixel blocks and 2D-DCT or 1D-DCT (applied twice, row and column) is performed on each of these blocks which decomposes the image into 64 harmonic cosine coefficients. Amongst 64 coefficients, only 1 is a DC coefficient and the rest are AC coefficients. These coefficients are altered to hide the information. There are many methods which uses DCT to hide information. For example, when a text message needs to be embedded in an image, the LSB bit of DC coefficient of the cover image is altered to hide the message.

One author used the secret image is Huffman encoded and then is embedded into the LSB DC coefficient of the cover image. There was a proposed method where the DC coefficient above threshold were only altered and this threshold was assigned by the respective author. Another author used Arnold's transform scrambles the secret image. More the number of iterations, more scrambled the image but after some iterations, the image starts getting restored. Here, the author scrambled the image with 10 iterations. Now, 2D DCT transform is performed on the cover image and then quantization of coefficient is altered using the scrambled image. The operations are performed in medium range frequency. To get the secret image, inverse DCT is performed on both stego and cover image. Then Arnold's transform 10 iterations are performed resulting into the original image.

h. Discrete wavelet transform method: DWT has similar process like DCT for image steganography. DWT has higher payload capacity but low PSNR value indicating that the quality of image is reduced. One author suggested a method where Haar-DWT was combined with Singular Value Decomposition (SVD). SVD is used for image compression, noise reduction and image watermarking. Here, DWT transform is applied for all the frequency bands of the cover image and text message is converted into binary and then into binary image or secret image. Then, SVD outlines the cover image as well as the secret image to improve the quality of the stego image. Quality of image provided by DCT surpasses other methods. The method of using DCT with Arnold's Transform offers PSNR value greater than 40 and MSE value near to 1 which surpasses other methods. But, Arnold's Transform is a complex method and its anti-transform takes a lot of time. Also DCT has low payload capacity. Whereas, DWT has a larger payload capacity but lower quality of the image. Hence the method of DWT with SVD is a very efficient and provides optimised solution to all the observing factors. It has PSNR value above 40 and MSE value near 1 with a larger payload capacity.

CONCLUSION

This paper gives an overview of steganography and types of image steganography. The various techniques like LSB, masking and filtering, spread spectrum, pixel value differencing, statistical, distortion, DCT and DWT have been reviewed and analysed on the basis of how securely data can be hidden behind an image. The efficiency of the

method can be best determined by the security of the data and the quality delivered after decoding the stego image. The comparison parameters observed under quality of the image are its robustness, payload capacity, distortion after decoding, etc. We found that LSB method does not provide essential security to the data being transferred and its less robust in nature. Masking and filtering was insufficient in payload capacity and restricted to grey scale images. Disadvantages of Spread Spectrum are that its robustness is limited, increased complexity, large Bandwidth and if the pseudo random generator is not synchronised properly, the desired output is not obtained.

PVD lacks in security of the data, decoding process of the method is often incorrect, reduces precision at curves and corners, sensitive to noise and time consuming. Statistical methods are hard to apply as there is need of proper testing and also a function to implement the whole procedure. Distortion techniques are hardly used as it doesn't ensure proper security of the hidden data. Quality of image provided by DCT surpasses other methods. The method of using DCT with Arnold's Transform offers PSNR value greater than 40 and MSE value near to 1 which surpasses other methods. But, Arnold's Transform is a complex method and its anti-transform takes a lot of time. Also DCT has low payload capacity. Whereas, DWT has a larger payload capacity but lower quality of the image. Hence the method of DWT with SVD is a very efficient and provides optimised solution to all the observing factors. It has PSNR value above 40 and MSE value near 1 with a larger payload capacity. Therefore, we propose the method comprising combination of DWT and SVD the efficient method amongst other mentioned method.

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Depth Estimation using FCNN

Pallavi Parlewar[1*], Siddhant Kumar[2], Bhumika Neole[3] and Manoj Sarve[4]
[134]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*Center Point School Wardhman Nagar, Nagpur, India*

ABSTRACT

This paper presents a novel supervised structure for estimating the depth from the monocular images. Floating point Convolution Neural Network (FCNN) which shows better results as compared to traditional algorithms. Rectified Linear Unit (ReLU) is the used as an activation function in deep learning models. As ReLu shows performance improvement between the layers as the data transferred is compatible to the ranges prescribe by the layers. KITTI and City Space dataset is use for training and testing. We have use most commonly dataset so that the benchmarking is done on the basis of same dataset and same parameter, Root Mean Square Error(RMSE) and Del< 1.25*3. Our purposed FCNN algorithm yields improved results in depth estimation of various images.

KEY WORDS: DEEP LEARNING, FCNN, DEPTH ESTIMATION, RECTI LINEAR UNIT.

INTRODUCTION

A fundamental challenge in computer vision is to estimate the depth of scene from images. Industrial applications such as self-driving platforms, robotics, augmented reality and localization and navigation systems are the areas where estimating depth from images and video is crucial. Object detection specifically for medical images and video reconnaissance which, when it comes to practical applications cannot target three-dimensional positions. Thus, it is important for practical purposes to combine information off depth to obtain three-dimensional object detection. Depth estimation is done through supervised and unsupervised learning network.

Anjie Wang et. al. perceptual loss for depth estimation is done using unsupervised learning framework. From the video sequence the depth and camera motion is estimated by training the network. The network gives depth and position of the scene which can be used for reconstructing the scene. The quality of the scene is assess by extracting features from the pretrained network and the experimental results shows improved estimation accuracy. Delong Yang et. al showed improved smoothness by using adaptive loss function. Yang et.al used successive stereo images to training of the model and only one image was used for testing. Eigen et al. used two layer to train depth network by using their corresponding ground truth. Huoling Luo et.al. estimated depth for laparoscopy images using unsupervised learning by training an encoder and decoder of convolutional neural networks model. Loss function is calculated and smoothness is done to get smooth depth surface.

The result shows that the depth of the proposed site is nearer to the real surgical site and reserves all the truthful details of the site. Junning Zhang et al. projected the UnLearner visual odometer, a novel unsupervised deep learning pipeline. To confine the use of the network, the system uses geometric consistency loss of temporal images. Unlearner visual odometry can also estimate camera motion between inconsecutive frames which allows UnLearner visual odometry to be well appropriate in scenes with large camera motion. Lipu Zhou and Michael Kaess evaded over fitting using windowed bundle adjustment framework to train the network. Context

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information attenuation had been eliminated using spatial pyramid net and super resolution net is castoff to recover details of the image which are the modifications in the U Net architecture. Clip loss function was proposed for designing complicated network to grip the moving object and occlusions. Shuhan Chen et. al. Salient object detection using full convolution based deep learning.

To guide feature learning in side output layers they first introduced a visual attention mechanism, attention weight is employed in a top-down manner to bridge high level logic information and subsequently filtering technique is used to remove background noise. Xiao Wang et. al. Saliency is detected from an encoder decoder framework using Deep Reinforcement Learning. In this the author has taken the adaptive weight of each domain so as to take the decision and is trained through discrete action selection with content loss and adversarial loss to interact with the environment. Depth and ego motion estimation is demonstrated using unsupervised stacked reproductive adversarial network. Lowermost layer of stack helps in estimating depth and ego motion where as higher layers are used in estimating spatial features.

Layers are recurrently represented to capture the temporal data. To evade the fault aliasing of multiple camera pose. Smoothing of uneven and unsmooth scene is done by using upsampling module in the encoder-decoder of the network. Xiaojiao Tang and lifang Then uses two aspect for learning unsupervised monocular image depth prediction. In first aspect they used multi-scale feature extraction for monocular image depth estimation the second part is deconvolution prediction network. In the second aspect they trained the model with asymmetric parameter. Image reconstruction is done by combining MS-SSIM algorithm and L1 algorithm. Images with mirrors, transparent, and shadows shows good Prediction accuracy.

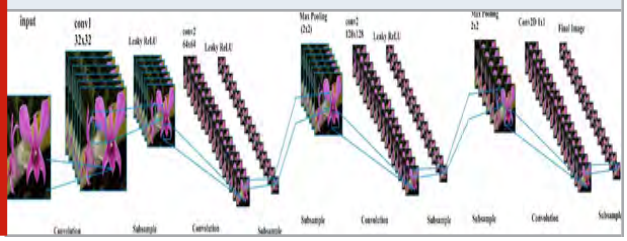
METHODOLOGY

In this section first we will deal with motivation of this work, overview and network architecture. We will introduce depth estimation network with how the network is train to get accuracy and RSME. With the wide application of depth estimation researchers are focussing on augmented reality. In coming days augmented reality may be our daily routine gadget. This may replace our today's very important gadgets such as mobile, laptops etc. Augmented reality in medical imaging will play vital role in days to come because it makes the anatomy of intent visible part to surgeon which otherwise is not visible. It results in better surgical precision and therefore potentially better surgical outcomes and faster recovery times.

For example by stacking 2D images we get 3D view of the object. 2D MRI scan images and calculating the depth estimation of the organ which on superimposed on the patient body using augmented reality can help to pin point the location of injuries and tumour and help the surgeon during surgery. So augmented reality is reliant on depth estimation. Depth estimation using deep learning gives better accuracy. In this work we have used Floating Convolution Neural Network (FCNN) for depth estimation. Floating CNN does not have a fully connected output layer.Floating point numbers are castoff in lieu of the weights. The Rectified Linear Unit(ReLU) is the usually used as an activation function in deep learning models. The function receives any negative input it returns 0, but returns the same value back for any positive value. Following is the steps of the algorithm:

Step1. Collect input images and ground truth images
Step 2. Train a CNN that can take an input image and produce an output image
Step 3. The following architecture is used for the floating CNN,
a. Initialize a sequential CNN
b. Add a Conv2D layer of size 32x32 with window size of 3x3, a linear activation function and similar padding
c. Add a leaky ReLU with alpha=0.1
d. Add a Conv2D layer of size 64x64 with window size of 3x3, a linear activation function and similar padding
e. Add a leaky ReLU with alpha=0.1
f. Add a Max Pooling layer of size 2x2
g. Add a Conv2D layer of size 128x128 with window size of 3x3, a linear activation function and similar padding
h. Add a leaky ReLU with alpha=0.1
i. Add a Max Pooling layer of size 2x2
j. Add a 1x1 Conv2D layer of window size 3x3, producing the final output
Step 4. Use a sparse categorical cross entropy based learning mechanism
Step 5. Train the network with different images, to get the final trained CNN
Step 6. Give a new image to the CNN to obtain the final depth map

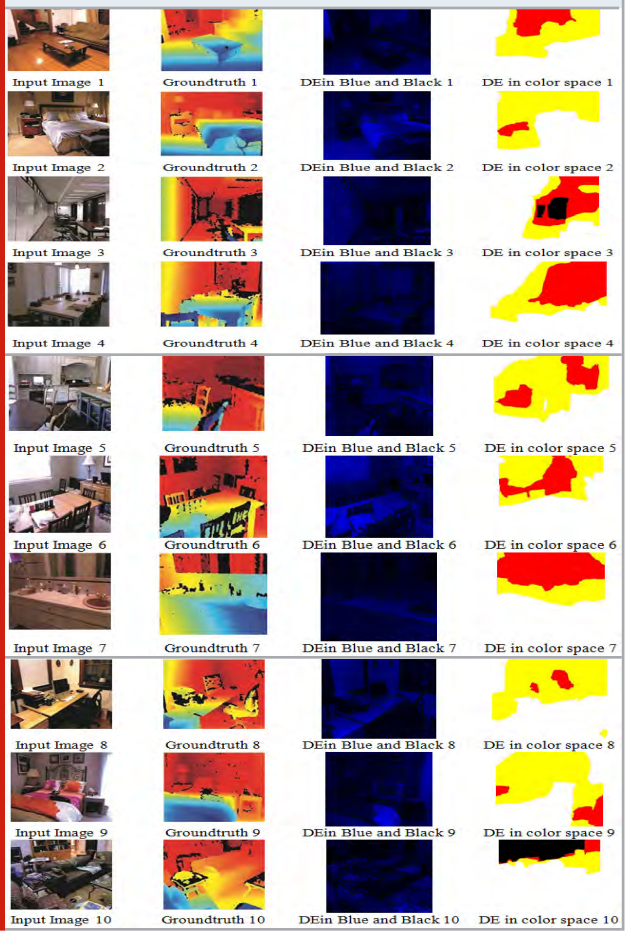
Figure 1: Proposed depth estimation architecture of FCNN structure based on ReLu



RESULTS AND DISCUSSION

This section deals with the comparison with the state-of –art algorithms. Network is implemented using Tensorflow 1.9 and is trained. KITTI and City space dataset is used for training set and test set. 9325 images for testing and 6528 images for testing out of which 1398 for validation. For evaluation of the FCNN architecture 3 different methods are used to compare the proposed work. To carry out the trials and evaluation for all algorithm same crop is used in all input images.

Figure 2: Depth estimation using FCNN for various images



The size of the input image to the network is 256 X 256, 256 X 256 for training and 256 X 256 in a depth map. The benchmarking is done on the basis of absolute relative difference (Abs Rel), Square related difference (Sq Rel), Root Mean Square Error(RMSE)and Log Root Mean Square Error(RMSE Log10). Our algorithm perform better in comparison with the supervised and unsupervised algorithms because our architecture use Recti Linear unit due to which their performance improvement between the layers as the data transferred is compatible to the ranges prescribe by the layers.

Fig. (2) Show home interior data as input image and ground truth is already available with the KITTI dataset. Image 1to 10 shows input images , ground truth images, depth estimated images, blue color indicate nearer and black far distance, similarly same depth estimated image is shown in red-yellow-white-black color space in which white shows to be nearer and black indicates to be far point Table: 1shows the results of various image extracted from KITTI dataset with ground truth. Our algorithm outperform for Del < 1.25^3. Table:2 shows the results of three different algorithms. The table is divided into several parts according to the supervised and unsupervised algorithms. Our algorithm shows better result for Del <1.25*3 and RMSE. Our algorithms learn from scrape without demanding more information and outperforms.

Fig.2 KITTI dataset is used to show qualitative results, Right to left FCNN output white-red-yellow-black colour space, our result in blue-black, ground truth from KITTI dataset and input images

Table 1. Results of various images. Ground truth is use from KITTI dataset

Image	Size	Lower is better				Higher is better		
		Absolute Relative difference	Squared Relative difference	Root Mean Square Error	Root Mean Square Error Log10	Del < 1.25	Del< 1.25^2	Del< 1.25^3
1	256*256	0.8624	1.6884	2.5576	0.4078	0.8916	0.9312	0.9906
2	256*256	0.6064	1.6061	1.1879	0.07478	0.83539	0.8725	0.9282
3	256*256	0.7366	1.6538	2.2964	0.3610	0.8946	0.9344	0.9940
4	256*256	0.7623	1.4522	3.004	0.4777	0.8979	0.9378	0.9977
5	256*256	0.6820	1.6501	1.9809	0.2968	0.8873	0.9267	0.9859
6	256*256	0.8494	0.8560	0.86072	-0.0651	0.8051	0.8409	0.8945
7	256*256	0.51825	0.9795	4.170	0.6201	0.8982	0.9381	0.9980
8	256*256	0.7056	1.3383	1.7537	0.2439	0.8715	0.9102	0.9683
9	256*256	0.7928	1.5169	1.8958	0.2778	0.8681	0.9066	0.9645
10	256*256	0.5496	1.3444	3.0349	0.4821	0.8906	0.9302	0.9895

Table 2. KITTI and City space dataset is use for training set and test set. Experimental data of other method is taken from the paper which is given in the reference

Image (.jpg)	Supervised	Absolute Relative difference	Squared Relative difference	Root Mean Square Error	Root Mean Square Error Log10	Del < 1.25	Del< 1.25^2	Del< 1.25^3
Zhang[1]	YES	0.144	1.391	5.869	0.241	0.803	0.928	0.969
Liu[4]	YES	0.202	1.614	6.523	0.275	0.678	0.895	0.964
Godard [2]	NO	0.140	0.976	0.471	0.232	0.818	0.931	0.969
Eigen [3]	NO	0.214	1.605	6.563	0.292	0.673	0.884	0.957
Ours	Yes	0.518	0.979	4.17	0.620	0.898	0.938	0.998

CONCLUSION

In this paper we have propose a novel FCNN network for depth estimation in monocular images. Because of Recti linear unit the data is transferrable to the prescribe ranges which increases the performance of the algorithm. In comparison with the existing supervised learning network our FCNN can generate more accurate result. In future we will extend our work with unsupervised learning method and also increase data set for training and testing.

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Personalised Spam Filter for Social Networks Using Machine Learning Algorithms

Mohammed Husain[1*], Antarang Poogalia[2], Devan Somani[3], Gauri Walke[4], Akash Agrawal[5], and A. J. Agrawal[6]

[1, 2,3,4,5,6]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Social Network is one of the well-known and reliable mediums for communication which has made the whole of the world 'A Global Village' and where people easily connect with each other. With this boom of internet, many instant social media platforms have brought exploration of interactivity among users. With this rapid evolution, users of social networking sites may easily get overwhelmed by the excessive volume of information feeds and may also face difficulties to find truly valuable information. This paper introduces a personalised feed system for users based on their interests and displaying the content accordingly. In this paper the different machine learning algorithm with natural language processing to classify messages were used which leads to a time saving and user-friendly system.

KEY WORDS: SOCIAL NETWORKS, PERSONALISED FEED SYSTEM, NATURAL LANGUAGE PROCESSING, MACHINE LEARNING.

INTRODUCTION

An online platform on which people connect with same interest is basically referred as social network. These platforms provide a medium to connect with individuals of similar or different interests creating a hub. Since a huge hub participates on these platforms, the user can receive a high volume of messages from different individuals creating a chaos and unwanted messages. These messages sometimes contain a true information and sometimes false, which leads to a state of confusion in the minds of the users and leads to first step towards spam messaging.

Spam messages means an irrelevant and unsolicited message sent by an known/unknown user which may lead to a sense of insecurity among users. These messages affect user's emotions and privacy and hence affect the lives of individuals. To deal with this problem there are a numerous spam detecting and filtering applications available. Most of these applications detect the spam messages by manually giving choice to the users whether message is spam or ham. The technic used by these applications reduces the spread of spam and rumoured messages but this leads to another problem i.e. user needs to read all the message spam then categories it as a spam and ham which is a time-consuming process.

This paper proposes a solution for classifying user's messages into different classes and displaying only those which the user wants. The messages which belong to the class which user does not want is classified as spam messages. This classification process is done with the help of three machine learning algorithm, classifying each and every message of the user.

Literature Review: There exist many papers in which detection is limited to spam and ham within emails and text messages, which perform well for email but not that suitable for social networking applications where different people may have different definition of spam.

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Some papers suggest classification of tweets or messages on the basis of emotions, others suggest comparing and selecting the best suitable machine learning algorithm for text classification for a multiclass system. The algorithm used by most of these papers were Naive Bayes, Support Vector Machine or Random Rain Forest algorithm. Previous work related to spam filtering and text classification are been mentioned below in brief:-

A. Personalized Spam Filtering with Natural Language Attributes: Rushdi Shams and Robert E. Mercer proposed a method which reposts the performance of an anti-spam filter personalized emails named SENTINEL. It uses Natural Language attributes that are related to different components like email readability, grammar, spelling, content words, etc. Categories implemented were Spam and Ham. Also, there are addition to some commonplace attributes, SENTINEL uses attributes related to natural language. The filter used in this paper has been tested with six benchmark datasets in the Enron-Spam collection. the Classifiers which are made by the meta-learning algorithms like ADABOOSTM1 and BAGGING perform equally the best, while a Random Forest (RF) generated classifier performs almost as well. The performance of classifiers using Support Vector Machine (SVM) and Naive Bayes (NB) are not satisfactory for them. The proposed paper shows the comparisons that the performance of SENTINEL surpasses that of a number of state-of-the-art personalized filters proposed in previous studies [Rushdi Shams, 2013].

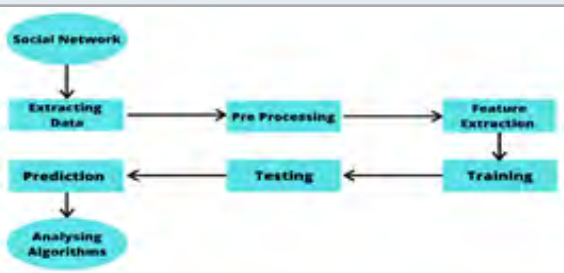
B. Personalized Spam filtering using Incremental Training of Support Vector Machine: Gopi Sanghani and Dr. Ketan Kotecha, the paper reposts the personalized spam filter using Support Vector Machine (SVM) with Incremental Training for E-Mails. The filter has two different approaches. First approach, the filter was trained with support vectors incrementally and a collection of incoming mails, keeping the identical set of features. While within the second approach, the feature set is heuristically updated before applying incremental training to SVM. Categories implemented were Legitimate and Spam. The classifier used was Support Vector Machine (SVM). The depth comparison results shows that with conventional SVM batch incremental training, higher classification accuracy and lower false positive rate is achieved [Gopi Sanghani, 2016].

C. Personalized Spam Filtering with Semi-supervised Classifier Ensemble: Victor Cheng and C.H. Li, the paper reposts the semi-supervised personalized spam filter based on classifier ensemble classifier that helps the user to label emails for personalizing the spam filter by learning on both generic labelled emails and personalized unlabelled emails. The proposed paper begins learning a SVM model from labelled generic data using multi-stage classification process. Personalized labelled data for constructing personalized naive Bayes classifiers are generated by feeding unlabelled user's emails to SVM. This paper also exploits some rare word distributions by generating some personalized labelled examples and then fed into semi-supervised classifier. This multi-stage results are integrated with SVMs learned from emails to produce final results. Categories implemented were Spam or not. The classifiers used were Support Vector Machine (SVM), and Naive Bayes (NB). Implemented combination of SVM and NB [Victor Cheng, 2006].

D. Decentralized and Personalized Spam Filter Based on Social Computing: Xin Liu, Zhaojun Xin, Leyi Shi, the paper reposts the personalized and collaborative spam filter based on social network to enable users to push spam reports to their social network friends with whom they have similar interest which reflects collaboration and personalization. The spam filtering for emails can be push to social networks. The proposal takes advantage to share user's individual spam knowledge with others via social network, which utilizes wisdom of crowds to resist spam by using push technology. The user can determine whether to push spam reports to his friends with the purpose of taking user's individual interest into consideration. Categories implemented were Interested and Uninterested on basis of user keywords. The classifiers used was Bayesian Filter [Xin Liu, 2014].

Proposed Methodology: In the proposed methodology, the fundamental step is extracting the data from social networks. This data is then pre-processed in which stemming and stop words are removed using Natural Language Processing. This noise-free data is further used for feature extraction which is done by tokenization where the frequency of all the tokens is taken, can be called an array of features. The features and their respective weights are then fed to the classifier to train the model. The trained model is tested on various machine learning algorithms and analysed the accuracy based on predictions of the algorithms.[Hu, 2016] (Fig 1).

Figure 1: System Architecture



A. Extracting Data: The most important attribute required to train a machine learning algorithm is the dataset. A dataset (Table 1) which had messages from publicity, covid-19, greeting, politics and science and technology classes would solve the purpose, these classes were chosen based on a survey. While searching for dataset on internet there was no dataset which met the expectation for training the model, thus a python code was used to extract messages from some sites. The model would have got a lower accuracy on this dataset as the dataset had noise or unnecessary words, thus filtered the dataset was filtered manually so as to achieve a higher accuracy (and decrease no. of misclassified messages).

For cleaning the dataset, the following parameters were taken into consideration:

- Removed #, @ and other irrelevant symbols.
- Removed blank rows.
- Removed URLs via regular expression matching.
- Removed mismatching/incorrect messages.

Table 1. Datasets Category

Dataset Category	Dataset Count (number of records)
Covid-19	3167
Publicity	595
Science and Technology	2439
Greeting	1012
Politics	3826
TOTAL	11039

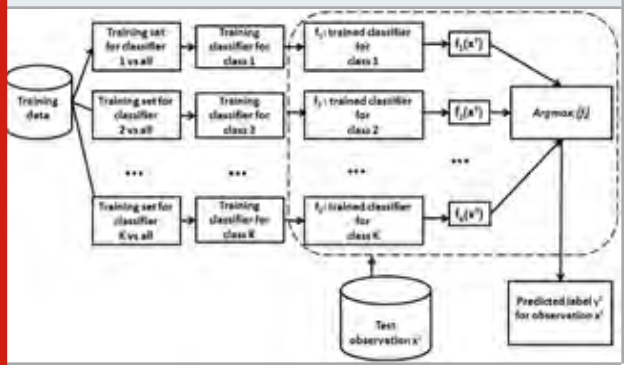
B. Pre-Processing: The process of converting data to something a computer machine can understand is termed as pre-processing. One of the important forms of pre-processing is to filter out purposeless data in a given dataset. In Natural Language Processing (NLP), this purposeless data, are referred as stopwords. Stopwords are a commonly word used in a sentence (such as 'the', 'is', 'are') that can be filtered from the text to be processed both when indexing for searching or retrieving them as results. These words take extra space memory in a database or take valuable extra time for processing. Therefore, removal of these words is essential for better performance [Daniel Jurafsky, 2019].

NLTK(Natural Language Toolkit) library in Python helps to remove this data. This library of English stopwords contains 153 stopwords. This library also provides PorterStammer Algorithm to reduce all those words which are mapped to the same stem. For instance, play, played, playing all will be viewed as same word. Even punctuations, special symbols and numeric values should be removed from the data as they do not impose a potential impact in the classification process.

C. Feature Extraction: To perform classification, the transformation of features into the numbers is required. Tokenization is a way of separating a piece of text into smaller units called tokens. Tokenization is done using CountVectorizer, which stores the frequency of all the tokens in the form of an array. This can be called as an array of features using which sparse matrix (it consists of multiple zeroes for the words that have not occurred in other documents) is created. Sparse Matrix is further used to adjust the weights of the features to improve the accuracy, which can now be given as input to the classifier [Deepa, 2019].

D. Classification: The first question while solving any machine learning problem is "What machine learning model should I use?", And the answer is always "It depends.", even the most experienced data scientists can't tell the best performing algorithm before experimenting. That is why the comparison of different multi-class text classification models is done, in order to choose the most accurate one. So the classification models used here are related to supervise machine learning algorithms. For this, the data is categorized into two sets i.e. training set and test set. After training different models with the training dataset, the check on performance for unseen dataset is carried out using test set. In supervised machine learning, various multiclass classification techniques/ methods exists. The one-vs-all technique for multiclass classification is used as shown in (Fig 2).

Figure 2: Multiclass Classification



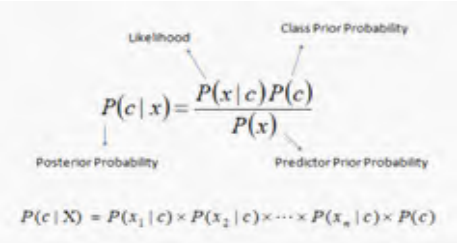
Top 3 most suitable classifiers were identified based on requirements and previous learning. They are:

- **Multiclass Support Vector Machine (SVM):** SVM is a supervised learning algorithm that is inherently a binary classifier. SVM is based on the principle to learn the maximum marginal hyperplane(MMH) that best segregates the dataset into independent classes. SVM constructs a hyperplane in higher dimensional space to separate different classes that is the relocation of points onto another space where the linear separation of data points is possible. There are several methods to do multiclass classification with SVMs. The method to use depends on the nature of classes whether they are mutually exclusive or not. It is improper to say that classes are independent of each other because classes are hardly statistically independent. The most widely used approach in practice is the "one-versus-all" technique (to build one-versus-rest classifiers) for multiclass classification [Fig. 2]. To generate the binary classifier models for every class individually that separates the rest datapoints of all other classes as one class. [Yi Liu, 2005]

- **Multinomial Logistic Regression(LR):** Logistic Regression is supervised machine learning algorithm that uses probability for classifying the input. In multinomial logistic regression the target variable ranges over more than two classes. The probability of target variable to belong to a class c is given by the formula, $c \in C$, $p(y = c|x)$ [Daniel Jurafsky, 2000].The output of a multinomial logistic regression is a model that explains the relationship between the explanatory variables and the outcome, so that the class of a new input can be

correctly predicted with the help of the explanatory variables while the outcome is to be predicted.

•Naive Bayes(NB): It is a supervised machine learning algorithm used for classification and is based on Bayes' Theorem. Reason behind the name 'Naive' is the assumption that the presence of a particular feature in a class is independent to the presence of any other feature. This model is basically used for large dataset and is also easy to build. The Naive Bayes algorithm backbone is Bayes Theorem. Here, we calculate the posterior probability (Fig.3) and choose the class with the highest



The class with the highest posterior probability is the outcome of prediction. There are 3 main types of Naive Bayes algorithms: -

1. Gaussian Naive Bayes: It is used when features follow a normal distribution.
2. Multinomial Naive Bayes: It is used for discrete counts. Here, this algorithm is implemented.
3. Bernoulli Naive Bayes: This model is useful for binary feature vectors (i.e. 0s and 1s).

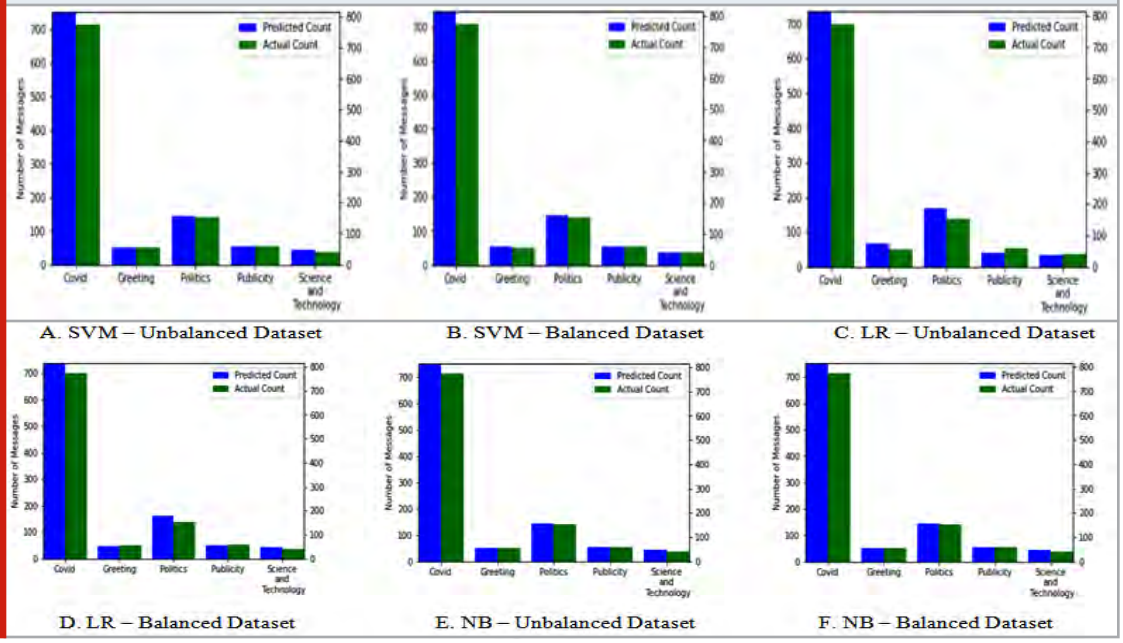
Table 2. Dataset

Total Dataset Messages	11039
Training Data	10039
Testing Data	1000

Table 3. Results

Classifier	Unbalanced Dataset				Balanced Dataset			
	Training Time	Testing Time	Misclassified Samples	Accuracy	Training Time	Testing Time	Misclassified Samples	Accuracy
NB	0.026578	0.000838	43	0.9586	0.042360	0.000998	55	0.9471
LR	1.174748	0.001639	68	0.93455	2.377615	0.001190	62	0.94033
SVM	238.375338	24.619462	78	0.924927	828.471336	48.092569	69	0.933589

Figure 4: Actual Count vs. Predicted Count



RESULTS

In (Fig 4), the actual and predicted count of samples of different classes on SVM, Logistic Regression, and Naïve Bayes is shown. A balanced and unbalanced dataset is taken into consideration for better analysis across different algorithms. Table-3 describes various important parameters of each algorithm on unbalanced

and balanced data. It shows total training time, Testing time, accuracy, and the number of misclassified samples for all the three algorithms. First, the model is trained using an unbalanced dataset and achieved high accuracy of 96% for the Naïve Bayes algorithm, and also the response time was comparatively very fast. There was a huge difference in the number of samples per class. Therefore, balancing the dataset was attempted which contains an equal number of samples of all the classes in the dataset, where Logistic Regression showed 95% accuracy and also better response time. Balancing dataset failed to show overall progress but in case of SVM and Logistic Regression, there was a considerable increase in accuracy respectively.

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CONCLUSION

Here, the comparative study of three supervised machine learning classifiers (Naive Bayes, Logistic Regression, SVM) for personalized spam filter of social network is shown (Fig 4). Through results, the conclusion was that, Naive Bayes is the best performing algorithm for multi-class text classification with large data set as studied earlier. Also the time taken for training and testing was very less in Naive Bayes and Logistic Regression as compared to SVM. The accuracy of SVM and Logistic Regression increased on balanced dataset as compared to unbalanced dataset while it decreased in the case of Naive Bayes, but still was best among all. The future goal is to check the news for true information using web scrapping. This will help to combat the rapid spread of fake news on social network. Another future goal is to increase the dataset automatically from the user and hence producing more accurate results with more dataset.

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Attentiveness Detection of Crowd Using Image Processing

Prof. S.C.Tirpude[1*], Neha Moharil[2], Aditi Agrawal[3], Komal Chandak[4] and Farhan Akhtar[5]

[1,2,3,4,5]*Shri Ramdeobaba College of Engineering and Management, Nagpur India*

ABSTRACT

During lectures, conferences or any sort of meeting that has a lot of audience present, it becomes really difficult to pinpoint which of the candidates are un-attentive. Over the years, quite some research has been done in the area of attention detection and identification of human faces with respect to different applications. In this paper we used multiple criteria's for determining whether the person is attentive or not. This attentiveness can be determined by the eye movements, head movements etc. We recognize the face of each candidate using image processing and then determine his/her attentiveness based on his facial features.

KEY WORDS: HISTOGRAM OF ORIENTED GRADIENTS, SUPPORT VECTOR MACHINE, EYE ASPECT RATIO, DLIB, FACIAL LANDMARK DETECTOR, SHAPE PREDICTOR.

INTRODUCTION

During lectures or conferences or any sort of meeting that have a lot of audience present, it becomes really difficult to pin point which of the candidates are un-attentive. In classrooms it is very important that students concentrate and it is necessary to know - are the students really grasping the knowledge provided to them? We also know that there are different modes of teaching like video or presentation teaching, blackboard teaching, etc. Which mode of teaching is suitable for which type of audience? All these questions can be answered by our project where cameras will be installed at workplaces and we can determine the attentiveness of each candidate. With this project we can also determine the most efficient mode of teaching from which students can actually understand and grasp things more effectively. This project can also be used to determine the effectiveness of the speaker who is orienting the crowd. In this project we have used multiple criteria's for determining whether the person is attentive or not some of which are eye movements, head movements etc. We recognize the face of each candidate using image processing and then determine his/her attentiveness based on his facial features. Hence at the end of this project we can detect attentiveness of large crowd using image processing.

Literature Review: Cheng et. al. proposed 'Driver Drowsiness Recognition Based on Computer Vision Technology'. They suggested a drowsiness detection method using eye-movements and image processing. An algorithm is presented to solve the problems caused due to lighting fluctuations and driver's body posture. The accuracy of this video-based model which relies on the above given 6 measures is 86%. Various parameters like eye movements, eye opening and closing speed,etc are considered here.

G. Kong et. al. proposed 'Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring'. They presented analysis of eye and head movements of vehicle drivers. The suggested model uses eye activity, and head movements to gain important knowledge on inattentiveness of the driver. A support vector machine (SVM) classifies video segments into two types-attentive or inattentive. This model has shown that it has high classification accuracy and low errors for different people and different genders in real world driving conditions.

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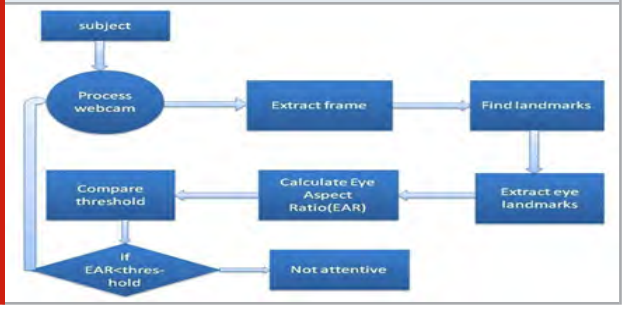
In the paper titled 'Driver Drowsiness Detection through HMM based Dynamic Modeling Eyosiyas Tadesse ; Weihua Sheng ; Meiqin Liu suggested a new technique of analysing the facial expression of the driver through Hidden Markov Model (HMM) based dynamic modelling to detect drowsiness. The model uses a simulated driving set up for the implementation of the algorithm.

MATERIAL AND METHODS

1. **Face detection:** Using a webcam we captured the video in the first step. It is then transformed into frames. Then we examine the faces from these frames. For the face detection, we used Histogram of Oriented Gradients (HOG) which is the object descriptor and Support Vector Machines (SVM) which is the classifier. Here the sliding window approach is used on the image. In this method we scan the frame horizontally and vertically. Once the image is scanned, we apply non-maximum suppression to get rid of multiple bounding boxes. These will give coordinates of faces.
2. **Facial Landmark Detection:** The shape predictor, which is a pre-trained model of dlib is applied. Through facial landmark detection, we get 68 points that map to the facial features in the face which is then converted from the dlib object to a NumPy array.
3. **Attentiveness detection:** The last part of the project was to detect whether a person is attentive or not. To check whether the eyes are closed or not we computed the eye aspect ratio (EAR). If the EAR< 0.3 for an adequately long amount of time, we concluded that the person is inattentive. Here p1... p6 are facial landmarks of the eye.

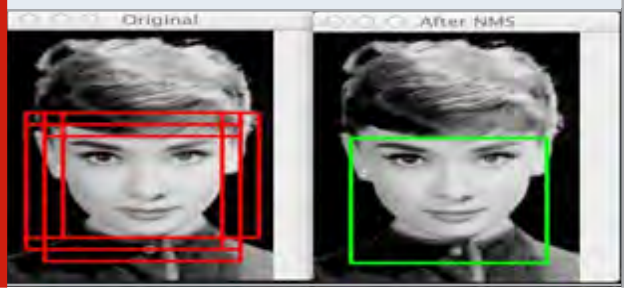
Figure 1: System architecture



Face Detection: Implementation of facial landmarks in real-time video streams, is similar to normal video streams. There are many methods to do so. One of them is the Haar Cascade classifier provided by OpenCV. Haar cascade classifiers are used to identify objects in an image or video. While cascade methods are very fast, they leave out many things that are desired. Another method for object detection (face detection here) is Viola Jones Detectors. But the problem with these detectors is that they are nearly 15 years old. Thus, here we use HOG and SVM for face detection because it can be used to train highly accurate object classifiers.

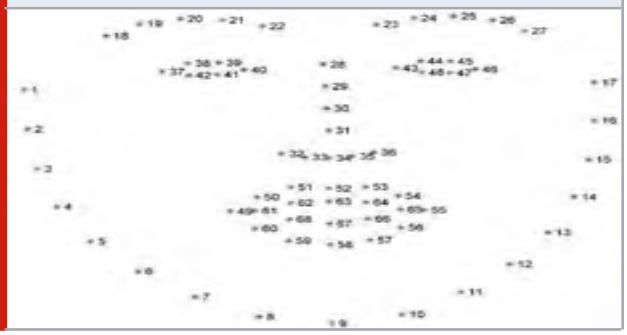
Histogram of Oriented Gradients (HOG) and Support Vector Machine (SVM): HOG is used as an object descriptor and SVM is a classifier. Positive samples are represented by P and negative samples by N. Here positive samples indicate images with faces whereas negative samples are those which do not have faces. Internally it uses sliding window technique. Once the image is scanned, apply non-maximum suppression in order to get rid of redundant and overlapping bounding boxes. In the non-maximum suppression method, we keep the largest bounding box and discard the others. The input image is then converted to a width of 500 pixels and further transformed to grayscale.

Figure 2: Non-maximum suppression to obtain one bounding boxes from many



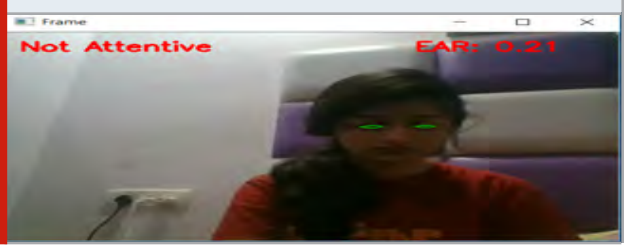
Facial Landmarks Detector: The shape predictor, which is a pre-trained model of dlib is applied, to get the points of the face regions. By applying facial landmark detection, we get 68 points that map to the specific facial features in the image. It is then converted to a NumPy array. The dataset- labelled iBUG 300-W is used here. Below is the figure illustrating the 68 points which are thus obtained by using the dlib extractor.

Figure 3: Facial coordinates being indexed to 68 points



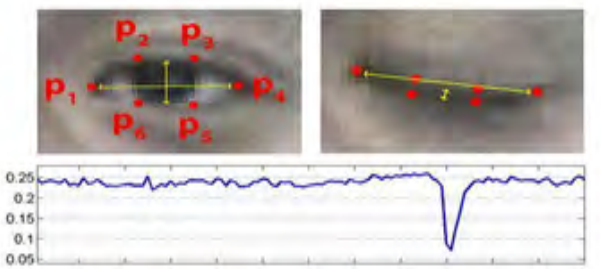
Attention Detection

Figure 4: Extracting the area of the eye from the face.



Now we have the eye regions, the eye aspect ratio (EAR) can be calculated to analyse whether the eyes are closed or not. A person is considered as un-attentive if the eye aspect ratio has indicated that the person's eye has been shut for a long time. EAR can be calculated using the SciPy package to formulate the Euclidean distance between the points mapped for the eye. We also use the imutils package, to make working with OpenCV easier. The EAR is computed as the ratio of vertical distances to horizontal distances of the eye landmarks. The EAR remains almost constant when the eye is open but rapidly reduces towards zero during a blink. When the eyes are closed, the value is much smaller as compared to when it is open.

Figure 5: EAR graph

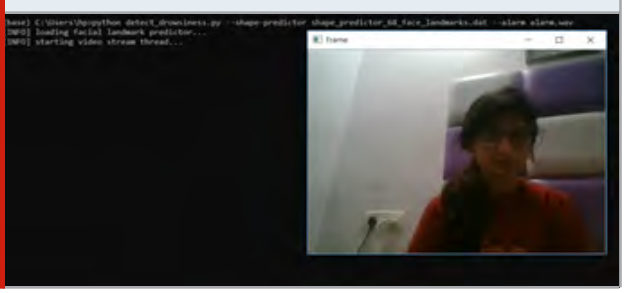


The above diagram shows an eye with the eye facial landmarks marked as p1,p2,p3,p4,p5,p6. The next diagram shows a closed eye. The graph shows a plot between the eye aspect ratio and time. Here in the diagram, the value of EAR is constant until we see a sudden drop. It means that when the drop is plotted, a blink motion is recorded. Here, we can deduce that if the EAR drops rapidly and then does not increase back to the original constant value, the eye remains closed continuously indicating that it is not a blink. If the EAR drops down below that particular threshold, we start incrementing the counter to count the frames for which the person's eyes are closed. If this goes above this threshold, we deduce that the person is not paying attention. The EAR formula is:

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Here p1, ..., p6 are facial landmarks.

Figure 7: Attentiveness model loading



Thus we conclude that if the EAR is dropped below this threshold, the person is dizzy which means he is not attentive. The EAR may differ due to closed eyes indicating that the person is asleep or tilted head movements all leading to the non-attentiveness of the person.

Implementation

Figure 8: Alert message popping up as candidate is not attentive

Figure 9: EAR being displayed along with alert message

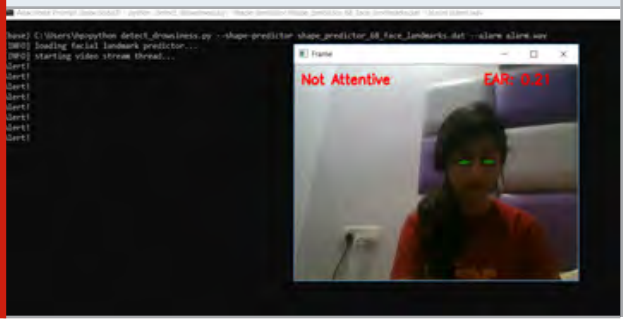
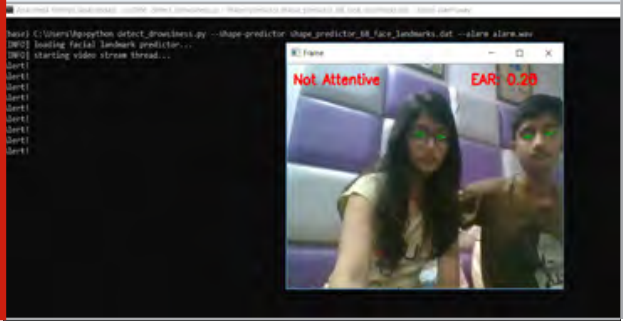


Figure 10: Attentiveness model for multiple people



CONCLUSION & FUTURE SCOPE

The model made by us suggests that it is very much possible to detect the attention of a person by analysing their blink patterns under the assumption that all individuals develop drowsiness in the same way. Our system has been proved effective in determining the attentiveness of a person irrespective of whether or not they wear spectacles. Other aspects of attention detection like head movements, body postures can also be taken into account to create a space wherein worrying

about the students' attention would be one of the least headaches to the teacher.

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Ph and NPK Sensor Based Soil Testing System

Dinesh B. Bhoyar[1], Amey Naik[2], Swati K. Mohod[3] and K. D. Kulat[4]

[1]*Assistant Professor, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India,*

[2]*PG Scholar, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India,*

[3]*Assistant Professor, Department of EL, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India,*

[4]*Professor, Department of ECE, Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India,*

ABSTRACT

Soil is the most important part of agriculture goods production. Therefore, it is important to know its quality and health. To know about the soil's health, we need to study various nutrients of soil. The nutrients not only help us to know the health of the soil but also helps us to know which crop to be planted in the soil. In this review, we will deal with developing a system that collects data from the soil. We will be using a sensor-based system that effectively suggest crops based on the data collected and analyzed. This system provide a cost-effective alternative for current chemical-based soil testing that is carried out in a laboratory and which may be out of reach of farmers that live in a remote area. This whole process may consume lot of time and may be sometime costlier.

KEY WORDS: SOIL HEALTH, SUGGEST BEST CROP, COST EFFECTIVE SYSTEM.

INTRODUCTION

The lack of information about the soil content affects the production of crop. This actually affects the returns of the farmer who has invested their time and money. Therefore, a system is required that can effectively tell about the crop to be planted and what care to be taken to make a good profit from production. Traditionally, the process of soil testing is done in a laboratory [D. B. Bhoyar, 2016] where it is tested chemically and results are then obtained which decides the crop that is suitable for the soil. The chemical testing method obtains mainly NPK and Ph from the soil [Nita Kamble, 2016]. NPK means Nitrogen, phosphor, and potassium. This a very important parameter. Therefore, it is important know the Ph content of the soil.

The farmers take the soil sample to laboratory then laboratory officials test the sample and obtain the above-mentioned parameters. This process is time consuming and also takes lots of efforts to obtain the values. Farmer may have to wait for weeks for the information about the soil. This may delay their agriculture process. Sometimes these laboratories are situated in remote areas where it becomes difficult for farmers to reach it. If they still want to access the laboratory, they need to courier it to laboratory. This very much time-consuming process. This also involves lot of money. For farmers money becomes the issue thus they have to settle with their previously planted crops. In this review we will study various parameters such as NKP, Phosphor, Zinc, and Sculpture ETC. We will purpose a system that is not only cost-effective alternative for obtaining values for above mention parameters but also will provide an effortless and less time-consuming alternative.

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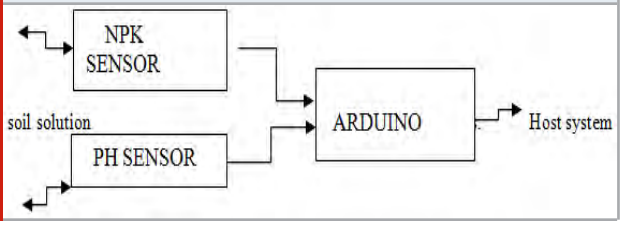
2. Related studies

a. Measurement of soil content using a PC (PERSONAL COMPUTER) and transducer-based system: This system is built using a bunch of transducers, multiplexers and a host personal computer. The transducers collect data and send it to computer via a line in multiplexers then processes it and produces a desired output. The main disadvantage of this type of system is its bulky nature and its portability. Such systems are immobile and cannot be taken out for soil testing. It also has complex nature because use of various transducer and multiplexers and its connection with the host system. These systems also require high level of calibration before actual process begins. This system is also a much costlier system and it up gradation even costlier. It also requires a costly software for effective data collection. The development of this type of system takes lot of efforts and time. This system may not be readily available in market. It also requires market analysis before being sold in the actual market. The transducer used in the system may not be available market as bulk production option. A high maintenance cost may be required to pay as well. The software requires a trained operator to operate it. Fault detection may sometime become a headache.

b. Trans receiver-based soil nutrients detection system: This system is based on the principle of detection of nutrients in soil with the help of Tran receiver chip that detects change in resistance affected by turbidity. Transmitting chip radiates certain radiation into the soil and receiver chip receives the radiation. Based on the radiation collected by the receiving chip the amount of nutrients is detected. Unfortunately, this system also suffers from certain drawbacks. They are, actual turbidity may affect the radiation reception and false values may be obtained. While diluting the soil sample with water resistance between soil contents may increase or decrease which give false value. The trans receiver chip are costlier hence cost of system in increased as they are manufactured with silicone wafer. It also includes a host machine to calculate and analyze the values.

3.Development of actual system: As per the study suggests all above systems have few pros and few cons. To overcome all the cons, we have purposed a highly accurate and precise system that can detect accurate values of nutrients present in the soil.

Figure 1: Block Diagram of Soil Testing System



a. Implementation of a ph and npk based sensor system: The system is comprised of a Ph and NPK sensor that are connected to a microcontroller unit that communicates with the sensors and obtains actual value of nutrients present in soil. The values are then used in a neural network-based[3][4] software which analyze them and suggests crops.

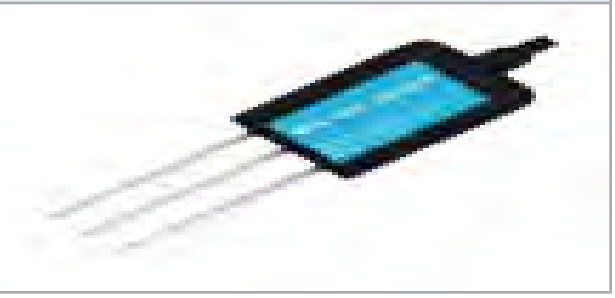
b. Block Diagram of the System

Introduction to sensors used

Figure 2: Ph sensor and its interfacing kit

a. PH Sensor

Figure 3: NPK soil sensor



A Ph sensor tell about the acidity and basicity of soil. The presence of H+ ions give information about acidity of the solution and HO- ions give information about basicity of soil. Ph value ranges from 1-14. PH value 1 is highly acidic and pH value 14 is highly alkaline. PH value 7 is considered as neutral value.

b. NPK Sensor

The above NPK sensor is capable of detection of Nitrogen (N), Phosphor (P), and Potassium (K). This sensor is dipped in the soil and electrodes come in contact with soil solution. An electric current of milli-ampere is then passed to the soil solution and it is read by its CPU unit to give actual values of NPK.

Figure 4: Arduino Board

c. Arduino Board

Arduino board is the main part of the system this actually interfaces Ph and NPK sensors and reads values from them and passes to the host system terminal. It is a board that has a microcontroller which can process 8bit of data. Fortunately, Ph and NPK sensor also provide data in digital form of 8 bits.

d. Host Terminal: The host terminal is basically personal computer that runs a software called MATLAB. MATLAB is basically a software program that contents a field called AI and machine learning which is useful in development of required system. The values form pH sensor and NPK sensor is obtained and provided to this software. This software analyzes the values and suggest crops according to the values entered.

CONCLUSION

In this review paper, we have studied different soil testing and nutrients acquisition machine. The goal of this paper was to provide an effective as well as efficient solution. For this we have purposed a highly precise and accurate system that not only obtains the nutrients from soil but also provide suggestion for the crop that are suitable for the soil.

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Performance Evaluation of Community Detection Algorithms in Social Networks Analysis

Prajakta Vispute[1*] and Shirish Sane[2]
[1, 2]*Department of Computer Engineering*
K. K. Wagh Institute of Engineering Education & Research, Nashik, India
affiliated to Savitribai Phule Pune University (SPPU), Pune, Maharashtra, India.

ABSTRACT

In social network analysis, community identification unveils properties shared by nodes like area of research, communication, common interest and many more. The evolving nature of social networks necessitates dynamic community detection methods. To handle the continuous change in data, improved community detection algorithms are introduced in various applications. To find communities in dynamic SNA, static community detection methods can be used to generate base communities, which then can be modified for dynamic data. This paper deals with selection of suitable algorithm for detection of communities from static data based on different performance parameters and thus could be used for efficient detection of dynamic communities.

KEY WORDS: COMMUNITY DETECTION, DYNAMIC COMMUNITY DETECTION, GRAPH MINING, NETWORK ANALYSIS.

INTRODUCTION

Various studies recently have emphasized on the social structure of individuals and their direct or indirect communication based on common relation of interests known as social networks [Lei Tang & Huan Liu, 2010] [Maryam pourkazemi et al., 2013] [Fortunato & Hric, 2016]. A group of people where each member is familiar with some division or other is known as a social network and the study of social networks to understand their structure and behaviour is known as Social Network Analysis. The data and information of social network is effectively represented by text, tables or graphs. By standards, a social network can be built up in an organization, educational institute, or among any group of people with the help of social interaction and building personal relationships. The module of networks studied comprises of a computer, biological, financial, medical, physical, and transportation networks and much more. The problem area includes the analysis of thoughtful structure of the networks, the development of such arrangements, and methodology data is transmitted inside the networks. There are various graphical representations used to show univariate data like pie charts, histograms, scatter plots, bar graphs, etc. The precise nature of the representation to be chosen depends on the data set and application. A significant and highly efficient way to visualize the social networks is 'graph'. Individuals or organizations communicating with each other are represented by nodes and communication between nodes is represented by edges. A Graph is denoted by G (V, E), where V denotes node and E denotes edges.

Some of the SNA [Cuvelier et al., 2012] tasks include centrality analysis, community detection and role analysis and outlier detection. One of the most prominent tasks used in many applications is Community detection [S. Fortunato, 2010]. The propensity of relating people of similar characteristics leading to the formation of groups are called communities. Community detection

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aims to segregate a cohesive group present in the network. Community detection [Michele Coscia et al., 2011] can be node centric, group centric, network centric or hierarchy centric. Depending upon the type of data and application, different types of community detection methods are used which include Hierarchical clustering, minimum cut method, modularity maximization and clique based methods. Communities can be advantageous in various fields such as searching a group of similar behaviour customers for marketing and recommendations, discovering protein interaction networks in biological networks, finding a common research area in collaboration networks, finding a set of students with common interests in an institutional network and so on.

In static approach, the network will be divided into different communities based on static graph. The relationship between nodes and edges will not change in static graph. The static clustering based on single time view of network does not depict the appropriate structure of social network and unable to cover all the necessary characteristics of a network. However, static graphs cannot represent the continuous change in real data. To handle the continuous change in edges and nodes, dynamic community detection methods are useful. A dynamic community detection method captures the ongoing change in node positions due to interactions between them in the network and updates the communities accordingly. At present this is one of the most noteworthy research topics in the field if SNA. Based on current work, in the field of dynamic community detection algorithm, more emphasis is given on processing the incremental data effectively. The first step of this class of algorithm detects communities and in a second step, updates the communities for new data. To detect communities in first step existing static community detection methods can be used. These detected communities derived from the first step will be updated in a second step to handle the incremental data.

There are a number of classic static community detection algorithms are available. Use of efficient static community detection algorithm in first step provides a good platform to process incremental data effectively. This study focuses on three classic static community detection methods and comparison between them based on different parameters. It is useful to recommend appropriate community detection algorithm for the first step of dynamic community detection. The rest of the paper is organized as follows: Section II deals with details of existing algorithms while datasets, parameters and details of experimentation is provided in section III. Section IV deals with the analysis of experimental results. The paper concludes with Section V and Section VI provides conclusions and future scope.

Related Work: Over the period of time relation between nodes and edges doesn't change in static community detection methods. However, in evolving networks, change in the data may change the community structure. A dynamic network captures change in node positions depending on the ongoing change of interactions in the network and updates the communities accordingly. It is very important to update the identified communities to increase its usefulness. One of the methods used to deal with dynamic community detection is called incremental graph mining. In incremental graph mining algorithm [Z. Zhao et al., 2019] [Javadi Saeed et al., 2018] [Mohammad Ali Tabarzad et al., 2018], graph is constructed using available data and communities are discovered in an initial stage. As the new data arrives, it was processed and updated in the graph without reconstructing the graph already constructed. Community detection methods (either static or dynamic) [Lancichinetti et al., 2009] [Cazabet & Rossetti, 2019] can fetch valuable information about the social structure. The rest of the section deals with three well known hierarchical community detection techniques for community detection using static data called Girvan Newman [Girvan & Newman, 2002], Blondel (usually referred as Louvain) [Blondel et al., 2008] algorithm and Label propagation algorithm [Raghavan et al., 2007].

Girvan Newman algorithm: Social network analysis [Girvan & Newman, 2002] uses variations of hierarchical clustering methods. It could be divisive or agglomerative. In divisive hierarchical clustering, initially complete network is considered and edges are deleted until the communities are formed. On the other hand agglomerative clustering algorithms, considers every node as a cluster. And merge the pair of clusters until all clusters merged into a single cluster. The Girvan-Newman algorithm is an example of divisive algorithm. This algorithm uses the concept of 'edge Betweenness'. The number of shortest paths passing through the edge defines the edge betweenness. Girvan Newman algorithm detects communities by progressively removing edge(s) with the highest edge betweenness. The algorithm begins with a single node, calculates edge weights for paths going through that node, and then repeats it for every node in the graph and sums the weights for every edge. To calculate edge betweenness, all shortest paths in the graph are computed. The Girvan Newman algorithm generates non-overlapping communities.

Louvain algorithm: The Louvain algorithm [Blondel et al., 2008] is agglomerative clustering algorithm and known as a greedy optimization method. It works in two steps, initially it checks small communities by local modularity optimization. The nodes belonging to same community are aggregated in a second step. It recursively merges communities into a single node until maximum modularity is attained. The modularity enumerates the quality of an assignment of nodes to communities. Louvain algorithm generates non-overlapping communities.

Label propagation: Label propagation algorithm [Raghavan et al., 2007] [Garza and Schaeffer, 2019] is also known as a localized community detection algorithm. Initially, a unique label is assigned to each vertex. Iteratively, each vertex obtains a label with the most recurrences in the neighbouring vertices. Finally, vertices with same labels are grouped as communities. The Label

propagation algorithm generates non-overlapping communities.

Datasets, Parameters & Experimentation: Four datasets, applied to the community detection algorithm named Enron dataset, DBLP dataset, Zachary's Karate club dataset and Facebook dataset. Initially datasets are processed to generate the information in the required form. Unnecessary data will be removed and datasets of required size depending upon the specified parameters are generated from this research. The data file is it iterated through each row, examining node1 and node 2 columns to create a pairwise combination of (u, v). As node 1 is connected to node 2, update the edge list and accordingly and an undirected graph is generated.

A. Enron email Dataset: Large set of email messages, the Enron email data contains email communications between around 150 employees of Enron Corporation from 1999 to 2002. For this work, emails exchanged for the year 2001 are considered. As existing dynamic community detection algorithms fetch the data month wise, January 2001 data will generate. It consists of employees (nodes), email communication between the employees (edges) and number of times two employees communicate with each other (edge weight). The dataset will be given as an input to classic static algorithms to find out communities and related parameters.

B. DBLP Dataset: DBLP stands for digital bibliography and library project. It provides a comprehensive list of research papers from various fields in computer science published over the years. It contains information of approx 1,632,442 research papers. It is also known as co-authorship network where two authors are connected if they publish at least one paper together. Common publication between two authors will be represented by an edge. Multiple edges between two nodes represents pairs of authors have written multiple publications together. This data set defines ground-truth community. The DBLP dataset has a massive list of publications. Data for the year 2000 is considered to generate the dataset. It consists of 357 Authors (nodes), 454 common publication details (edges) and number of times two authors publish paper together (edge weight).

C. Zachary's Karate Club dataset: Wayne Zachary collected the data from the members of a university karate club in 1977. It is widely used dataset in community detection research field. In the graph, member of the club is represented by a node and the communication between the two members of the club is represented by an edge. The data set considered here contains 34 members of the club and 78 ties between the members of the club. No multiple edges are present in this dataset.

D. Facebook Dataset: This dataset consists of friends lists from Facebook. This dataset shows the relationship between facebook users. Here interaction between 178 users (nodes) with 267 communications (edges) is taken into consideration. Parameters are calculated to understand the statistics of the data represented in the graph. The values related to the basic measures related to the datasets used in this research are as shown in table 1.

Table 1. Dataset Characteristics:

Dataset	# Nodes	# Edges	Average Degree	Graph Density
Enron	146	728	6.192	0.043
DBLP	357	454	2.543	0.007
Karate Club	34	78	4.588	0.139
Facebook	178	267	3	0.017

In case of non-overlapping community detection, network divides into groups of nodes with dense connections on the inside and sparser connections between groups. To understand the structure of data, degree distribution of the data set is produced. The degree distribution provides the number of nodes in the graph at each degree. The degree distribution d (k) of a graph or network is the fraction of nodes with degree k. So if there are n nodes in total in a network and q (k) of them have degree k, then d(k) = q(k)/n. Degree distribution of used dataset is shown in figure 1 to 4.

Figure 1: Degree Distribution Enron Dataset

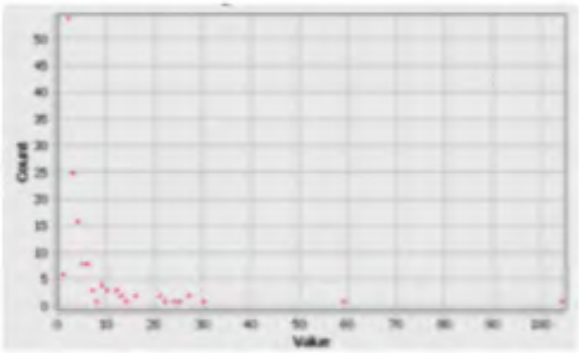
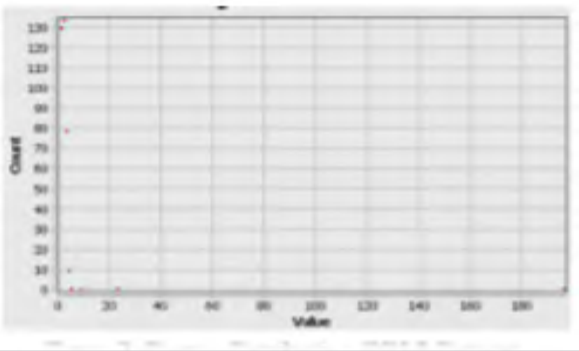


Figure 2: Degree Distribution DBLP Dataset



Degree distribution of Enron email dataset with 728 sent-emails between 146 emplyoees is shown in figure 1, DBLP dataset with 454 common publication details between 357 authors is shown in figure 2, Karate club data set with 34 members of the club and 78 ties between the members of the club is shown in figure 3, Facebook

dataset with interaction between 178 users with 267 communications is shown in figure 4.

Figure 3: Degree Distribution Karate Club Dataset

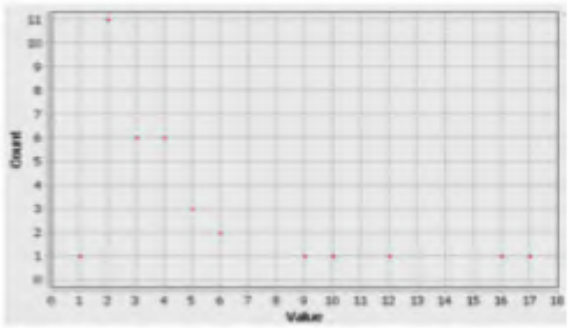
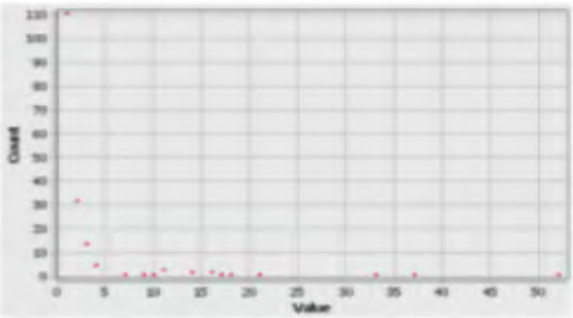


Figure 4: Degree Distribution facebook Dataset



In this research, non-overlapping algorithms like Girvan Newman, Louvain and LPA are used to detect the communities. These algorithms are applied to data sets from different domain to a range of degree distribution. Extracted communities are evaluated using different parameters. Basically a graph consists of vertices and edges. The size of the graph is the number of vertices in V, degree of a vertex is the number edge attached to it. The minimum possible degree of vertices is zero & maximum possible degree is n-1. Average number of edges per node in the graph specifies the average degree of a graph. The density of a graph G is the ratio of edges in G to the maximum possible number of edges in the G. Another community detection measure used widely is centrality.

It identifies the most important node or an edge within a graph. Calculate the degree of a node known as degree centrality. Depending upon the number of connected edges to a node degree centrality of a node can be measured. Average length of the shortest path between the node and all other nodes in the graph defines the closeness centrality. A node is considered to be close to all other nodes when the closest value of a node is high. Another commonly used centrality measure is betweenness centrality. There exist many shortest paths between nodes. An edge present on number of shortest paths is considered to be a connection edge between two communities. In a graph, connected components, i.e. communities can be derived by removing connecting edges. This concept is called edge betweenness. The concept of betweenness centrality can be applied to edges as well as nodes. The Girvan Newman algorithm is based on edge betweenness.

To characterize communities generated by an algorithm on the given data parameters like number of communities and modularity are used. As the number of communities increases the quality of community also increases as it provides more dense connected components and detailed information about the data. One of the important quality parameters is modularity [Girvan & Newman, 2002]. The strength of a community is measured by modularity. Modularity values can be positive or negative. A Positive value indicates presence of community. The Dense connection between the nodes indicates high modularity within the community, whereas sparse connections between nodes indicate low modularity. The general expression of modularity is

$$Q = \frac{1}{2m}\sum_{ij}(A_{ij} - P_{ij})\delta(C_i, C_j)$$

Where,
Q: Scalar valued function (ranges from -1/2 to 1)
m: the sum of the weights over all edges (in case of weighted graphs) and the total number of links (in case
of unweighted graph)
A_{ij} : Total number of edges within community
P_{ij} : Expected number of edges in community
C_i: The community to which node i is assigned.
Here, δ (C i , Cj) = 1 if $C_i = C_j$
$\delta(C_i , C_j) = 0$ otherwise

A significant difficulty with modularity approach is that it cannot detect well defined small communities when the graphs are extremely large. Details of experimental setup used for this work are as follows: All experiments were performed on core i5 @ 1.70GHz machine, 4GB RAM and 64bit operating system.

Experimental Results: Comparative performance of the three algorithms in terms of performance parameters such as number of communities, modularity and execution time is shown in Tables 2, 3 and 4 respectively for the benchmark datasets. The last rows in each of these tables show average values of the parameters. A number of communities provide insight into strongly connected nodes in the community.

Another significant parameter for evaluation of such algorithms is modularity. Community strength is measured by modularity. The community that obtains the maximal modularity is considered to be the best. Table 3 shows the modularity values generated by the algorithms for given datasets. Average of modularity with respect to the algorithm is provided in the last row.

Social network analysis needs to process large size data and thus the execution time of an algorithm is one of the important performance parameters. Table 4 shows the execution time required to identify communities by mentioned algorithms. To analyze the performance of community detection algorithm and come across the best algorithm average valuable 2, 3 and 4 are summarized in table 5.

Table 2. The performance of community detection algorithms in terms of number of communities (C)

Dataset	Algorithm		
	GN	Louvain	LPA
Enron	6	4	18
DBLP	218	217	217
Karate Club	2	4	3
Facebook	2	9	12
Average	57	58.5	**62.5**

Table 3. The performance of community detection algorithms in terms of modularity

Dataset	Algorithm		
	GN	Louvain	LPA
Enron	0.345	0.58	0.51
DBLP	0.99	0.99	0.99
Karate Club	0.359	0.41	0.32
Facebook	0.069	0.64	0.62
Average	0.441	**0.655**	0.61

From the experimentation using benchmark data sets with data of range of degree distribution it is observed that Louvain algorithm performs better than others in terms modularity. Louvain tries to optimize the modularity of network partition using greedy optimization. The modularity is first developed locally in small communities and then the smaller communities are considered as the nodes are aggregated into bigger communities iteratively until the maximum modularity is achieved. Maximum numbers of communities are detected by the LPA in the least amount of execution time. Also the modularity value generated using LPA is closer to the maximum modularity value obtained by Louvain algorithm. LPA is the simplest and time-efficient approach. Thus the overall LPA algorithm performs better than GN and Louvain.

Community analysis is carried out using different methods and parameters. The research on community analysis has different challenges as well, such as - use of community, networks with huge sizes, evaluation and visualization of communities and the need of effective identification. With the rapid growth in network sizes, detection of communities and extracting required information from them is therefore a challenging task.

Table 4. The performance of community detection algorithms in terms of execution time in seconds

Dataset	Algorithm		
	GN	Louvain	LPA
Enron	0.417	0.107	0.12
DBLP	0.05	0.131	0.022
Karate Club	0.069	0.017	0.007
Facebook	0.479	0.179	0.016
Average	0.254	0.109	**0.041**

Table 5. Average performance of community detection algorithms in terms of number of communities, modularity and runtime

Algorithm	Performance parameter		
	#C	Modularity	Runtime
GN	57	0.44	0.254
Louvain	58.5	**0.655**	0.109
LPA	**62.5**	0.61	**0.041**

To deal with these challenges good quality communities should be detected in first and foremost step in algorithms for dynamic community detection. Once communities are identified accurately, incremental data can be updated with respect to the identified communities. Among the different methods for detecting communities, the Girvan Newman algorithm is not very time efficient.

It is difficult to detect communities in large and complex networks effectively using Girvan Newman algorithm. Louvain is the most popular modularity optimization algorithm. However, its performance is not suitable for the base community detection in large dynamic social networks. Therefore, variations of Louvain algorithms like distributed [S. Ghosh et al., 2018] and parallel [Xinyu Que et al., 2015] approaches are used to deal with disadvantage of Louvain algorithm. Experimental results in this paper show that LPA performs better as compared to other algorithms for different parameters and datasets.

CONCLUSION

This paper addresses the issue of community detection in social network analysis. Community detection is one of the important aspects in static as well as dynamic data. In this paper, three well-known state-of-the-art community detection algorithms for static graphs are evaluated using four benchmark datasets. This work centered on the study of performance of algorithms for community detection with reference to different performance parameters. Experimental results bring out that Girvan Newman algorithm is not very efficient in case of large networks as compared to the other two algorithms. Louvain algorithm generates communities

with higher average modularity, but generates a slightly lesser number of communities as well as needed more execution time when compared with LPA algorithm.

The experimental results presented in this paper show that the LPA generates the maximum number of communities with modularity value closer to maximum modularity value generated by Louvain. LPA is the fastest community detection algorithm. Therefore, algorithm LPA could be useful for generating base communities in dynamic community detection algorithms for optimum processing of incremental data. In future, this research aims at using algorithms for static community detection for the efficient and accurate detection of dynamic communities.

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Comparative Study of Illumination Pre-processing Techniques using Histogram Equalization and its Application in Face Recognition

R. P. Dahake[1], M. U. Kharat[2] and S.V. Gumaste[3]
[1,2,3]MET's Institute of Engineering, Nasik, India

ABSTRACT

In the last decades, automatic face recognition has become more prominent in the wide range of applications including security, judicial investigations and law enforcement etc. For practical face recognition systems different challenges are lighting, posing, expression, ageing, occlusion etc. Changing the appearance of faces is due to various lighting conditions such as shadows and exposing the light on different parts of the face. Balanced illumination in face image helps to enhance its quality which is an important parameter to increase the rate of face recognition. A better quality image provides a better detection and recognition rate than poorly illuminated images. Extraction of features for face recognition is even more difficult with such images resulting in reduction of face recognition rate hence for overcoming this problem, illumination pre-processing techniques usually adopted before face detection and extraction of features from an image. In this paper the objective is to analyse performance of contrast enhancement techniques such as Histogram Equalization, Contrast Limited Adaptive Histogram Equalization and Contrast Limited Adaptive Histogram Equalization (CLAHE) with image entropy techniques for pre-processing of poor illuminated facial images. Further two basic techniques of feature extraction such as Principal Component Analysis and Local Binary Pattern and their hybrid approach for global and local feature extraction from images are utilized for evaluation on facial images. Yale B and extended Yale B datasets are used for experimentation. CLAHE with image entropy illumination pre-processing approach outperforms as compared to Histogram Equalization and CLAHE techniques. The very first noting is, initially face detection accuracy which is poor after applying illumination pre-processing improved, detection rate 81.66% is observed. Secondly using hybrid features of facial images and CLAHE with image entropy for illumination pre-processing has shown better recognition performance as 92% on cropped frontal faces of the same dataset.

KEY WORDS: ILLUMINATION, HISTOGRAM EQUALIZATION, PRE-PROCESSING, ENTROPY, FACE DETECTION, RECOGNITION.

INTRODUCTION

In the recent decades Automatic Face Recognition (AFR) has drawn a lot of attention because of the wide applications ranging in the vast areas like security, criminological assessment, and law implementation. The framework of the AFR system needs to face difficulties like changing facial appearance, varying lighting conditions, posture, facial expression etc. Changing lighting conditions for example shadows, over and under exposure of light on face pictures are vital issues that a practical face recognition system has to address. In fact light variations cause significant changes in the appearance of face image due that intra-personal differences can be larger than inter-personal differences (Y. Adini et al., 1997).

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Although various approaches have been proposed in the past decades for dealing with light variation's effect on the face. Illumination pre-processing is a very crucial step used in recognition of faces (Hu Han et al., 2013). Most of the works addressed the illumination problem in the field of AFR. A good survey is given in (X. Zou et al., 2007). Compared to the traditional face recognition method, illumination pre-processing is more popular in face recognition, because of its simplicity and feasibility. After applying illumination pre-processing, the output still provides a face image and various feature descriptors such as Local Binary Pattern (LBP) (Jiwen Lu et al., 2015; Di Huang et al., 2011) which can be applied after illumination pre-processing. There are a number of applications of face detection and recognition. Human Computer Interaction is an important domain nowadays. Human faces are the key element to interact with the smart system as well as hand gestures are also mostly used in such systems where accuracy and efficiency plays vital roles (R M Kagalkar et al., 2015).

Though the efficiency and accuracy of face recognition are important factors that have been reduced due to facial illumination variations. Traditional methods make it difficult to find a face if it has images with heavy shadows and over-exposure. For example Viola–Jones face locator (Paul Viola et al., 2004) fails under extreme light varieties. In these conditions, face identification strategies dependent on skin discovery procedures (S. Shan et al., 2003; B. Martinkauppi et al., 2003; Leyuan Liu et al., 2011; R.P Dahake et al., 2018) may be utilized to locate the facial skin zone.

Histogram Equalization (HE) based methods are simple and effective to use in image illumination pre-processing. Low contrast images visibility can be clearly enhanced with this technique as in (N.SiaPikKong et al., 2013) a good literature review is given and some of the extensions of HE can be classified into four groups. They are Mean Brightness Preserving HE (Kim Y.-T et al., 1997), Bin Modified HE & Local HE (S.M. Pizer et al., 1987). In Mean Brightness Preserving HE the idea of keeping the mean brightness of an image for consumer electronic product where as in Bin Modified HE modifies the shape of the image histogram by reducing or increasing the value in the histogram's bins based on a threshold limit before the equalization is taking place.

HE modifies the histogram for distributing the narrow range of gray scale values across the entire available range (Ranjan Parekh., 2006). In local HE multiple regions of image are considered. One of the variation of Local HE is Contrast Limited Adaptive Histogram Equalization. There are some approaches based on CLAHE which work on a limited number of images for deciding the clipping and other parameters using entropy curve (Byong Seok Min et al., 2013) towards enhancing image contrast. Authors in (G. F. C. Campos et al., 2019) have provided a learning-based hyper parameters selection technique for the CLAHE. In this paper, a comparative study on HE, basic CLAHE and CLAHE with image entropy is done, further analyzing impact of illumination pre-processing in the application of face recognition. There are two important parameters of CLAHE clip limit (CL) and block size (BS) which play an important role for contrast enhancement. The strategy for deciding these two parameters with a concept CLAHE with entropy of image is adopted.

For the determination of face matching algorithm basic techniques like Principal Component Analysis (PCA) (M. Turk et al., 1991; Chris Solomon et al., 2010) and Local Binary Pattern (LBP) (Di Huang et al., 2011) are largely used facial feature extraction, one of the best in class strategies (W. Zhao et al., 2003) are selected. Moreover, two public face database Yale B (A. S. Georghiades et al., 2001) and extended Yale B (K.C. Lee et al., 2005) for analyzing impact of illumination in face recognition are utilized. Comparative analysis of face recognition methods is done on these dataset. The paper is divided as Introduction in section 1, Importance of Readings and Observations in section 2. Section 3 provides details of adopted pre-processing approaches for contrast enhancement in face recognition. In section 4 experimental strategy is given. Section 5 provides result analysis and discussions. Section 6 contains conclusions followed by references.

2. Importance of Readings And Observations: There are countless illumination pre-processing techniques in the literature. Illumination pre-processing approaches are assembled into three classes: Gray-Level Transformation, Gradient and Edge Extraction, and Face Reflection Field Estimation (Hu Han et al., 2013). These methods are elaborated in section 2.1, 2.2 and 2.3. Followed by some of the important observations of recent work under these categories.

2.1 Gray-Level Transformation: In this method the guidelines for pre-processing is to play out a pixel-wise intensity planning to map using one particular transformation function. After this, the distribution of intensities in a face picture is carried out so that the unbalanced illumination can likewise be adjusted. Linearly or non-linearly the transformation functions are utilized. The non-linear transformation is more viable, the methods like Logarithmic Transform (Y. Adini et al., 1997), Histogram Equalization (HE) and Gamma Intensity Correction (S.Anila et al., 2012) can be viewed as methods in non- linear category of Gray-Level Transformation.

2.2 Gradient or Edge Extraction: This method is based on extraction of gradients or edges for illumination pre-processing on the face. Brightening pre-processing considers gray-level gradients or edges and boundaries of objects which plays a very essential role for identification. Approaches like Directional Gray-scale Derivative and Laplacian of Gaussian (Y. Adini et al., 1997) are under this category and they are dependent on gradient and edge highlights.

2.3 Reflectance Field Estimation: In this method brightening pre-processing is to gauge the face reflectance field from a two dimensional face picture.

Clearly, the face reflectance field is light invariant. For example a reflectance-brightening model which speaks to a face picture as the result of face reflectance and light segment. Some of approaches under this category are Logarithmic Total Variation and Self Quotient Image (SQI).

Numerous pre-preparing techniques work absolutely to determine all around controlled light varieties, yet acknowledgment in uncontrolled circumstances is one of the most significant bottlenecks for viable face acknowledgment frameworks (X. Tan et al., 2010). In (W. Chen et al., 2006) Discrete Cosine Transform is employed to compensate for illumination variations in the logarithm domain space. Authors in (J. Ruiz-del-Solar et al., 2008) have worked on the Self- Quotient Image and demonstrated that the most appropriate techniques for achieving light compensation and normalization using eigenspace for recognition of faces are (SQI) and the modified LBP transform. Whereas authors in (X. Xie et al., 2008) a single face image is first decomposed into large -and small –scale feature images using logarithmic total variation.

Ping-Han et al. proposed the Orientated Local Histogram Equalization technique. This technique uses the edge orientations for compensation of illumination (Ping-Han Lee et al., 2012). Regardless of the accomplishment of these algorithms, as per analysis of authors in (H. F. Chen et al., 2000) there are no discriminative functions of images of objects that are in variant to illumination.

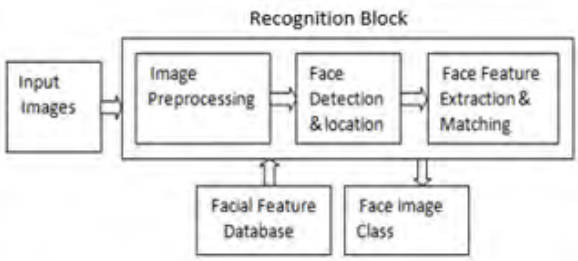
Histogram Equalization (HE) is many times valuable for contrast enhancement, only the thing is, it functions admirably just when the face picture is darkened globally. CLAHE and Local Histogram Equalization (LHE) (S. Pizer et al., 1990) are more powerful in repaying local lighting varieties. CLAHE is proposed by the author in (K. Zuierveld 1994), its two important parameters are block size and clip limit. These parameters are basically used for controlling quality of image, but the user determines them heuristically. CLAHE was originally developed for medical imaging (S.M. Pizer et al 1987). One of the modified CLAHE approach for auto defining clip limit is (Jharna Majumdar et al., 2014) where authors have worked on enhancement of aerial, medical and underwater images using modified CLAHE techniques. Method of image enhancement with brightness preserving histogram equalization with maximum entropy is given in (C. Wang et al., 2005).

An approach using enhancement in CLAHE technique is proposed to provide a face recognition system that is useful for invariants of illumination. Block Size 8X8 & clip limit 0.01 are applied and testing of work on simple and elementary image dataset is done (A. Thamizharasi et al., 2016). In the CLAHE method for getting satisfactory results the correct block size and clip limit need to be determined. Work in the paper is towards this direction with evaluation of low contrast facial images.

3. Contrast Enhancement For Face Recognition: Illumination pre-processing is one of the essential steps in face recognition frameworks as shown in Fig. 1. Face recognition block contains a series of steps. One of the important steps is detection of faces. If the input images are provided with very low contrast and visually dark as shown in Fig. 2 then illumination pre-processing is must for successful face detection otherwise lighting variation also affects detection performance. In most of work illumination processing is carried before the feature matching phase in the framework, but in this work it is also applied before detection of faces with the novel thinking that lighting variations impact on faces. It degrades not only the face recognition performance but it also reduces the face detection accuracy. It is the initial step in a face recognition block.

In the face recognition framework illumination pre-processing applied before detection and feature matching phase. Three illumination pre-processing techniques independently processed namely HE and basic CLAHE and CLAHE with image entropy. When CLAHE with image entropy pre-processing used then initially finding the range of entropy values of every image in the dataset, the second step is applying CLAHE. However, this method relies on two essential parameters: the block size and the clip limit which are defined in further sections. For face detection Viola Join face detector is used. For feature extraction selected techniques are PCA and LBP as well as hybrid features of combining these two methods. A holistic approach is used for the entire face area and Principal Component Analysis is to represent feature space.

Figure 1: Face Recognition Framework

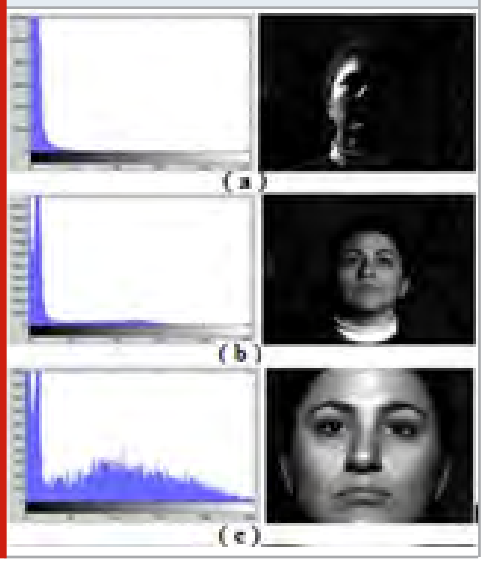


Local features of facial components like eyes features are extracted from face for performing hybrid approach. Both local and global features are considered just like a human identity system uses both local features and full face regions for recognizing a face, the machine recognition system also uses both features. Input images are from more challenging facial dataset Yale B and extended Yale B containing a huge set of images with a large range of contrast and intensity variations. These set of images are input to the face recognition block. Matching between facial features database images and testing probes using Euclidean distance measure. Finding the face image class is recognizing the specific subject image from the dataset. Further in section 3.1 exploring the entropy of image, image histogram. Illumination

pre-processing approaches for enhancing the contrast of dark facial images namely HE, CLAHE and CLAHE with image entropy are explained in following sections 3.2, 3.3, 3.4.

3.1 Image Entropy: The shape of the gray level histogram can provide an idea about the overall appearance of the image. For an illustrative face from extended Yale B dataset and corresponding histogram of the face image is shown in image Fig 2. The first two are the actual face images with their relevant histograms i.e. (a), (b) and (c) is the cropped face from the corresponding image. An image with a positive-skew gray level histogram looks brighter than with a negative-skew gray level histogram because the total pixels with higher gray values in the previous image is greater than the latter image. If there are L gray levels with probability p_i associated with i^{th} event (i =0,1,2...,L-1)such that Σ_(i=0)^(L-1) $\Sigma_{i=0}^{L-1} p_i = 1$, then the entropy or information content can be defined in eq. (1).

Figure 2: An Illustrative face images from extended Yale B dataset (a) dark face image with its histogram, (b) dark visible face image with its histogram, (c) bright image with cropped face and its histogram



Entropy of grayscale image I is represented by E, a scalar value. It is a statistical measure of randomness and used to characterize the input image texture value (R. Gray., 1990, C. Wang et al., 2005, Byong Seok Min et al., 2013).

$$E = -\sum_{i=0}^{L-1} p(x_i)\ log\ p(x_i) \quad (1)$$

Here $p(x_i)$ is the normalized probability of the gray level xi. The entropy is maximal when $p(x_i)$ is constant. When the incident frequency is the same across all gray levels, entropy is increased in the image. That is, the gray level histogram will be uniform. The Gray level histogram reveals the overall appearance of the image (B. Chanda et al., 2009).

3.2 Histogram Equalization: The main idea of HE is to redistribute the gray-level values uniformly (M.Anji Reddy et al., 2009). The contrast of the grayscale image indicates how easily objects in the image are recognizable. High intensity images have several different intensity values where low contrast images have low intensity values. In Histogram Equalization, contrast enhancement is proportional to the histogram's height at that intensity. Cumulative Density Function (CDF) is calculated by eq. (3). For making a uniform intensity distribution HE re-maps the gray levels of input image by re-assigning intensity values of pixels (Rafael Gonzalez et al., 2009; Anil K. Jain., 2008). The process of histogram equalization is as follows (Kim Y.-T., 1997)

Image I = {I(i, j)} and denoting the L discrete gray levels as{ I_0 ,I_1 .....I_{L-1}} ,an intensity of $I_{(i,j)}$ at the spatial location (i, j) and I ($_{i,j}$) ε{ I0 ,I_1 .....I_{L-1}} and p(Ik) is Probability Density Function(PDF) as defined in eq. (2).

$$p(I_k) = \frac{n^k}{n} \quad (2)$$

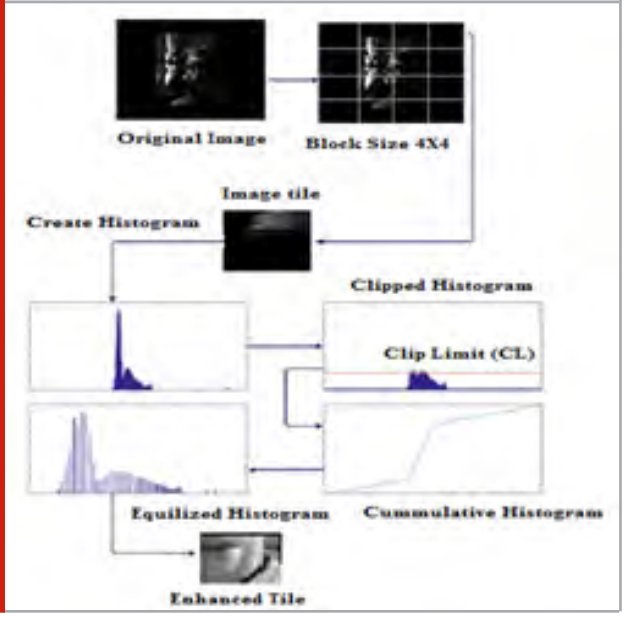
for k =0,1,...,L - 1, where n^k represents the number of times I_k appears in the given image I and n is the total number of samples in the image. I_k associates with histogram of a given image which represents the number of pixels with intensity I_k. A plot of n^k vs. Ik is referred to as histogram of I. C(x) is defined on the basis of PDF.

$$C(x) = \sum_{j=0}^{k} p(I_j) \quad (3)$$

Where X_k= x, for k=0, 1,..., L – 1 and $C(X_{L-1}) = 1$ by definition. As HE maps input image into the entire dynamic range, (I_0 ,.I_{L-1}) by using CDF as a transform function as defined in eq. (3). HE is based on the whole information of the input image to implement, the local details with smaller probability would be less enhanced.

Contrast Limited Adaptive Histogram Equalization(CLAHE): CLAHE is another technique for contrast enhancement for poorly illuminated images. It is one of the Adaptive Histogram Equalization approaches. Several histograms are called sub histograms, for emphasizing local contrast, instead of overall contrast. Fig. 3 represents basic steps of CLAHE using a sample image. CLAHE divides the images into equal regions. These regions are also called tiles. Number of tiles are specified by block size. Histogram of every region is generated by eq. (2) further it applies the histogram equalization to each region. The histogram is clipped to a predetermined value before calculating CDF described by eq. (3) and therefore limits the CLAHE amplification. CLAHE overcame the limitations of standard histogram equalization. The two key parameters: block size and clip limit are mainly used to control image quality which has been heuristically determined by users.

Figure 3: Process of Contrast Limiting Adaptive Histogram Equalization.



Algorithm 1 is basic CLAHE, Clip limit is the histogram clipped value and it depends on the generalization of the histogram and the size of the neighboring area. This performs uniform distribution of grey values which helps for providing a more visible image with hidden features. The full grey spectrum is utilized for expressing the image.

Algorithm 1: Basic CLAHE
begin
Input: face image
Output: image with improved contrast
(Parameters: CL= 0.01, BS 8x8)

1. for all tiles of an image
2. Extract single image region
3. Perform Histogram equalization on each tile using a pre-defined clip limit.
4. Interpolating gray level effects at the join boundaries of region to assemble the final image
5. Image with improved contrast

end

CLAHE works on tiles, instead of the whole face picture. It calculates the contrast transform function for each tile independently. Each tile's contrast is improved, so the histogram of the output region approximately matches the histogram determined by the distribution value which is considered as uniform. CLAHE other parameters such as distribution type, bin size etc. are need to set for the same. The neighboring tiles are then joined utilizing bilinear interpolation to eliminate artificially induced boundaries. The contrast, particularly in homogeneous regions, can be restricted to avoid intensifying any noise that may be available in the face picture. The ultimate result of CLAHE depends on the CL value picked by the user, if default values are used then for varied low contrast input images may not be adaptively adjusted.

3.4 Contrast Limited Adaptive Histogram Equalization with Image Entropy: Clip limit is a contrast factor that prevents oversaturation of the image specifically in homogeneous areas. These areas are characterized by a high peak in the histogram of the particular image tile due to many pixels falling inside the same gray level range. In basic CLAHE pre-processing approach the values of two parameters clip limit and block size are heuristically selected by user for avoiding this trial basis input of these parameters, in CLAHE with entropy pre-processing for contrast enhancement is adapted. Algorithm 2 provides details for determining clip limit for the CLAHE technique. Image entropy calculated as per described in eq. (1). Clip limit is decided from the entropy value which is considered a quality parameter for a given image. Initial CL value can be incremental with step value given. Clip limit is determined at the saturation point of the entropy value of the image. As shown in Fig. 4 in the plot of clip limit verses entropy value of image, for the given value of block size as increases clip limit, with that, the value of image entropy after some initial values it remains constant for further change in the value of clip limit at this saturated point CL is determined.

Algorithm 2: CLAHE with Image Entropy

begin
Input image file
Output: image with improved contrast
Initialize all input parameters of basic CLAHE
CL = 0.01, BS = 4x4,
Array of entropy values: entropy,
Step value: incremental value

1. Read image
2. Calculate image entropy by eq. (1)
3. Store entropy value
4. Increment value of CL by stepvalue
5. Repeat step 2 and 4 till entropy value remains constant (Comparing previous one value)
6. Sort all the entropy value and CL values
7. Select CL at maximum value of entropy
8. Process CLAHE on image
9. Repeat step 1 to 8 for all images
10. end

4. Experimental Strategy: Following sections (4.1, 4.2 and 4.3) provides dataset detail, process of experimentation and result analysis and discussion.

4.1 Dataset Details: For evaluation of the illumination pre-processing approaches discussed in this paper Yale B and extended Yale B datasets are used. In Yale B dataset a total 10 individual facial images are provided, each individual's images are captured under 64 various lighting conditions. Total 9 pose or viewing angles are there with frontal face as pose 0. Extended Yale B consists of 16128 face images. There are 28 different

individual's facial images. These images were captured under the same illumination conditions as the images in Yale B. For further evaluation a combined Yale B and extended Yale B data set is formed. It contains faces of 38 individuals.

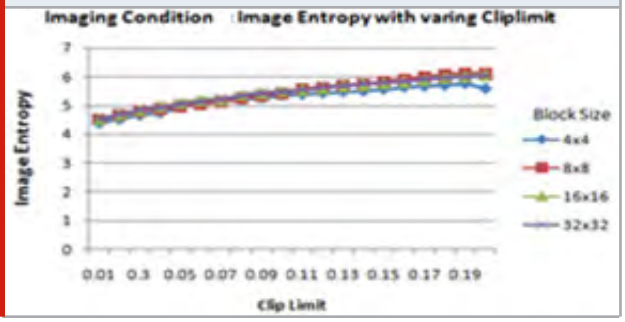
4.2 Process of Experimentation: Experimentation is carried out in two phases initially pre-processing techniques HE, Basic CLAHE with fixed parameters CL=0.01 and BS=8X8 and CLAHE with entropy applied independently then the evaluation process for face detection and recognition of facial images is carried out in second phase. Setup for implementation: Matlab on 64 bit operating system with Intel(R)Core(TM) i7-7500U CPU @2.70GHZ and RAM: 8.00 GB.

In table 1 two important parameters details are listed used for pre-processing for CLAHE with image. Block size is a two-element vector. It's a positive integer specifying the number of tiles by row & column. Product of row and column is consider as the total number of tiles. A clip limit is real scalar in the range [0 1] in Matlab and others. That specifies a contrast enhancement limit.

Table 1. Key Parameters Range of CLAHE with Image Entropy

Symbol	Parameter	Range	Step
CL	Clip Limit	[0,...,1]	0.01
BS	Block Size	[4,...,32]	2

Figure 4: Image Entropy with varying clip limit



4.3 Experimental Results: In the selected dataset there are 64 varying illumination conditions for each pose so we observed entropy values for various imaging illumination conditions as well as the entropy value with all possible values of clip limit up to the saturation level. Illustrative graphical representation is shown in Fig. 4. Initially the value of BS is kept constant at BS=4x4 & CL value is varied to 1 Then the experimentation is repeated for the value of BS=4x4, 8x8, 16x16 and 32x32. A saturated point is shown for deciding the clip limit for this approach. An exemplary image with a particular illumination condition which is having very low entropy values and thus the image under such illumination conditions are more difficult to detect and recognizes. Thus for face detection and recognition appropriate CL value is to determine on the basis of entropy values of that image.

Darker images have less visibility as shown in Fig. 5 (a). 5 (b) is a face image after Histogram Equalization. This image is visible but due to over amplification some local details are lost, 5(c) basic CLAHE preprocessed image is shown with fixed parameters values CL= 0.01 and BS = 8x8. From Fig. 5(d) to 5(h) CLAHE with image entropy for illumination pre-processing with changing values of CL 0.01 to 0.1 and fixed BS =4x4 on same the input image showing enhancement in visual appearances.

Table 2. Varying illumination and pose face detection performance on extended Yale B dataset

Table 2. Varying illumination and pose face detection performance on extended Yale B dataset

Image Set	Method of Illumination Pre-processing	Detection Accuracy (%)
Set0	Before Pre-processing	67
	Histogram Equalization	91
	CLAHE With image Entropy	91
Set 1	Before Pre-processing	61
	Histogram Equalization	78
	CLAHE With image Entropy	77
Set 2	Before Pre-processing	60
	Histogram Equalization	72
	CLAHE With image Entropy	77

In phase two experimentation after pre-processing is performed and performance of pre-processing methods of face detection using three methods without pre-processing, using Histogram Equalization and using CLAHE with image entropy with respect to changing illumination and pose is analyzed. So for detection purposes extended Yale B dataset images are divided into three sets which are set 0 in , set 1 and set 2 based

on various illumination conditions total 64 and pose of subjects in images. Set 0 contains frontal face images as well as 1 and 2 are with similar illumination condition with varying poses with 12 and 24 degree. As shown in table 2 face detection accuracy gets decreased with varying illumination and changing pose of subject.

As shown in table 3 average detection accuracy on the extended Yale B dataset is significantly improved using CLAHE with image entropy method than before pre-processing detection of faces. Experimental results show significant advantage against non-pre-processed detection of faces from the images in extended Yale B dataset. This is due to the effect of different illumination conditions initially facial parts are unclear and have a shadowing impact on them after the illumination pre-processing these features like eyes and others are more clearly visible and thus more number of faces are successfully detected.

Face recognition is performed using PCA, LBP and Hybrid approach. Hybrid approach provides better results than the individual method as in this approach the integrated facial features of PCA with LBP are utilized. Calculating the global feature using PCA and getting the local or texture features of facial parts likes eyes and using them in training and testing of the faces. Face recognition performance is as shown in table 4. Recognition results on extended Yale B dataset using preliminary Histogram Equalization approach and hybrid approach as recognition method are listed where hybrid approach with CLAHE with image entropy for illumination method in this work has shown improved performance of 5.8%.

CLAHE with clip limit 0.01 and BS=8x8 is basic CLAHE. Table 5 shows details of evolution using basic CLAHE and another approach CLAHE with image entropy based illumination pre-processing. Input images are cropped frontal faces from both of the dataset. From the different recognition methods for evaluation, Hybrid approach of feature extraction and CLAHE with image entropy as illumination pre-processing provides higher performance as compared to other approaches.

Table 3. Face detection performance on extended Yale B dataset

Illumination Pre-processing Method	Average Detection Accuracy (%)
Before Pre-processing	62.66
Histogram Equalization	80.33
CLAHE with Image Entropy	81.66

Table 4. Face recognition performance on extended Yale B

Dataset	Recognition method for evaluation	Illumination Pre-processing Method	Recognition Rate (%)
Extended Yale B Dataset	Hybrid(PCA and LBP)	HE	74.9
	Hybrid(PCA and LBP)	CLAHE with Image Entropy	80.7

Table 5. Face recognition Performance on Yale B & extended Yale B

Dataset	Recognition method for evaluation	Illumination Pre-processing Method	Recognition Rate (%)
Frontal faces of combined dataset	PCA	Basic CLAHE	79.2
	LBP	Basic CLAHE	84.1
	Hybrid(PCA and LBP)	Basic CLAHE	85
	PCA	CLAHE with Image Entropy	85.7
	LBP	CLAHE with Image Entropy	86.3
	Hybrid (PCA and LBP)	CLAHE with Image Entropy	92

RESULTS ANALYSIS AND DISCUSSION

In Histogram Equalization it is observed that, it over amplifies certain areas and increases the contrast of background noise, while decreasing the usable signal in some face images. Some of the failure cases of face detection are non- face like face image background or single eye on face are wrongly detected as faces. Further exceed amplification producing a lower performance in face recognition as compared to CLAHE pre-processing method. In basic CLAHE histogram is cut at some extent further HE is applied for improving local contrast of image. To avoid the amount of over implication, the peak of the histogram in every tile is truncated. In basic CLAHE here applied CL and BS parameters are fixed though illumination conditions are varying so noticeable visual improvement not able to produce. Whereas CLAHE with image entropy is adaptable to select CL value with the help of entropy of image in different imaging conditions. It is observed that BS has least impact on entropy value ultimately on quality of image.

In the analysis it shows that as CL increases with the step value the quality metric entropy parameter initially is increasing but after certain values it reaches saturation and remains constant throughout the scale. Thus selecting the saturated point CL value. This analysis of visibility along with the corresponding entropy of input images helps improve face detection and face recognition results. For most of the very low contrast images the observed average range of entropy value approximately with minimum and maximum as depicted in Fig 4. with varying illumination conditions. As dataset images are mostly dark and low contrast, which can be vary for other set of input images. As entropy provides the information about richness of content in the image, most of the lower range image entropy are observed for very dark and low contrast images whereas the range increase towards maximum value with better visibility and good contrast in the image. The important noting is that after the saturated point clip limit if it increases then thought the entropy remain in the same range but the over amplification and unbalance contrast effect is added in the image. So the clip limit selection is very decisional at the first saturated point of entropy.

Location of the human faces in the image can be found by using Haar features. A common universal property about all human faces is related to their facial features like the region of eyes is darker compared to its neighbor pixels and the region of nose is brighter as compared to eye region is benefited for local feature extraction. But in face detection phase some of the detection portion of the eye, upper head portion, and lower neck portion are falsely detected as faces. When in the datasets where their separation is not on the highest variance, then the use of the most important components of PCA will not work. One limitation of the basic LBP operator is that its small 3x3 neighborhood is unable to capture dominant features with large scale structures. Thus compared to individual methods PCA and LBP of feature extraction hybrid features of these techniques perform better using CLAHE with image entropy pre-processing approach for face recognition.

CONCLUSION

Illumination pre-processing is an effective approach for elimination of lighting variations before face detection and recognition. Representative illumination pre-processing approaches Histogram Equalization basic or fixed Contrast Limited Adaptive Histogram Equalization and Contrast Limited Adaptive Histogram Equalization with image entropy are analyzed briefly with respect to facial images. These approaches are evaluated for face recognition in various illumination conditions on Yale B and extended Yale B datasets.

With the use of CLAHE with image entropy method for illumination pre-processing significant improvement is observed in face detection and recognition for Yale B and extended Yale B dataset images. The face detection performance for illumination variation with pose variation image is low compared to the frontal images with same illumination condition. As the pose changes with the same illumination condition face detection performance decreases it is due to illumination impact on different facial parts. In face detection before any illumination pre-processing detection rate is 62.66% whereas after applying illumination pre-processing using CLAHE with image entropy, it is improved up to 81.66%. Face recognition on extended Yale B using hybrid approach of Principal Component Analysis and Local Binary Pattern and CLAHE with entropy illumination preprocessing is tested and it is observed improvising recognition performance as compared to Histogram Equalization illumination preprocessing. Hybrid approach applied on cropped frontal faces.

These faces are pre-processed using CLAHE with image entropy. It has shown better recognition performance as 92%. The results for illumination pre-processing are noted which eliminate the lighting variation before face detection and recognition. From the experimental analysis CLAHE with image entropy illumination pre-processing approach outperforms than Histogram Equalization and basic CLAHE illumination pre-processing techniques. It is observed that pre-processing on images has significant improvement in the performance of detection and recognition. Thus illumination pre-processing before face detection and feature extraction process for low contrast and dark images is a very essential step which provides improved performance. In this work the main focus is for improving visibility of low contrast images towards face recognition. Still for performance enhancement significantly in changing illumination condition with respect variation of poses, blending of various approaches under the Gray Level Transformation and other methods can be studied and planned for implementation as future work.

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High Performance Processing of Satellite Data Using Distributed and Parallel Computing Techniques

Lalit B. Damahe[1], Sanket S. Bramhe[2], Nilay C. Fursule[3], Ram D. Shirbhate[4], Pournima S. Ajmire[5], Girish Kumar[6]

[1,2,3,4,5]*Department of Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur, India*

[6]*Scientist Engineer, RRSC-Central, ISRO, Nagpur, India*

ABSTRACT

In today's world of technological revolution when the volume of the data is increasing enormously coincided with the growth in technology, it has become crucial to process and store data adroitly. Due to increasing demand of high processing speed, the traditional methods of processing satellite data have become incompetent. This propelled the need for high performance computing, which is the ability to process data and complex calculations at an accelerated speed effectively and accurately. It takes prolonged time for batch processing of satellite images which acts as the foundation of analysis developments in many technological and geological fields. In this paper, presented, a proposed distributed and parallel computation solutions for satellite image processing and computation of various indices normalized difference vegetation index that improves the performance of the system. By taking advantage of apache spark and cluster computing techniques real-time high-speed stream processing of satellite data is achieved. Some main features are discussed comprehensively about apache spark cluster formation, distributive and parallel computing methodologies, calculation and processing of indices with satellite data of Landsat 5. Also, python programs for processing of satellite data of Landsat 5 are executed and their results are presented in terms of processing speed and time.

KEY WORDS: APACHE SPARK; DISTRIBUTIVE COMPUTING; HIGH-PERFORMANCE COMPUTING; PARALLEL COMPUTING; SATELLITE DATA.

INTRODUCTION

Most important method for directly obtaining information on the Earth's surface is remote sensing. Remote sensing information frequently vary features with respect to their resolution, spectrum, mode of imaging and revisited cycle (Liu, 2015) which plays a vital role in many fields of research. the possibility to gain remote detecting information has been created to a striking level. For a huge ground station, the volume of universal data archive could be on Exa-byte level (Liu, 2015) which makes it imperative to process it capably. Real-time high-speed stream processing demand of satellite data can never be achieved using traditional systems. Parallel computing techniques and multicore technologies were acquired to generally speed up the computing, execution and processing efficiency, for this various parallel and distributed techniques are used.

High-performance Computing HPC) is the supercomputers application that solves computational problems that are either huge for traditional computers or time consuming. Unlike desktop PC's with single processing chip, HPC system is network of nodes with multiple processing chips and memory. HPC satisfies the demand of increasing processing speed. HPC innovation is executed in several multidisciplinary fields. HPC works on high-data transfer capacity, low-latency network to connect numerous clusters and nodes. In parallel system, numerous

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processors correspond with one another utilizing a mutual memory however in distributed system, numerous processors with individual memories are connected by network communication.

Distributed Computing: In the distributed computation as shown in figure 1, multiple computers with individual memories communicate with each other in network to perform computation tasks efficiently. Numerous processors correspond with one another using message passing techniques in the cluster (Distributed and Parallel computing, 2020) in distributed computing. Coordinating heterogeneous applications that are established and works with various operating systems and technologies, many applications having shared communal assets, a solitary occurrence administration being reused by numerous clients, and using same user interface for many functions are some of the capabilities of distributed system.Advantages of Distributed Systems are as follows:

Figure 1: Distributed Computing Architecture

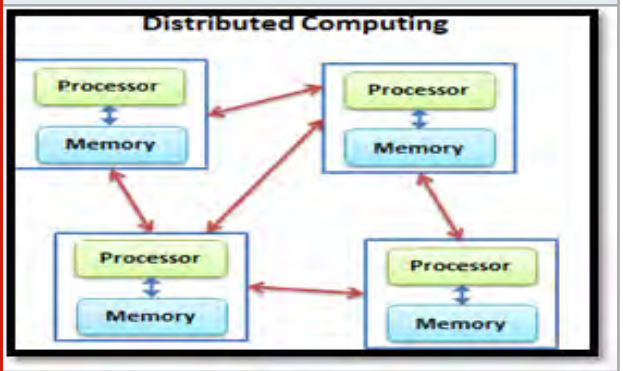
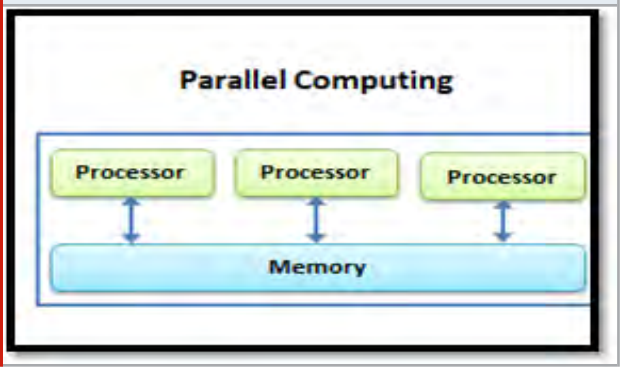


Figure 2: Parallel Computing Architecture



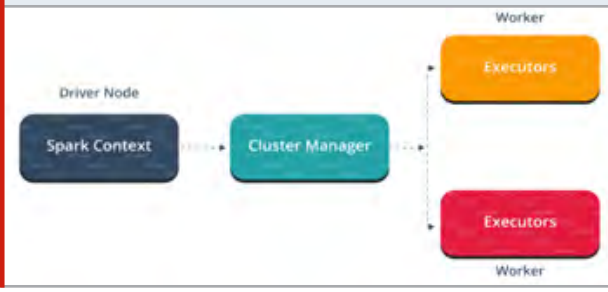
It is scalable means more nodes can be added whenever needed to increase the speed and efficiency. All nodes in distributed system are connected to every alternative in share data likewise (Distributed and Parallel computing, 2020). Thus, the failure of one node doesn't cause the failure of the distributed system as alternative nodes will still correspond with one another.

Parallel Computing: A computation type in which numerous processors carry out numerous assignments concurrently for the rapid computing of data using shared memory forming a communal address space is parallel computing. The projects requiring complex computations and more time particularly uses parallel processing technique (Distributed and Parallel computing, 2020) .In parallel processing, as shown in figure 2, numerous computations can be executed concurrently for lessening the speed of processing. The assets can incorporate a solitary PC with various processors or different PCs in system or blend of both. Advantages of Parallel Systems are as follow:
It increases the efficiency of the system as it uses all the cores of the system which reduces the time of processing.

Apache Spark: Apache spark is an open-source fast clustering framework. Spark has an in-memory computation feature, but it does not store complete data in memory. RDD (resilient distributed datasets) are created in a spark which is mainly responsible for the spark's high performance. RDD's are immutable datasets (Almeer, 2012) which are divided into various logical partitions and can be executed in the cluster.

Important Feature of Apache Spark: Speed – the logistic regression compared between Hadoop and Spark, the latter is a hundred times faster than Hadoop and ten times faster when running on disk. Apache spark provides a great speed for computing the data rapidly. Supports numerous programming languages- support various languages such as Python, Java, Scala, SQL, and R in apache spark which provides ease of usability. Runs everywhere -Spark runs on the cloud or Hadoop, or in Apache Mesos, standalone, Kubernetes, it can access various data sources.

Figure 3: Apache spark Architecture

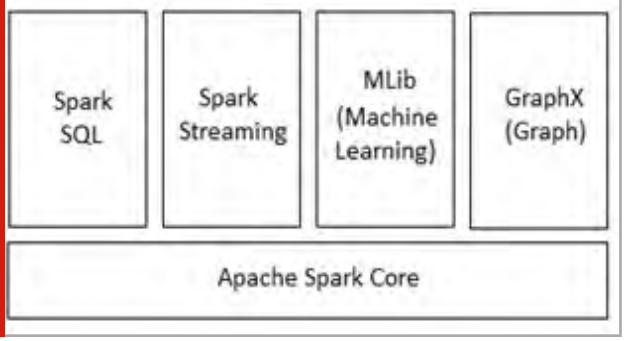


Apache Spark Architecture: As shown in figure 3, it follows the master-worker architecture in which the driver node acts as the worker node and executors act as worker nodes in the cluster. The main program of the application is called by the driver program and it creates spark-context which consists of basic functionalities. Spark-driver and spark-context collectively manage the job execution in the cluster. The cluster manager manages resource allocation. Then the job is splits into various sub-tasks that are carried out by the worker nodes (Apache Spark, 2020). When execution of tasks allocated by cluster manager is completed, it returns it back to the spark-context.

Apache Spark Components:
Spark is improvement over the Hadoop, yet it isn't reliant on Hadoop as it has it's own cluster manager. Spark is quick and Streaming, machine learning, and graph process can be done using big data processing tools of spark as shown in figure 4.

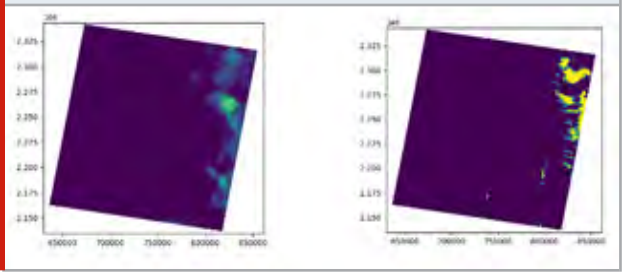
Spark Core: It consists of the main execution engine with built in-memory computing and references to external memory dataset.
Spark SQL: It introduces the feature of schema RDD for both structured and semi-structured data (Apache Spark, 2020).
Spark Streaming: It adds the feature of real-time computation.
GraphX: It supports the manipulation and computation on graphs

Figure 4: Apache spark components



Satellite Data: The satellite image data is obtained by the process of remote sensing. Sample is shown in figure 5.In this paper, we have used Landsat 5 dataset which is a low Earth orbit satellite launched on March 1, 1984 (Landsat 5, 2020).

Figure 3: UV-VIS Spectra of the compound, PA-B-ester



Landsat 5 dataset consists of total 10 images in Tagged image file format (TIFF) with 7 spectral band images. The 7 spectral bands consist of:
Band1- Visible Blue (0.45 - 0.52 µm) 30 m
Band2- Visible Green (0.52 - 0.60 µm) 30 m
Band3- Visible Red (0.63 - 0.69 µm) 30 m
Band4- Near-Infrared (0.76 - 0.90 µm) 30 m
Band5- SWIR 1 (1.55–1.75 µm) 30 m
Band6- Thermal (10.40–12.50 µm) 120 m
Band7- SWIR 2 (2.08–2.35 µm) 30 m

Normalized Difference Vegetation Index (NDVI): The Band-4 and Band-5 spectral images are used for the calculation of NDVI as Equation 1, which is a index for greenness on earth surface and classifies low and high vegetation areas.

$$NDVI = Rnir - Rred / Rnir + Rred \quad (1)$$

Literature Survey: There is a need of developing a solution by using fast computing methods to store and process satellite data which can improve performance and reduce processing time. This section reviews the work, of many authors in order to find reasons and solutions for the problem of processing of satellite data. In present time, there are many proposed solutions and research works is available on processing of remotely captured images on hadoop. For processing big geo TIFF format images (Sharma et al., 2017) uses a hadoop mapreduce based methodology to produce NDVI raster images . Researchers showed the solution to produce NDVI image by taking landset 8 images as input. Proposed system takes the input sequence file consist of landset 8 based geo tiff images. The arrangement uses the circulated conduct of mapreduce furthermore, HDFS. The experiment determined the scale up and speedup proportions to check the performance and demonstrated that the system performs well.

(Huiyu X et al. , 2017), Identified that parallel usage of Kauffman's initialization will enhance the outcome as well as also helps in scale up. Researcher explained that Initial cluster beginning point is affecting the k-means method which Kauffman's initialization can enhance. Nonetheless, the last formula is not quicker and hence applied on hadoop mapreduce. Hence, they arranged an answer for k-means++ algorithm whereby for different values of k, clustering is done in distributed approach for remotely captured images. A detailed review on the development in high performance computing technology (Parallel, Distributed and Cluster Computing) as well as the fundamentals of HPC for processing and analyzing of satellite data is presented (Bhojne et al., 2013).They have offered a thoughtful perspective about how various approach can be used to solve different problems. Distributed processing is mostly helpful when more data has to be processed in less cost and minimum time. Parallel processing is particularly helpful in image fusion algorithms and hyper spectral image processing, whereas cluster computing can be applied to geo-referencing, image transformation, image mosaicking based processes (Bhojne et al., 2013).

Authors (Buche et al., 2016 ; Patel et al., 2017), has discussed a detailed review on different support vector machine-based image classification algorithms out of which GA based image classification have shown promising results. Researchers showed that as the size of the satellite images and the required time for processing is also increasing, parallel computing of graphical processing unit is a good solution. To prove the solution, authors created a normal GA on CPU as well as also on GPU and the produced outcome are reviewed and

differentiated. Authors (Patel et al., 2015) presented, how parallel computing and distributed computing methods such as MPI, CUDA, Map reduce, HIPI, Hadoop can be used efficiently to handle enormous amount of data and to fetch and query the required runtime information as per the needs of the user application. Parallel computing model of map reduce provide high efficiency in image processing of large-scale image in distributed approach.

Remotely captured images are mostly used in different department, whose size and the time to process them are increasing day by day. Researcher showed a case study of the chinese academy of science to review how they process and save the data in database. They also explained the required hardware to query and fetch the data as well as various important points such as OS, servers, different processors and data base management systems (Haiming et al., 2011). Processed satellite images in tiff by parallel processing of image processing method on hadoop map reduce is presented (Almeer, 2012). Authors claims, hadoop map reduce is specifically created for text related processing ,but enormous size of data can be efficiently processed on parallel processing hadoop map reduce (Almeer , 2012) . Experiment gave the hadoop map reduce method for land cover recognition. In the Map reduce framework, a scalable modeling system is enforced (Codella et al., 2011). The importance of compression (Damahe et al., 2019) is described for variety of application including remote sensing.

PROPOSED METHODOLOGY

The proposed system aims to develop a method to escalate the efficiency of the system for rapid processing of satellite data as Satellite image processing is resource intensive and thus takes prolonged time. The proposed system consists of two major modules which are explained in detail below.

Processing of satellite data using Distributive computing technique using Apache spark: Workfolow is shown in figure 6

Prerequisite: Java JDK, Apache Hadoop, Apache Spark, Lan or Wi-Fi enabled network of systems.

Workflow: Configuration of Apache Spark- Apache Spark is installed and configured in all the distributive systems used to create the cluster of master- worker for processing of satellite data using cluster computing technique.
Formation of Cluster- Set the master node using master system ip address in the network using spark class and then number of worker nodes can be added in the network cluster as per requirement using spark-class.
Process applications (programs)-
Processing the program using spark submit in the cluster with masters ip address.
Calculation of indices (NDVI) and getting rapid efficient outcome.

Processing of satellite data using Parallel computing technique: Workfolow is shown in figure 7
Prerequisite: Python libraries- Gdal, Rasterio, Multiprocessing, OpenCV, time, OS

Workflow: Calciulating input data set and the numer of cores of the system
Split Dataset into n Equal Size Chunks-

In this, Dataset and No of cores of the computer is taken as input. Dataset is Spited into N equal sized chunks. So, that it can be assign as one chunk per core of the processor. the application is defined with chunk generator.
Pool of Processes base on No of Cores-

To Create No of Processes, Pool feature of Multiprocessing Library of Python has been used. The Pool class creates the Python processes on each respective core of the processor.
Assign Chunk to Process:-

The application is mapping each of the chunks to an independent process. Each Process runs independent of the other process and the results are combined after the processing of various chunks is completed. Calculation of indices (NDVI) and getting rapid efficient outcome.

Figure 6: Flow Diagram of the Distributive System

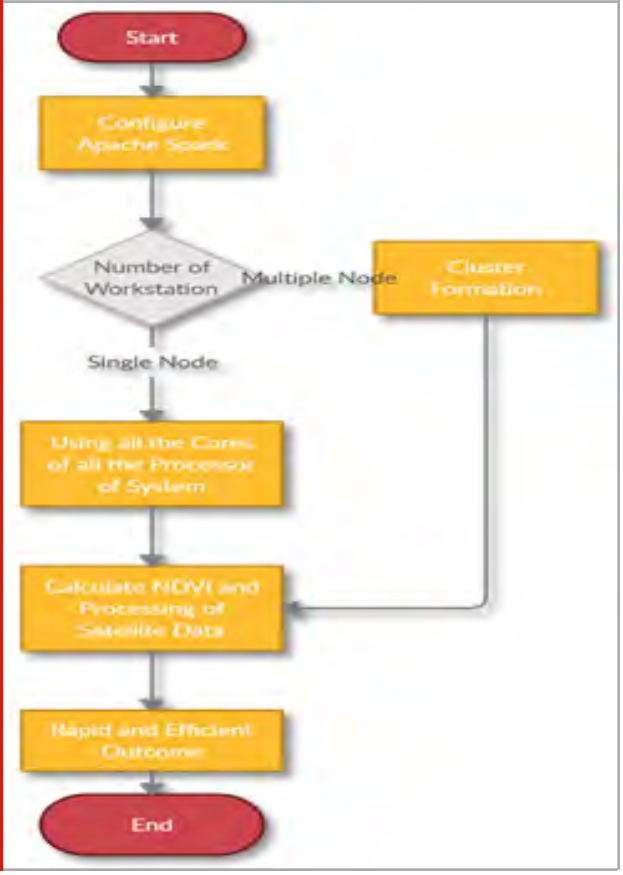


Figure 7: Flow Diagram of the Parallel System

RESULTS AND DISCUSSION

Experimentation of proposed system is done on Landsat 5 dataset which contains 10 band images in tiff i.e. tagged image file format shown in figure 8. All the images are processed using parallel and distributive techniques as required and NDVI is calculated using band 3 and band 4 images using different methodologies and the processing time is reduced thus increasing efficiency. The figure below shows the pictorial view of various 10 bands images.

Figure 8: Input dataset display of Landsat 5

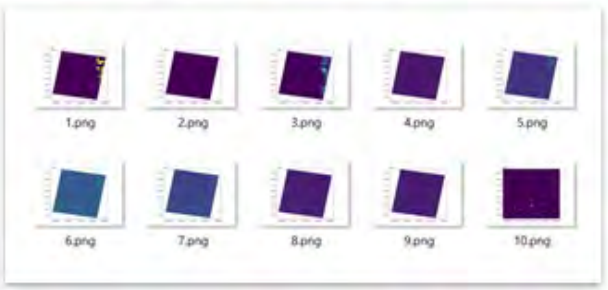
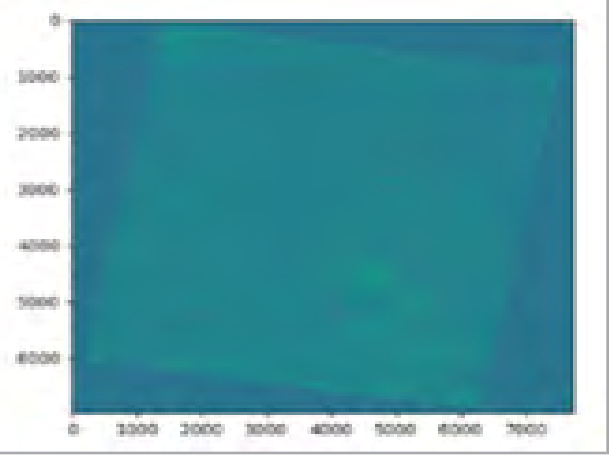


Table 1 shows the outcome of the experimentation in terms of time required for processing and calculation of NDVI on satellite data using different methodologies of distributive and parallel computing techniques along with normal computation on a single system. The outcome of the NDVI calculation is shown in figure 9, which represents the vegetation index in the required geographic area

Table 1. Comparison of DC and PC technique

	Normal Computation of NDVI Technique	Using Distributed Computing Technique	Using Parallel Computing
Time Required	4.104 Seconds	3.00 Seconds	2.338 Seconds

Figure 9: NDVI output of programs



CONCLUSION

In the given approach of processing satellite data and calculation of indices using high performance computing methodologies such as parallel and distributive computing techniques that increase the computational speed and execution efficiency over existing traditional methods. The methodology to process tiff images of satellite data for calculation of various indices including NDVI at high computational speed to increase the efficiency of the system is presented. By taking advantage of apache spark and cluster computing techniques real-time high-speed stream processing of satellite data is achieved and the results are studied in terms of processing speed. In future experiments, implementation can be done on large clusters and with customized algorithms. Also processing using GPU based parallel system can be achieved.

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Low Power Complex Multiplication using Pre-computation Technique For FFT Algorithm in Wearable ECG Gadgets

Pankaj U Joshi[1], and Vipul S Lande[*2]
[1]*Department of Electronics Engineering,*
[2]*Department of Electronics & Communication Engineering,*
Shri Ramdeobaba College of Engineering and Management Nagpur,
Maharashtra, India

ABSTRACT

The focus on wearable devices for biomedical applications is gaining a lot of research and market interest. Heart diseases remain by far the main cause of death and a challenging problem for biomedical engineers to monitor and analyze. Electrocardiography (ECG) is an essential practice in heart medicine. However, wearable ECG gadgets for real time analysis still faces computational challenges, especially when multiple lead signals are to be analyzed in parallel, in real time, and under increasing sampling frequencies and battery operated gadgets. Another challenge is the computation of Fast Fourier Transform (FFT) on huge amounts of data that may grow to days of recordings. In this research we present the comparative study of FFT calculation best suitable for power optimized applications in the biomedical field and exclusive performance enhancement by reducing dynamic power consumption. ECG application specific to FFT calculation to the final hardware-software(HW/SW) architecture is the focus of this paper.

KEY WORDS: WEARABLE ECG DEVICE, FFT COMPUTATION SCHEME, POWER CONSUMPTION IN COMPLEX FFT, ELECTROCARDIOGRAM ALGORITHMS.

INTRODUCTION

Cardiovascular diseases (CVDs) have been on top behind the cause of deaths globally. According to the World Health Organization (WHO) report an estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke. WHO has predicted, by 2030, almost 23.6 million people will die from CVDs, mainly from heart disease and stroke (https://www.who.int/cardiovascular_diseases/about_cvd/en/). Due to rapid increase in cardiac diseases, the rate of hospitalization has drastically increased followed by periodic cardiac examination. This have demanded more efficient methods of cardiac diagnosis and desired to meet the great demand on heart examinations (Fuster V. 1999).

However, the traditional biomedical equipment for heartbeat sensing and monitoring lacks the ability of providing large-scale analysis and remote, real time computation at the patient's location. With the advancement of sensing, processing and communicating technology in the field of biomedical have encouraged the researchers to focus on such issues. This demand has given opportunities to design and modify biomedical equipments as modular and portable gadgets to facilitates the remote diagnosis. Electrocardiography (ECG) is a popular measure to quickly investigate the CVDs. It is desired that such continuous monitoring ECG gadgets should not be power hungry devices (Harland et al. 2002 and 2003). Therefore many power optimized solutions for

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devices are proposed in past. This work is focused on a new approach of power optimization in FFT estimation for ECG monitoring. The table I shows the summary of multiplication operations in N point FFT algorithms. It can be seen that multiplication operations are very large in the number for high resolution and practical FFT applications.

Table 1. Comparison of FFT for Real and Complex value signal(RFFT stands for Real FFT and CFFT stands for Complex FFT)

N	Regular CFFT	Optimized CFFT	RFFT	% saving in number of multiplications		
				Optimized CFFT Vs Regular CFFT	RFFT Vs Regular CFFT	RFFT Vs Optimized CFFT
1024	20480	13824	7172	32.5000	64.9805	48.11921296
2048	45056	30720	16388	31.8182	63.6275	46.65364583
4096	98304	67584	36868	31.2500	62.4959	45.44862689
8192	212992	147456	81924	30.7692	61.5366	44.44173177
16384	458752	319488	180228	30.3571	60.7134	43.58849159
32768	983040	688128	393220	30.0000	59.9996	42.85656157

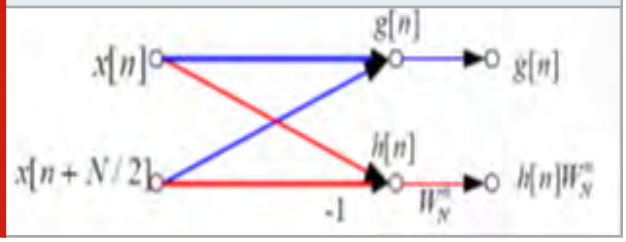
FFT algorithm involves four multiplication operations for a complex multiplier. Mathematically these four multiplications can be converted into three multiplication operations to reduce the computational time and power. This conversion involves pre-computations, leading to change in the signal patterns, entering to the FFT block. We explore the possibility of best pre-computation technique to reduce the dynamic power consumption.

II. Background And Related Work: Fast Fourier Transform (FFT) architecture has a great significance in the world of signal processing. The literature has witnessed many optimization techniques to improve its performance at algorithmic levels, architectural level, system level and using signal properties. This section discuss about some milestone techniques related to FFT and its architectural optimization. The recent contribution by (S. M. Noor et al. 2019) proposed a lookup memory to provide the most frequent multiplication result for the most frequent multiplication operands. It uses the statistical approach to identify the most frequent multiplication operands for the ECG signal as input to the FFT block. (R. Neuenfeld et al. 2016) propose the optimization of butterfly for the power optimization of FFT algorithm, along with the reordering technique to avoid one adder and one subtractor operation in the butterfly unit. (Chu Yu and Mao-Hsu Yen 2015; W. Tsai et al. 2019) Utilizes the properties of twiddle factors and constant multiplication techniques to meet the low area and power requirements. The complex multiplication involving four multiplications is reduced to three multiplications has been reported in the past literature. However there are eight different techniques to represent this conversion. These techniques are not explored with respect to their dynamic power consumptions. We explore the scope of this finding for ECG signal as test input.

III. Mathematical Variations For Converting Four Multipliers To Three Multipliers: A DFT of an N point input signal is given by Equation (1) shows the mathematical formulation of the complex multiplier.

$$(A + jB) \times (C + jD) = (AC - BD) + j(BC + AD - \quad (2)$$

Figure 1: Butterfly as Processing element.



Right hand side of the Equation (2) shows the four real multiplications as AC, BD, BC, AD. AC and BD represent the real part while BC and AD represents the imaginary part of the complex multiplier. Mathematically this complex multiplier can be expressed using only three multiplications by manipulating the equation (2).

IV. Proposed Work: Precomputation For Complex Multiplication

This section discusses about the 1024 point FFT computation using different complex multipliers schemes. FFT has a butterfly section, using which iteratively; N point FFT is generally computed. A butterfly section involves four multiplication operations. These four multiplications can be converted into three multiplications using eight different mathematical schemes given below. We have derived all the possible variants for converting the four multipliers of complex multiplication into three multiplications.

Scheme I:	Real Part: $AC - BD$	....	(I.I)
	Imaginary Part: $(A + B) \times (C + D) - AC - BD$	....	(I.II)
Scheme II:	Real Part: $(A + B)(C + D) - BC + AD$	....	(I.I)
	Imaginary Part: $BC + AD$	....	(I.I)
Scheme III:	Real Part: A (C+D) - D (A + B)	....	(III.I)
	Imaginary Part: $D(A + B) + B(C - D)$	....	(III.II)
Scheme IV:	Real Part: $A(C + D) - D(A + B)$	....	(IV.I)
	Imaginary Part: $A(C + D) - C(A - B)$	....	(IV.II)
Scheme V:	Real Part: $B(C - D) + C(A - B)$	....	(V.I)
	Imaginary Part: $B(C - D) + D(B + A)$	....	(V.II)
Scheme VI:	Real Part: $D(A - B) + A(C - D)$	....	(VI.I)
	Imaginary Part: $B(C + D) + D(A - B)$	....	(VI.II)
Scheme VII:	Real Part: $C(A + B) - B(C + D)$	....	(VII.I)
	Imaginary Part: $C(A + B) + A(D - C)$	....	(VII.II)
Scheme VIII:	Real Part: $B(C - D) - C(B - A)$	....	(VIII.I)
	Imaginary Part: $C(B - A) + A(C + D)$	....	(VIII.II)

It is to note that the input signal applied to an N point FFT block is passed through the pre-computation process. For example in a scheme I, (A + B) and (C + D) are pre-computed. The figure 2 shows the section of MATLAB code utilizing the one of the pre-computation schemes in the complex multiplication of the butterfly. This work proposes to analyze dynamic power values in the complex multiplier due to the effect of pre-computations for the eight different schemes derived in equation I to VIII.

Functional Verification of the 1024 point Radix2-DIT FFT algorithm is done using a ECG signal taken from the MIT BIH (https://archive.physionet.org/physiobank/database/mitdb/) data base. Figure 3a shows the 1024 points of data extracted from the ECG signal. The signal is sampled by frequency 250 Hz. The duration of data is 5.384sec. The Figure 3b shows the theoretical values of the FFT algorithm using direct FFT command of MATLAB. These samples are supplied to the FFT algorithm written in matlab for functional verification. Figure 4 shows the visual comparison of the magnitude Vs. frequency spectrum of FFT algorithm with eight different complex multiplication schemes. All the eight schemes show exactly same Magnitude Vs. frequency plot. Further, we have calculated the cross -correlation of the each scheme with the theoretical value of the FFT using direct command. All the schemes show the maxima on same index value as shown in the Figure 5. This confirms the functional integrity of all the eight schemes.

Power Performance observations: The dynamic power consumption of the N point FFT architecture is highly dependent on the bit patterns. The eight different schemes are responsible for generation of different bit patters. The Table I shows the dynamic power consumed by each multiplier of the scheme for 1024 point FFT calculations. The algorithm is implemented using a Microblaze soft core processer in a XilinxXC3S500E-5FG320C for functional verification on FPGA platform. The ECG signal samples taken from MIT BIH library as test signal. The test signal going as input to the multiplication operation in each stage is captured using soft core processor. The captured signal is then passed to the multiplier using VHDL test bench for dynamic power measurement in Xilinx x-power utility.

Figure 2: Section of Matlab code with complex multiplication realized using three multipliers.

```
Pi = xif(k+index+1)/2 + xif(k+index+M+1)/2;
A =  xrf(k+index+1)/2 - xrf(k+index+M+1)/2;
B =  xif(k+index+1)/2 - xif(k+index+M+1)/2;

C = Wrf(twid_add);       %real(twid_fact(twid_add));
D = Wif(twid_add);       %imag(twid_fact(twid_add));

apb= (A/2+B/2);
cpd=(C/2+D/2);
AC = my_multiplierRR(A,C)*2;
BD = my_multiplierII(B,D)*2;
apbcpd= my_multiplierapbcpd(apb,cpd)*8;


temp_real = AC - BD;
temp_imag =  apbcpd -AC - BD ;
```

Experimental Results: It can be observed that the all the eight schemes show different total dynamic power consumption values. Some of the schemes have given a lower dynamic power every time even though a different ECG data set is applied. The pre-computations in each of the schemes generate different input bit patterns for N point FFT architecture. The different bit patterns, generated in each of the eight schemes, pass through N stages of the FFT architecture.

Figure 3: (a) Four cycles of ECG signal with 5.834sec, duration N=1024 samples, Sampling frequency: 250 Hz. (b) Theoretical Value of FFT of a ECG signal using FFT command.

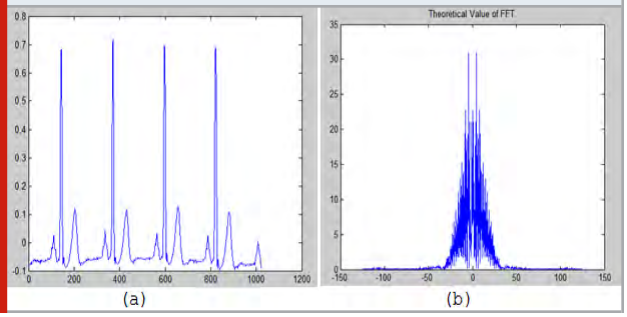


Figure 4: Magnitude Vs. Frequency Spectrum of the FFT algorithm using eight different complex multiplication schemes

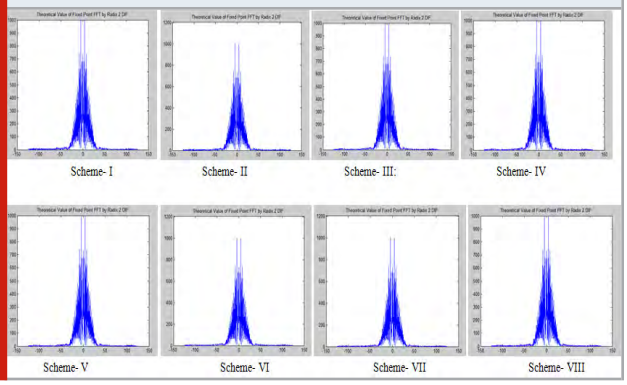
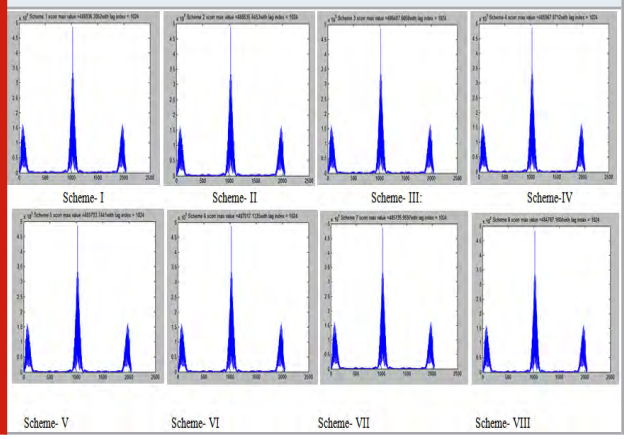


Figure 5: Index matching using Cross correlation results of each of the schemes with the theoretical values of the FFT



However, the result of the Nth stage of the FFT in terms of the frequency verses magnitude plot is same, even though the bit patterns are different at every stage. Therefore, intelligent selection of a low power complex multiplication scheme will make the overall design power efficient.

Table 2. Dynamic power consumption in multiplier components of scheme I to VIII.

Schemes	Mathematical Equation	Dynamic power in multiplier without power optimization	Total Dynamic Power
I	Real= AC-BD; Img= (A+B)(C+D)-AC-BD;	AC = 50 BD = 38 (A + B)(C + D) = 47	135 mW
II	Real: (A+B)(C-D) – BC + AD; Img: BC + AD;	BC = 41 AD = 48 (A + B)(C - D) = 43	132 mW
III	Real= A (C+D) – D (A + B); Img= D (A+B) + B (C - D);	B (C - D) = 34 A (C + D) = 48 D (A + B) = 41	123 mW
IV	Real= A(C+D) –D(A+B); Img=A(C+D) –C(A - B);	A(C + D) = 48 C(A - B) = 48 D(A + B) = 41	137 mW
V	Real= B(C-D) + C (A –B); Img= B(C-D) + D(B +A);	B(C - D) = 34 C (A - B) = 48 D(B + A) = 41	123 mW
VI	Real= D(A-B) +A(C-D); Img=B(C+D) + D(A-B)	A(C - D) = 44 B(C + D) = 38 D(A - B) = 42	124 mW
VII	Real=C(A+B)-B(C+D); Img=C(A+B)+A(D-C);	A(D - C) = 46 B(C + D) = 38 C(A + B) = 47	131 mW
VIII	Real= B(C-D) - C(B-A) Img= C(B-A) + A(C+D)	B(C - D) = 34 C(B - A) = 34 A(C + D) = 48	116 mW

CONCLUSION

This paper discuss about the power efficient complex multiplication scheme in FFT architecture. The pre computation in the complex multiplication allows us to generate eight different schemes. The proposed pre-computation schemes have shown different dynamic power values while computing 1024 point FFT. The observations are taken over 5 data sets form MIT BIH library. The lowest power consuming scheme can be selected for the design of battery operated wearable ECG monitoring gadgets. The reason behind lower the power consumption in the specific scheme can be investigated by applying some automated techniques from data analytics. The probability of change in the values applied to the multiplication in the consecutive operations will give us the insight of efficient pre-computation method for the complex multiplication.

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ECG-Based Heartbeat Classification using Machine Learning: Survey

Komal S. Jaisinghani[1] and Sandeep Malik[2]
[1]*Ph. D. Scholar at Oriental University, Indore & Assist. Professor at SVPCET, Nagpur, India*
[2]*Associate Professor, Oriental University, Indore, India*

ABSTRACT

Cardiovascular diseases (CVDs) affecting millions of people around the world. Classification of heartbeat is very important step to determine cardiac functionality. An electrocardiogram (ECG), (a graphical representation of heart signals) is used to measure the electric signals of the heart and is widely used for detecting any abnormality lies within. By analyzing and studying the electrical signals generated from ECG with the help of electrodes, it is possible to detect some of the problems in heart. There are many types of classifiers available for Heartbeat classification. However in this paper we survey the methods used for automatic ECG-based heartbeat classification by discussing pre processing, Electrocardiogram dataset, feature extraction and types of classifiers available for automatic heartbeat classification.

KEY WORDS: ECG, HEARTBEAT CLASSIFICATION, CLASSIFIER, ECG DATASET.

INTRODUCTION

Cardio vascular diseases affect millions of people throughout the world every year. If your Heart is not working according to Normal beats then it indicates that there is a cardiovascular disease. Heartbeats not properly working means there is a common heart related issue called as arrhythmia. There are many reasons for arrhythmia, if there is an irregular conduction and formation of electrical signal, which may results in changing the heartbeat impulse shapes and it may create problem in normal functioning of heartbeat. The process or method of finding and differentiating arrhythmia can be very complex for a human being because sometimes it is necessary and important to analyze each heartbeat impulse of the records generated by ECG machine, acquired by a holter monitor for example, during hours, or even for days.

Apart from this, there are the chances of human mistakes during the analysis of ECG records, due to health conditions of patient. A substitute is to use techniques based on computation for human less and machine oriented classification. A fully automatic and mechanized system for heartbeat classification from impulses acquired by an ECG machine can be bifurcated in 5 steps: - (1) Pre-processing of ECG impulses (2) heart beat segmentation (3) Feature finding (4) Feature selection and (5) Classification of arrhythmia. In each of these 5 steps, an action is performed and the final target is to discriminate/identify the type of heartbeat.

Related Work: The function of electrocardiogram (ECG) is to measure the electrical activity of the heart and to detect heart diseases. It is possible to diagnose whether there are any anomalies in the heart by examining the electrical signal of each heartbeat produced by the ECG study. Till now many researchers developed different classifiers which are used for automatic ECG-based heartbeat classification. In survey of ECG, author gives overview of different methods used for ECG-based automatic heartbeat classification. [Eduardo José da S. Luza, 2016].

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*****Corresponding Author: 10584.komal@gmail.com
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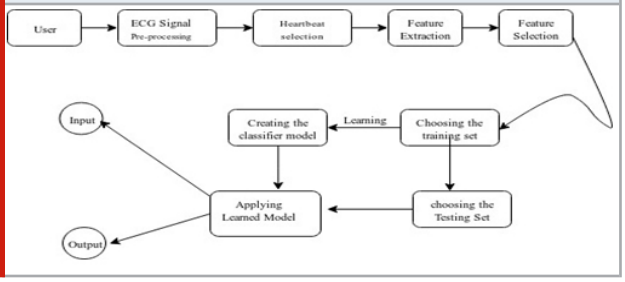
A hybrid model was proposed which is used for differentiation of cardiac arrhythmias and also used to select their features in optimum way. Genetic Algorithm (GA) was utilized for determination of the element ideally and the Decision Tree with the C4.5 calculation was applied for highlight finding and to separate and prepare the model. In this research author has utilized the GA and DT strategies as another blend (Hybrid) model to take care of the arrhythmia characterization issue and to evaluate the presentation of the proposed model, UCI arrhythmia dataset was utilized to figure exact outcomes, affectability, particularity, and normal Sen-Spec measurements. [Mehdi Ayar, 2018].

Figure 1: A diagram of the arrhythmia classification system



Ensemble method for ECG based heartbeat classification was proposed for this. Ensemble method is a meta-algorithm which is used to make strong classifiers that were based on a consortium of weak classifiers. In this work, author has explored some ensemble classifiers on UCI Arrhythmia Dataset to arrange the heartbeat data. In this work, XGBoost, Random Forest ensemble classifiers along with classic Logistic Regression was used for comparing results. The author has also designed Voting Classifier which are based on ensemble voting meta-algorithm and the above 3 built-in classifiers. The said design outperforms even well tuned XGBoost and Random Forest classifiers. The best prediction accuracy achieved by the Voting Classifier was 76% in multiclass classification problem [Rui Duan, 2019].

Conventional Neural network method was proposed for heart rate deviation detection because of the automated feature processing layers, CNN does not require extra work relative to conventional machine learning approaches. In the classification of heartbeat problems, CNN proved extremely competitive. [Dokur ,Wang 2020]. Time-domain aspect produced from the 1-lead Electrographic machine were intentionally opted to make them satisfied, and the classification process of the heartbeat by utilizing RF was reasonably assessed by succeeding; the AAMI guidelines and the paradigm of the person who is suffering. The results obtained were best with the help of best 6 most enlightened attitudes and a 40-trees RF classifier. The assessment results based on the arrhythmia database of MIT-BIH resulted in an overall precision of 96.14% with definite F1-scores of 73.06%, 97.97% and 90.85% for the SVEB, VEB and NB, classes, appropriately. [Jose Francisco Saenz-Cogollo , 2020]

A comparison based on a Deep Neural Network (DNN) for the mechanized division of irregular ECG beats, separated from regular ones. It has been established by utilizing the free and open source software library, the pre-written professional quality codes from Google, which comprises of 7 concealed layers, with Five, Ten, Thirty, Fifty, Thirty, Ten and Five neurons, appropriately. The free and open source software library is to be utilized in the training or examining mode of the DNN [G. Sannino, 2018]. A fast, efficient ECG arrhythmia differentiator build on an easy intellectual capacity motivated by mechanized study method termed as Echo State Networks. The heart rate differentiator is analyzed over 2 ECG data contents, the AR, the AHA and Massachusetts Institute of Technology-Beth Israel Hospital (MIT-BIH).

In the Massachusetts Institute of Technology-Beth Israel Hospital (MIT-BIH) data content, the classification/ differentiation method gives 92.70% perceptivity and 86.1% of practical expected figure for the ventricular ectopic heart beats, using the 1-lead II [Miguel C. Soriano, 2019]. Automatic Cardiac Arrhythmia detection using abnormal ECG was investigated. Data classifier by using deep learning model was used and applied on wearable ECG monitoring devices. Android terminal module was used. This study relates with artificial intelligence (AI), deep learning, cloud computing. Experimental results gives better reliability, less cost, good accuracy of deep learning models [Xin Gao, 2019].

Proposed Model:

A. ECG Raw Data: Generally for ECG classification, the dataset which is used is from MIT-BIH dataset. This database is generally used as standard dataset for detecting cardiac problem. The MIT-BIH database consisting of 48 ECG records which was obtained from 47 subjects which was sampled at frequency 360Hz.

B. Pre-processing of ECG Data: Preprocessing of ECG data is very important and challenging to remove noise from ECG data and produce a clear ECG data. There are different noise available with ECG data like muscle noise, impulsive noise, frequency noise. Many different methods are available to remove these noises such as wavelet coefficient threshold, FIR filter, median filter and Gaussian approach. It is necessary to select proper de-noising algorithm in preprocessing of ECG data.

C. Feature Extraction & Feature Selection: Feature extraction contains most of the important data from original data. Wavelet Transform method is generally used for feature extraction of ECG Data. Morphological and temporal features are extracted from ECG data. For selection of various features, the techniques which are used are as follows; Grey Wolf Optimizer (GWO), Genetic Algorithm (GA), and Particle Swarm Optimization (PSO).

D. Classifier used for classification: Different classifiers are used for heartbeat classification such as support vector machine (SVM), Convolution Neural Network (CNN), Artificial Neural Network (ANN), Random Forest Classifier, Hierarchical Classification, Echo sate network classifier, Deep Neural Network.

Table 1. Summary of Different methods used for Heartbeat Classification

Sr. No.	Model of Classifier	Characteristics	Dataset	Performance Metrics
1	Hybrid Model with Genetic Algorithm and Decision Trees Used.	Genetic Algorithm (GA) was used for feature selection. For classification and training features Decision Tree with the C4.5 algorithm was applied	UCI arrhythmia dataset	Accuracy:- 86.96% Sensitivity:- 88.88%
2	Ensemble Classifier XGBoost and Random Forest used	XGBoost and Random Forest Ensemble classifiers were used, and the classic Logistic Regression was used for comparison. Voting Classifier was built based on the ensemble voting meta algorithm	UCI arrhythmia dataset	Accuracy :- 76% by the Voting Classifier
3	Convolution neural network with Walsh functions used [4]	In this research, Walsh function (WF) was used and discrepancies of converting 1D signals to 2D images have been investigated.	MIT-BIH arrhythmia dataset	Accuracy :- 99%
4	An Improved Convolutional Neural Network	For ECG classification Advances Convolutional neural network (CNN) model was used. If the proposed improved CNN model can be trained properly then it works as a tool to automatically identify different kinds of arrhythmia from ECG.	MIT-BIH arrhythmia dataset	Accuracy 99.06% [5]. Accuracy 99.43% [6].
5	Random Forests Classifier used	In this research Random forest classifier was used for selection of informative features.	AAMI guidelines MIT-BIH dataset	Accuracy of 96.14%
6	Hierarchical Classification approach was proposed.	Hierarchical approach provided an improvement in classification performance of N and SVEB classes.	MIT-BH dataset	
7	Echo State Network Classifier was used.	Combination of ensemble helps to train classifier with high speed.	MIT-BH dataset	Sensitivity is 92.7%

E. Performance Parameters:

Performance parameters are generally Sensitivity, Specificity and accuracy. These parameters are achieved from the classification result.

- SEV (Sensitivity): The sensitivity test is to calculate number of patients with disease.
- SPV (Specificity): The specificity test is to find number of patients without the disease.
- TPV True positive values : Positive test means patient is suffering from disease
- FPV False positive : Positive test means the patient is not suffering from disease
- TNV True negative: Negative test means the patient is not suffering from disease
- FNV False negative: Negative test but the patient has the disease.

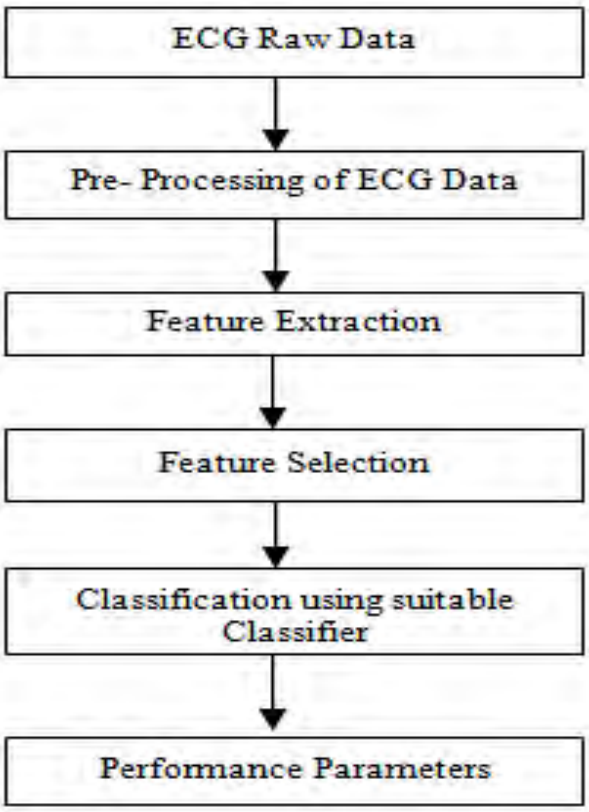
Equations of SE and SP:

$$SEV = \frac{TPV}{TPV} + FNV * 100$$

$$SPV = \frac{TNV}{TNV} + FPV * 100$$

- CC: Correct Classification (Accuracy) is computed as below:

Figure 2: Proposed Model



CONCLUSION

We have reviewed various methods used for automatic ECG based heart rate classification in this review article. For arrhythmia detection, the standard defined classifiers such as neural network and SVM are found to be accurate. Using morphological and time frequency based aspects; the precision rate of more than 99 percent is achieved. Recent research shows that deep learning methods are successful in terms of computational complexity and accuracy compatibility compared to the regular classifiers.

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Brief Review of Short Utterance Speaker Verification Systems

Asmita Nirmal[1] and Deepak Jayaswal[2]
[1]*Assistant Professor, Department of Electronics Engineering, Datta Meghe College of Engineering, Navi Mumbai, India*
[2]*Professor, Department of Electronics and Telecommunication Engineering, St. Francis Institute of Technology, Mumbai, India*

ABSTRACT

Due to technological improvements many methods have been proposed for speaker verification. While performance is satisfactory with large amounts of speech data, there is significant degradation in performance with short utterances. Many research works have been carried out to handle short utterance issue of the speaker verification systems used in real-world scenario. In this paper we primarily emphasis on the survey of different feature extraction methods for text-independent speaker verification. We first briefly review conventional systems to show its progress. In this work, we present a brief review of features that are used to capture speaker information at different analysis lengths of speech utterance. We also put the major findings and challenges of this research feview in a nutshell.

KEY WORDS: SPEAKER VERIFICATION, SHORT UTTERANCES, FEATURE EXTRACTION.

INTRODUCTION

Speech signal is a main source of speaker specific information. Jain et al., 2004 have shown that besides containing the information related to behavioral aspects speech also contains information of speaker's speech production system. This speaker specific information conveyed by speech signal motives us to use speech signal as a biometric trait. Speaker recognition is the process of automatically recognizing a speaker from his/her speech utterances. Speaker recognition has two categories of tasks: verification and identification. From the speaker recognition systems reviewed by Cambell,1997 speaker identification (SI) is the process of comparing the input speech signal with the models of registered speakers. In contrast, speaker verification (SV) is a process of verifying a claimed identity of a person from his/her speech. Depending on the text contents of the speech speaker recognition systems are categorized into text-dependent (TD) and text-independent (TI) systems. These approaches are used in the studies proposed by Rodriguez –Linares et al., 1998 and Mengistu et al., 2017 respectively. The text-dependent systems have same text content for training and testing phase. Unlike TD systems, TI systems have no control over the speech contents. In TI systems text content for training and testing phase can be different.

a. Motivation: During the last few decades, the use of speech and speaker recognition techniques is increased in smartphones, and various hhandheld devices. Almost all of these devices are used in applications subject to noisy conditions. Along with this the channel variations introduced from the handset and/or microphone devices are also of major concern. Many solutions have been proposed to provide robustness in such practical situation. The performance of existing SV systems have been found satisfying when sufficient amount of speech data is available as shown in the approach proposed by

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**Corresponding Author: nirmalasmita2607@gmail.com*
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Kounoudes et al.,2006. However in most of the realistic cases such as forensic applications proposed by Jayanna et al., 2009.,it is hardly impracticable to get sufficient data and that also covering intra-speaker variability to mitigate the effects of the realistic environment. In case of access control systems deployed in banking applications, the average input test speech is limited just for few seconds.

In both of these scenarios, very less amount of feature vectors will be available for enrollment and evaluation, which causes poor speaker modeling and give unpredictable decision of verification. Hence, it is important to consider the effects of the real-life environment.Further to have reliable performance in practical applications one should take into consideration the problem of limited speech data availability. Concerned to these issues different approaches for speaker verification system have been developed for short utterance based speaker verification by Fatima et al.,2012, Matza et al.,2011. In this paper, we make a broad survey of short utterances SV systems considering the studies from recent research. From this review we also give summary of the major findings, issues and various solutions in short utterance point of view.

b. Organization: In this paper the key emphasis is on review of short utterance TI-SV systems. This paper is organised as follows: First the conventional speaker verification systems are reviewed to show development in this area . Next to this the detailed literature review of features extraction methods which are suitable for the short utterances based SV systems is done.Then, major findings from the review followed by different future opportunities and challenges to be handled in this area are discussed. Lastly, the conclusions for the reviewed work are drawn.

2. Basic Components of Speaker Verification System: Before reviewing various text-independent SV research works in short utterance framework, we first detail basic components of SV system. The feature extraction module extracts feature vectors from the raw input speech to form voiceprint of a speaker. During the enrollment phase, a speaker model is trained using extracted features obtained from the feature extraction module Then the trained model is stored into the database. During the verification phase, the features extracted from test speech are compared against the claimed model to compute a similarity score. Finally, this similarity score is used by a decision module to accept or reject the authencity of input test speech. From frame duration point of view, SV systems divide features extraction methods into three categories: source features, short term features and high level features.

Source features are computed from short duration frames of 3-5 milliseconds. An approach proposed by S.R.M.

Prasanna et al., 2006 use sourch features for representing glottal flow information of a speaker .Short term feature analysis use speech frames of about 20–30 milliseconds. These features convey vocal tract information of the speaker. Existing verification systems commonly use vocal tract features because of their less computational complexity. High level features used by Doddington ,2001 capture conversation level information of speakers. These features use frames of 100-300 milliseconds in duration and can capture information such as speaker's word usage, speaking style. High level features are comparatively robust but can be spoofed easily. Selection of particular type of features depends on type of application, computational complexity and amount of available speech data as per the study made by Reynolds,2003.

From the last five decades SV systems are advanced significantly from models based on direct speaker specific features to Gaussian mixture models (GMM) based models proposed by Reynolds et al., 1995.The main reason of progress in the speaker recognition area is the development of various session compensation methods for both GMM and support vector machines (SVM).The detail study of this can be found in the study made by Campbell,2006.With the aim of adapting the GMM-based acoustic model to new operating conditions to compensate intersession variability, a speaker independent model known as universal background model was proposed by Reynolds et al., et al.,2000 . Then study made by Kenny et al.,2007 has extended GMM-UBM model to latent variable based method known as Joint factor analysis (JFA).

In this study supervector space were developed to solve the session variability issue. Combination of JFA compensation and Gaussian supervector SVMs was studied by Dehak et al., 2008. Recent research proposed by Dehak et al., 2011 has introduced the i-vector based speaker recognition. The idea of i-vector is initiated from a JFA that models speaker and channel subspaces separately. In contrast to JFA, i-vector use a single sub-space to represents both speaker and channel variability. Over the past few years the i-vector based on probabilistic linear discriminant analysis (PLDA) modeling which was proposed by Prince et al., 2007 have been developed in SV field[19]. Now a days deep neural network (DNN) are widely used to extract speaker specific information. Lei, et al., 2014 have suggested the use of DNN in a i-vector framework to capture pronunciation patterns of a speaker . The results obtained from this approach have shown performance improvements over the conventional GMM- UBM framework.

3. Review of different feature extraction methods for short utterance speaker verification systems: From the recent few decades many methods are developed to handle the short utterance issue at different levels of speaker verification system. In this section we primarily explore various research studies that are carried out at feature level. List of of different methodologies used in various research studies is shown in Table 1.

a. Low level Features: The most commonly used vocal tract feature in conventional SV systems is Mel-frequency cepstral coefficients (MFCC).However, It is shown in the approach proposed by Kanagasundaram ,2011 performance drops significantly when these features are used for short utterances SV. In this consent features that are less sensitive to lexical content of speech should be focused more. In addition to this the use of complementary information captured by different low level features should be used. Fusion of systems using different set of low level features proposed by Hosseinzadeh et al., 2007 helps in improving the performance. The local covariance features are based on eigen-structure of covariance matrix. Unlike cepstral and delta features, covariance matrix captures uncertainty information. The authors , Sahidullah et al., 2016 have investigated the use of individual as well as fusion of features such as frequency domain linear prediction (FDLP) , mean Hilbert envelope coefficient (MHEC) and power-normalized cepstral coefficients(PNCC) . Further, a new feature set known as constant Q cepstral

coefficient (CQCC) derived from constant Q transform (CQT) is recommended in . CQCC features characterize: the human auditory system. The detail study of FDLP,MHEC, PNCC,CQCC can be found in the approaches proposed by Athineos et al., 2007, Sadjad et al., 2015,Kim et al., 2012 Todisco et al.,2016 respectively. The goal of CQT is similar to RASTA filtering. It focuses on extracting the information pertinent to the articulation rate of the speaker. In contrast to RASTA, however, the CQCC filter bank is adaptive to speech utterance. Further the complementary information captured by different features is explored through the use of Robust Speaker Recognition (RSR 2015) dataset.

b.Source features: The subsequent work proposed by Patil et al.,2013 suggests the use of Liljencrants–Fant (LF) parameters to characterize the glottal flow derivative (GFD) by locating the glottal closing and opening instants. Explicit and implicit modeling of glottal.

information along with their comparison is done in this approach. Explicit approach is more suitable for verification task as it captures small intra-speaker variation. In contrast, implicit approach is found to be useful for SI as it captures large inter-speaker variation. Individually both implicit and explicit methodology signifies the speaker characteristics complimentary to the conventional vocal tract based approach. Following this Chen et al.,2013 have proposed a noise separation method motivated constrained non-negative matrix factorization (CNMF) of short utterances . This method uses difference detection and discrimination (DDADA) algorithms to categorize speech into high quality and low quality speech.

The features from different quality speech are then used in the conventional GMM-UBM framework. Li et al.,2015 have suggested the use of the multi-resolution time frequency feature (MRTF). This study is based on the idea that speaker specific information might be available in the spectrogram calculated at different time frequency scales. Two dimensional cosine transform of spectrogram matrix calculated at different scales is used for forming the feature set. Systems with this feature set have shown superior performance when tested on National Institute of Standards and Technology Speaker Recognition Evaluation (NIST SRE) 2008 corpus. Fusion of amplitude and phase-information is proposed byAlam et al.,2015. For the amplitude- related different cepstral features are considered whereas for phase related features, modified group delay and all-pole group delay, linear prediction residual are considered. The average fused system has shown EER improvement.

A new feature set based on instantaneous frequency cosine coefficient (IFCC) free from phase warping issue is suggested by Vijayan et al., 2016. The improved results obtained from the fusion of IFCC feature with the MFCC and FDLP features shows complementary nature of information captured by individual features. Recent research suggests the use of deep neural network (DNN) based speaker verification. In one of approach proposed by Guo et al.,2016. DNN is used as a regression model which transforms filter-bank coefficients of the speech signal to the associated sub-glottal features. A distinct approach, mainly useful for degraded condition is proposed by Bharathi et al.,2013.It measures amount of non-stationarity of speech signal using amplitude and frequency modulation concept. For doing this study it has used Texas instruments and Massachusetts institute of technology (TIMIT) database. Further, more advanced analysis technique motivated by work proposed by proposed by Ambikairajah et al.,2007 uses empirical mode decomposition (EMD) for feature extraction. It has demonstrated that this approach captures the information complementary to that of vocal tract and source excitation features.

c.High level features: Mary et al.,2008 have [36] proposed use of prosodic features for speaker verification. It is based on the assumption that prosody is related to linguistic units such as syllables. The syllables are extracted by detecting the vowel onset points which is primarily helpful when explicit syllable boundaries are not easily obtainable. Prosodic features formation using pitch and energy contours of speech is studied by Dehak et al.,2007. Significant improvement is achieved when these prosodic features are combined with MFCC features for GMM based modeling over the conventional JFA based modeling approach. One can distinguish speakers just by listening the one who is familiar than the one who is not. Based on this fact the work studied by proposed by Doddington et al.,2001 use various idiolectal dissimilarities of speakers. The results achieved are very encouraging but feasible with a sufficient amount of training data. Another innovative approach proposed by Andrew et al., 2002 has used phone sequences from multiple languages to create gender-dependent phone models. It is observed that this strategy helps in reducing cross-talk from input speech.

Table 1. Review of short utterance speaker verification research

Year of Publication	Methodology	Database
2001	Bigram statistics from familier speaker characteristics such as speaker specific words	SwitchBoard
2002	Extract phone sequences using phonetic recognizers for speaker modeling	Switchboard
2006	Conditional pronunciation modeling of articulatory features	SPIDRE ,Switchboard
2007	Vocal tract and excitation feature extraction from LPC based group delay Prosodic feature extraction by fitting pitch and energy contours with Legendre polynomial expansions	NIST SRE 2001 NIST SRE 2006
2008	Prosodic features associated to linguistic units such as syllables directly extracted from speech	NIST SRE 2003
2009	Multiple frame size and frame rate instead of single frame size and rate	TIMIT
2011	Match the pitch and MFCC contours using dynamic time warping	NIST SRE 2008
2012	Auto-encoder bottleneck feature ASCCD	
2013	Glottal closing and opening instants are located using Liljencrants–Fant parameters	NIST SRE 1999 , 2003
2014	Multiresolution analysis of speech spectrogram Phone discriminant and speaker discriminant DNN as deep features	NIST SRE 2008 RSR2015
2015	Phonetic contents Amplitude- related cepstral features and phase related modified group delay and all-pole group	RSR2015 and NIST SRE 2010 NIST SRE 2008 and 2010.
2016	delay, linear prediction residual are fused togather Tackle the phase warping issue using Instantaneous frequency cosine coefficients	NIST SRE 2010
	Estimation of subglottal acoustic features based on DNN Eigen-structure analysis of covariance matrix of local short term features Constant Q cepstral coefficients (CQCC) features inspired by the human auditory system	NIST SRE 2008 NIST SRE 2001, 2008 ,2010 and RSR2015 NIST SRE RSR2015
2017	Voice quality features motivated by a psycho-acoustic model	NIST SRE 2010
2018	Patterson-Holdsworth Meddis hair cell model Human based subjective evaluations and machine based evaluations using the high level speaker characteristics	TIMIT UCLA
2019	Weighted sum of phoneme variations	NIST SRE 2010

The work studied by Leung et al.,2006 makes use of speaker pronunciation of the speakers who are from different educational background, and different accent. Further this study has also investigated the relationship between articulatory features and phoneme patterns of speakers using conditional pronunciation model. An analysis of deep features in a Tandem method for speaker verification is studied by FU et al.,2014. Phone discriminant and speaker discriminant DNN are combined with conventional acoustic features and applied in a GMM-UBM framework. Another strategy proposed by Sainath et al.,2012 is based on neural network (NN) bottleneck features is experimented on Annotated Speech Corpus of Chinese Discourse (ASCCD). Here, a constant number of hidden units are used to predict output targets. Then, auto-encoder bottleneck feature set is formed using dimensionality reduced output target probabilities. Another system which makes use of bottleneck features for studying the language independent speaker verification can be explored in the

study made by Fatima et al., 2012. Another study made by have used different vowel categories as high level features for SV in a GMM-UBM framework.

The work made by Scheffer et al., 2012 is a study to match the content from a speaker's enrollment data with the test data content. Matching of the contents is done at the statistical level. Inspired by a psycho-acoustic model proposed by Park et al., 2017 make use of voice quality features. The study proposed by Park et al., 2018 compares SV performance human based subjective evaluations and machine based evaluations using the high level speaker characteristics like speaking style. It is shown that evaluations done by humans and systems based on University of California Los Angeles (UCLA) speaker variability database are dissimilar.The system performance can be enhanced by investigating more advanced relation between different acoustic features and perceptual features. Paulose et al., 2017 suggests the use of inner hair cell (IHC) coefficients based on the physiological variations of the mammalian outer hearing system.

A significant rise in the performance is achieved when the IHC features are combined with pitch and formants. The phonetic influence of short utterances is analyzed in the study made by Vinals et al., 2019 .It is shown that weighted sum of phoneme influences is representative of the speaker specific auditory system component to some extent. When the weights fluctuate from the required weight distribution, they do not contribute to the speaker specific information and hence cause performance degradation. A system detecting whether the input is a authentic or a recorded speech is used in the work done by Villalba et al., 2011 to avoid false acceptance. In this system short testing utterances are formed by cutting and pasting the speech segments of registered speaker's utterances. The spoofing attack is detected by matching the pitch and MFCC contours of the enrollment and test segments using dynamic time warping. This study is to avoid spoofing of speaker verification system essentially in the presence of replay attack.

4. Major findings and Future Opportunities and challenges: In this paper we have mainly briefed the research solutions and challenges considering the feature extraction approaches to be eployable in the real world applications. The study proposed by Athineos,2007 has explored how the specific factor performs when utterance lengths are considerably shortened. Essentially, the existing factor analysis systems which use different compensation methods have not shown any strong performance dissimilarities for short utterances. Most of the session variability compensation techniques used in factor analysis approaches are general. The performance of factor analysis based tactic drops severely when utterance lengths is decreased mainly less than ten seconds. Further efforts to explore the optimal compensation techniques are required. The work proposed by Sahidullah,2016 has derived a set of feature vectors using local covariance information. Further this study has also inspected how the local and global covariance information is related. Relative performance improvement 12.28% is obtained when the derived local features are combined with conventional cepstral features.

How to handle robustness of the authentication system while capturing the local uncertainty information from the speech segments is the unsolved problem. So there is a considerable scope for researchers to do further analysis in this direction. Some of the works in the literature suggests using complementary features besides using the conventional features for representing speaker specific information. The idea of Athineos,2007 is based on finding the relationship between the time domain envelope and autocorrelation of frequency domain envelopes of a speech segments. The constant Q transform based coefficients proposed by Todisco,2016 are substitute to traditional cepstral coefficients and it also resembles the human perception system more precisely. Combining CQCC and conventional cepstral coefficients extracted from the RSR2015 database have attained 60% reduction in the EER compared to cepstral features. This work could be extended further to analyze whether the fusion of CQCC features and time domain features would help in improving the system performance.

The aim of work suggested by Li,2015 is to analyze the complementary information captured by amplitude and phase features. The combined system has achieved 37% reduction in EER compared to that of cepstral features on NIST SRE 2008 database. The work suggested by Vijjayan, 2016 is based on the use of speaker specific phonemes to improve the discrimination ability of the classifier. The EER reduction of 4% is obtained when speaker phonetic information is utilized in classification task. Mary,2008 has experimentally demonstrated a new method of extracting prosodic features directly from speech segment. Syllable level sequence is acquired using vowel onset point as a reference without using any speech recognizer. Evaluation of proposed prosodic features on NIST SRE 2003 database has shown EER reduction of 2.5%. Many authors in literature have emphasized on exploring high level features . Thus high level features also have significance similar to low level features for speaker representation. From the studies which we have reviewed , we observe that most of the researchers have used spectral features and some of the studies have used combination of spectral features and long term features. However, exploring the best combination of these features which could uniquely characterize speaker in practical situation is the toughest challenge. The work made by Scheffer,2014 deals with the content mismatch issue of test and enrollment data at the statistical level.

The statistics of the enrollment data are transformed to that of the test data followed by predicting the speaker model related to test input. This system show performance boost by 50% for seen conditions .However, data from different content degrades the performance. This issue opens up research directions to analyze why

the content matching could not work in the practical senario. This encourage further study in this direction to design the decision tree taking into consideration more and more the realistic conditions. This could help in achieving better system performance. The study made by Park,2017 focuses on the issues related to large intra-speaker variability particularly for short utterances It is found that performance deviates to the large extent with seen and unseen intra-speaker variability which is not like humans. For that reason exploration of speaker characteristics insensitive to intra-speaker variability is the another big challenge which is yet to be resolved. We observe that works reviewed in this paper use different databases with different conditions for short utterances for evaluating the proposed systems. Therefore, direct comparison of their performance is not beneficial.

Another challenging problem in speaker verification is benchmarking the amount of speech data for obtaining SV systems with acceptable performance. This opens up scope for the researchers to study whether a speech utterance with the given duration is appropriate for enrollment or test and suggest some reliable performance measures in this direction. We also observe that the performance of the SV system is very much dependent on phonetic contents of the speech. This inspires further study to find out the features invariant to phonetic content of the speech data. Another problem which needs to be addressed is replay attack on the SV system by using the speech recordings of the claimed speaker to get access to the required service. With the importance of spoofing attack, development of systems in his direction has gained attention recently. Apart from the above discussed directions the deployment of SV system in presence of noisy conditions is of major concern .There are many methods for improving SU-SV system with constrained noisy conditions, however, very few for unconstrained noisy conditions. More advanced feature extraction approaches could be investigated relevant to short utterance

CONCLUSION

The issue of short utterance for speaker verification point of view has been considerably increased in recent studies. Many research efforts are carried out to handle this problem in different domains of speaker verification. In this paper, we have essentially done a brief review of feature extraction strategies that are used in the past and recent studies. In this review we have explored features extraction methods at different levels such as source level, vocal tract level and supra-segmental level. This review provides possible suggestions with which researchers could extend the existing work and solve the challenges in this area.

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Performance of Routing Schemes in Wireless Sensor Network

Poonam T. Agarkar[1], Manish D. Chawhan[2], Pradeep T. Karule[3] and Pratik R. Hajare[4]

[1]*PhD. Scholar, Electronics Engg., YCCE, Nagpur, Maharashtra, India*
[2]*Associate Professor, ETC Department, YCCE, Nagpur, Maharashtra, India*
[3]*Professor & Head, Electronics Engg., YCCE, Nagpur, Maharashtra, India*
[4]*Director, The Pearl Engineering Solutions, Nagpur, Maharashtra, India*

ABSTRACT

Adhoc on Demand Distance Vector (AODV) mechanism had been extensively incorporated with various scenario of Wireless Sensor networks to evaluate various performance parameters. The work presented in this paper is a comparative analysis between AODV and other two standard routing protocols named Destination Sequenced Distance Vector (DSDV) and Dynamic source routing (DSR) protocols. A scenario of 17 nodes is created using NS2 Scenario Generator/NetSim with some mobile nodes and Tool Command Language (TCL) file has been created using New trace file format to extract the required information for writing the AWK scripts for estimation of Packet Delivery Ratio (PDR), Throughput, End to End (E2E) Delay, Energy of the Network, Packets delivered by the sensor nodes and packet accepted by the final nodes. The result obtained showed that AODV have higher throughput, E2E delay and also the numbers of packet sent and received than DSDV and DSR. DSR have higher throughput than DSDV. The PDR is higher in case of DSR and DSR has higher throughput than DSDV while the residual network energy of AODV and DSDV is higher than DSR.

KEY WORDS: ADHOC ON DEMAND DISTANCE VECTOR (AODV), WIRELESS SENSOR NETWORKS, DESTINATION SEQUENCED DISTANCE VECTOR (DSDV), DYNAMIC SOURCE ROUTING (DSR), NS2 SCENARIO GENERATOR, TOOL COMMAND LANGUAGE, PACKET DELIVERY RATIO (PDR), END TO END (E2E) AND THROUGHPUT.

INTRODUCTION

Due to immense increase in wireless network users and availability of mobile devices, there was an explosion in wireless sensor applications over the last decade [Munisha Devi et. al., 2019, L. Guaya-Delgado et. al., 2019, Rutvij H. Jhaveri, et al., 2018, S.L. Meshram and P.D. Dorge. 2017]. Beside improved quality service and mobility, networks have enhanced organizations and corporates with respect to their business and increased the productivity [A.M.E. Ejmaa et. al., 2015, Nguyen Dinh Han et. al., 2015, H. Xiao et. al., 2014 and C.R. Komala et. al., 2010]. The primary goal of a routing protocol (Rp) in networks is to allow efficient flow of packets over the network. Rp's in wireless scenario has varied requirement as compared to wired network in terms of performance parameters. They are classified as proactive (PR) and reactive (RR) where the former only generate routes when data transmission is initiated. The AODV [E.M. Royer et. al., 2001 and B. Abasgholi et. al., 2008] is an example of RR and based on DSDV technique.

The mechanism of AODV is totally node dependent that is the current node decide where to route the packet in the network. A hop-by-hop transmission of packets is maintained by a route table consisting of three fields: hop count, sequence number and next hope node. Thus, individual packets find their own path and maintain their

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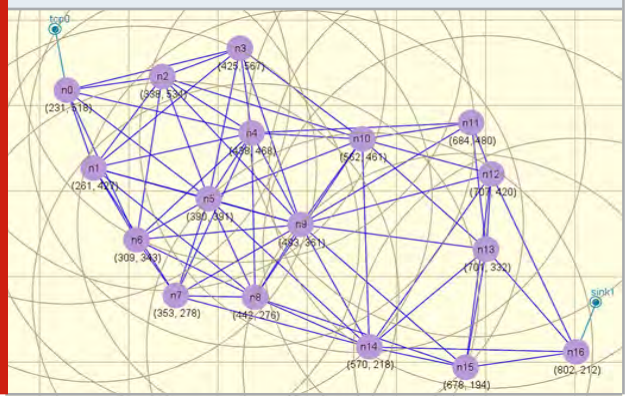
transmission link. Hello messages are delivered at regular intervals to nearby nodes. The three different messages used by AODV are Route Request (RREQ), Route Reply (RREP) and Route Error (RERR). For a packet in the network, the algorithm checks the route table to validate the connection. If the path is valid then the packet is transmitted to the next jumping node. It broadcast RREQ for route search, when it fails to do so. The format of the RREQ is shown in figure 1 below.

Figure 1: RREQ Packet in AODV

Transmission ID	IP Address: Source	Sequence Number: Destination (Recent)	Sequence Number: Source (New)

Figure 2: WSN for 17 Nodes showing source and destination nodes.



All the nodes receiving RREQ will update information as per the source and establish a reverse pointer to the sender in the routing table. The RREQ may be received by an intermediate node or the last node. The last or final node will send a RREP packet. This RREP packet will follow a reverse path via the intermediate nodes to the source and thus a link is established from the source to the end node. Once a path or route is maintained in the route table, any later RREQ to the destination is not forwarded but uses the same route in future. For any link failure or breakage within the network due to change in topology, information regarding invalid path is conveyed to all the nodes by itself. It is loop free, dynamic and multi-hop in nature. A WSN with 17 nodes generated in NS2 Scenario Generator/NetSim is shown in figure 2 below.

[Shaily Mittal and Prabhjot Kaur, 2009] varied pause time using random waypoint for their model and simulated the network for 'N=15' times for CBR traffic. They considered ZRP (Zone Routing Protocol) instead of DSDV. They showed that average E2E delay of AODV was less, PDR to be high and hop count increased continuously with respect to other routing protocols. The effect of black hole attack on AODV and comparison with DSDV is listed in [A. A. Chavan et. al., 2016]. The author showed that PDR was reduced and throughput was zero with AODV considering the attack named black hole. Further they improved AODV and showed that both the parameters were unaffected at the cost of packet population. Anshuman Biswas et. al carried the simulations in NS2 using new trace format and compared AODV and DSR. They analyzed the protocols by varying parameters such as network size, network load and mobility and made comparison in multiple dimensions. They showed that AODV performed better except for low mobility situations [Biswas A. et. al., 2012]. Similar work was carried out in [P. Manickam et. al., 2011] and the performance was analyzed using NS2 simulator with varying network size and simulation time. The author concluded that DSR was suitable for moderate traffic and mobility. DSDV produced low end to end delay as compared to others. PDR was better with AODV for low traffic. Another work carried by Thakre and Joshi in [Amit Thakre and Mrs. M. Joshi, 2010] using NS2 simulation showed that both Adhoc and Dynamic schemes are similar but AODV is easy to implement and use with other routing protocols and have good packet delivery ratio as compared to DSR whereas DSR is more stable and have low overheads.

Table 1. Node movement initialized over the simulation time with respective speed.

Node_ID	X_init	Y_init	X_pos	Y_pos	Time	Speed
5	493	330	500	300	1	10
5			600	500	10	30
8	649	300	363	287	2	30
8			695	54	8	25

Table 2. Parameters initialized for AODV, DSDV and DSR Routing protocol for WSN.

Sr. no.	Parameter	Value
1.	Routing Protocol	AODV/DSDV/DSR
2.	No. of Nodes	17
3.	X- Dimension	1036
4.	Y-Dimension	646
5.	Simulation Time	25/1000/25
6.	Node Energy	1000
6.a.	Tx power	0.9
6.b.	Rx power	0.4
6.c.	Idle power	0.05
6.d.	Sleep power	0.005

METHODOLOGY

The simulation of the wireless sensor network was modelled using NS2 Scenario Generator/NetSim with 17 nodes placed over the default space region of 1036x646. Except two nodes with node ID's 5 and 8 all other nodes were assumed to be stationary without any movement over the complete simulation time whereas node 5 and 8 were free to move in the space as listed in the first table below. The values in the table are the node initial and final positions in the space and the time and speed at which they tend to move. The time indicates when the node will start moving in the space towards its new position as indicated by X_pos and Y_pos in the two-dimensional space.

The various parameters initialized for the networks are listed below in table 2. Note that the simulation time for DSDV was increased to 1000 since for low simulation time, the packets transmitted were zero. The common parameters initialized for all three routing protocols are listed in table 3. The only change required for DSR routing is the type of QUEUE used. In case of AODV and DSDV, DropTail Priority queue is used whereas for DSR, CMUPriQueue is used instead of DropTail/PriQueue.

Table 3. Common parameters for routing protocols in WSN.

Parameters	Description
Channel	Wireless Channel
Propagation	Two Ray Ground
Network Interface Type	Wireless Phy
MAC Type	802_11
Interface Queue type	DropTail/PriQueue for AODV and DSDV/ CMUPriQueue for DSR
Link Layer Type	LL
Antenna Model	Omni Antenna
Maximum Packet in IFQ	50

The instructions included in TCL file for defining New Trace File format, initializing interface Queue type for DSR routing and node energy initialization are listed below in figure 3: AWK (Aho, Weinberger and Kernighan, 1977) scripts were individually written for all the three routing protocols for the same 17 nodes wireless sensor network and results were evaluated for PDR, Throughput, E2E Delay and network residual Energy.

RESULTS AND DISCUSSION

The aim of the work was to compare the performance of three standard routing protocols with stationary and mobile nodes. Wireless Sensor Network with 17 nodes was simulated using NS2 Scenario Generator/ NetSim. Using New trace file format and AWK scripts the performance parameters PDR, Throughput, E2E-Delay and network residual Energy were estimated which are shown below in table 4.

The results in table 4 clearly shows that the packet delivery ratio of DSDV is lower than other protocols where DSR has the highest value. Even at the initialization

Figure 3: TCL instructions for initialization.

```
\\ For generating trace files with new format
$ns use-new-trace

\\ DSR protocol uses CMUPriQueue instead of DropTail/PriQueue
if { $val(rp) == "DSR" } {
set val(ifq) CMUPriQueue
} else {
set val(ifq) Queue/DropTail/PriQueue
}

\\For Node Energy initialization
$ns node-config     -energyModel "EnergyModel" \
                    -initialEnergy 1000.0 \
                    -txPower 0.9 \
                    -rxPower 0.4 \
                    -idlePower 0.05 \
                    -sleepPower 0.005
```

Table 4. Estimated parameters for AODV, DSDV and DSR routing techniques in WSN.

Estimated Parameters	AODV	DSDV	DSR
PDR	0.9611	0.2857	0.9774
Throughput (Kbps)	213.65	0.0446	184.16
E2E Delay (milli second)	33.496	0	26.47
Network Energy (Joules)	5957.07	5694.31	5957.44
Packets Sent	669	7	576
Packets Received	643	2	563

the simulation time for DSDV was increased to 1000 as compared to 25 for other two schemes to obtain some transmission of packets. The throughput and number of packets transmitted/received is higher in case of AODV. Both the parameters are considerably low for DSDV routing protocol for the same network. The overall residual energy of the network in DSR is slightly higher than AODV, where DSDV have the lowest value. The DSDV routing has superior performance in terms of E2E delay which is zero where AODV requires the maximum time.

CONCLUSION

It is seen from various literatures that there is no generalized routing scheme which can be suited for diverse applications to produce optimum results in terms of performance parameters. The objective is to have a generalized routing scheme meant for sensor networks which would yield the performance irrespective of the scenario and applications. One way is to combine the features of all the three routing schemes and incorporate some optimizing algorithms to design a better routing technique suitable for WSN. Some of the computational Intelligence based routing schemes are proposed in [Tarunpreet Kaur and Dilip Kumar, 2019] which includes fuzzy logic, reinforcement learning, particle swarm optimization, ant colony optimization, genetic algorithm, artificial bee colony optimization etc.

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Indoor Fire Localisation using WSN and Fire Map Generation for Industrial Environment

Atharva R Karpate[1*], Piyush P Agarwal[2*] and Ashlesh A Jaiswal[3]
[1]*Department of Electronics and Communication,*
Shri Ramdeobaba College of Engineering and Management, Nagpur, India

ABSTRACT

Every year Industrial fires lead to tremendous economic and human loss. Real-time fire detection and localisation remains a serious challenge, especially for the industrial environment. With the substantial growth of Wireless Sensor Network(WSN) in recent years, one of the most important applications of it has been in the area of fire detection and protection. In this paper, we present a low-cost and scalable wireless sensor network-based system for fire detection and localisation. To analyse the fire source and spread in real-time we also present a fire map generation mechanism in our system. Various sensor configurations are tried to optimize fire detection and localisation coverage.

KEY WORDS: WIRELESS SENSOR NETWORK, FIRE DETECTION, INDOOR LOCALIZATION, FIRE MAP GENERATION.

INTRODUCTION

Fire detection and prevention systems constitute a crucial part of any industrial establishment. In recent years, there has been an increase in the number of fire-related accidents which have resulted in significant loss of lives and properties. An efficient and effective system can reduce losses considerably. Consequently, much research has been carried out in the area of fire detection and prevention. One such example is the use of wireless sensor networks for fire detection. A Wireless Sensor Network(WSN) is a collection of multiple sensor nodes which communicate with a set of gateways to transfer information about their environment. Wireless systems have an advantage in emergency fire situations as they are less prone to damages caused by the fire source and are easy to install compared to wired systems. Wireless sensor nodes also have other advantages such as low cost, flexibility in the operating environment and low power consumption per node.

Literature Review: Traditionally, fire detection systems have relied on smoke sensors to warn for possible fires. These systems generally do not have monitoring devices and do not help with localising fire. Efforts have been put to design WSN based fire detection systems, [1] combines smoke and temperature sensors to detect fire and reduce false positives. [2]To ensure the safety of workers working in mines, various network topologies and communication protocols were analyzed for the optimum performance of a WSN-based fire detection system. Apart from mere fire detection, [3] uses multiple sensors on a wireless node with trilateration technique to localise fire in the indoor environment. [4] A framework is designed to detect fire and simultaneously perform rescue operations with the help of WSN based technology.

The framework consists of a fire detection sensor network, middleware, data gathering layer, and an escape system. Vision sensors or a combination of vision and smoke sensors have been used in many fire detection systems [5, 6]. Though vision sensors help in getting real-time visual information, these systems have high deployment costs and are less effective in large indoor environments

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which are typical of industrial settings. In this paper, we present a low cost and scalable system for fire detection and localisation using WSN. The paper also presents an analysis of various sensor configurations in each wireless node. Finally, the paper proposes the generation of a fire map in real-time to help with the monitoring and mitigation of fire sources. The paper is divided into three sections starting with the overview of the proposed system followed by its detailed architecture and analysis.

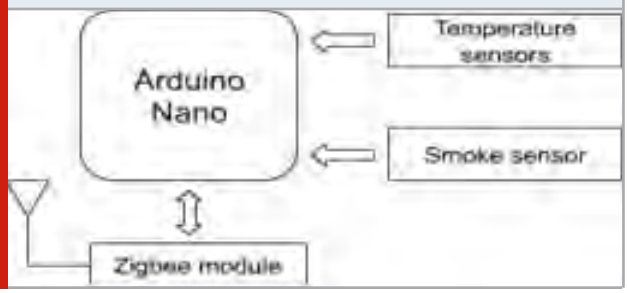
Overview of the System.

Figure 1: Overview of the System

The proposed system is divided into three parts as follows -

1. Fire Detection subsystem - Fire detection subsystem has a high sensitivity for smoke and is primarily tasked with detecting fire. This system is continuously polling for signs of smoke and fire.
2. Fire Localisation subsystem - After the successful detection of fire, it is important to localise the position of fire. This subsystem is tasked with localising the fire source and it's spread.
3. Fire Map Generation subsystem - Once the fire is localised, this subsystem acts to produce real-time Fire Map of the environment which tracks the source and spread of fire.

Figure 2: Block Diagram of Wireless Node

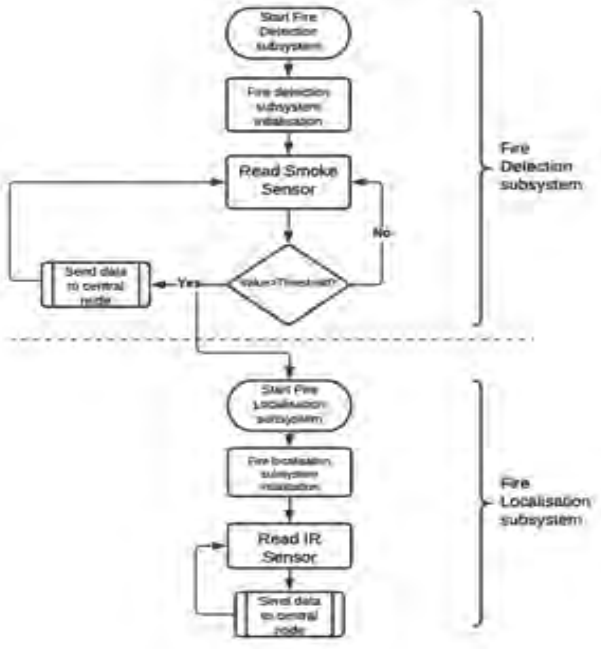


Hardware Description and System Architecture: We propose a simple wireless node for the system which is a low cost, low power consumption and scalable wireless sensor node as shown in Figure 2. The Node consists of a simple microcontroller-Arduino Nano, Zig-Bee module for wireless communication, Smoke sensor and IR temperature sensors for detecting and localising fire respectively.

Hardware Components

1. Arduino Nano - Arduino Nano is an open-source embedded computing platform based on Atmega 328 single-chip microcontroller. Arduino provides a development environment which utilizes Processing for creating stand-alone embedded systems applications. We use this as the primary processing unit in the Wireless Node.
2. Zig - Bee module - Zig- Bee is a specification for a group of high-level communication protocols targeted at low power, low data rate and low-cost wireless devices. It has a range of 100-120 meters and has a defined bandwidth of 250kb/s. The Zig-Bee module acts as the communication medium between each node and the central node in our system.
3. Smoke sensor - MQ-2 Gas sensor is useful for detecting H2, LPG, CH4, CO, Alcohol and smoke. The sensor provides digital as well as analog outputs for measurement with a range of 200 to 10,000 PPM. Smoke sensors have high sensitivity but do not help with the localisation of fire. As smoke is pervasive in nature, smoke arising from one area could easily be detected in other areas. Hence, we have used the MQ-2 Smoke sensor primarily for the Fire Detection subsystem.
4. IR Temperature Sensor - We use IR temperature sensors in combination with the MQ-2 Gas sensor in order to localise the fire source. For the proposed system, we have used MLX90614ESF-AAA IR Temperature sensor. It is a high-resolution and high-accuracy non-contact temperature sensor with a 90-degree field of view and can detect temperatures between -70 to 380°C. This sensor uses a digital interface(SMBus) and can provide continuous readings with customizable 10-bit PWM output.

Figure 3: Workflow of Detection and Localisation subsystems.



System Architecture

Fire Detection Subsystem: Fire detection is the first step in the proposed system. MQ - 2 gas sensors are used to

detect smoke from the fire source. Each MQ - 2 Smoke sensor is equipped with multiple IR Temperature sensors for fire source and spread localisation. As MQ - 2 smoke sensors have low specificity we do not use them for fire localisation. Once the PPM of smoke crosses a preset threshold value, the detection subsystem activates the fire localisation subsystem and sends this data to the central node for the fire map generation.

Fire Localisation Subsystem: After the successful detection of fire, it is important to localise the fire in real-time. To localise the fire source and its spread, this subsystem uses multiple IR temperature sensors(MLX90614ESF-AAA). This subsystem is not activated until the fire is detected by the fire detection subsystem. This saves power as only one sensor is polling continuously in each wireless node. After fire detection, each IR temperature sensor detects the temperature within its surrounding and this data is reported to the central node for the generation of a fire map.

Wireless Pod Design: Each wireless node is termed as a pod. It consists of a smoke sensor at its centre and a varying number of IR Temperature sensors. The pod is further divided into cells based on the location of IR Temperature sensors. These cells are arranged in different patterns to get multiple Pod configurations. To detect and localise the fire source in each WSN Node or Pod, we propose various Pod Configurations based on the following parameters -

1. Percentage of Detection Area - This is defined as the percent of area out of the total area within a Pod which can timely detect the presence of fire and the concentration of smoke.
2. Percentage of Localisation Area - It is defined as the percent of area out of the total area within a Pod where a fire source can be accurately and timely localised.
3. Number of Sensors - Number and type of sensors(Smoke and IR Temperature Sensor) required per pod.
4. Pod Shape Scalability - The Pod design should have a repeatable geometry so that it could be deployed across various industrial spaces.
5. Taking into consideration the above parameters, we propose the following three configurations -
6. Pod Configuration A - This configuration consists of 4 IR Temperature and 1 Smoke sensors which are positioned as shown in Figure 4. The shape of the pod is square which is inscribed in a circle whose radius is the detection radius of the smoke sensor. This square is further divided into 4 smaller cells and one IR sensor is placed at the centre of each square.
7. Pod Configuration B - This configuration consists of 5 IR Temperature and 1 Smoke sensors which are placed as shown in Figure 4. The shape of the Pod is square whose sides are equivalent to the diameter of the smoke sensor detection circle i.e the detection region is inscribed in the square Pod, which primarily differentiates it from configuration A.
8. Pod Configuration C - This configuration consists of 7 IR Temperature sensors and 1 Smoke sensor placed as shown in Figure 4. The pod consists of seven hexagons, each with 1 IR Temperature sensor at its centre. These seven hexagons are inscribed inside the smoke detection region. These configurations are repeated over the specified industrial environment for detection and localisation coverage.

Figure 4: Pod Configurations

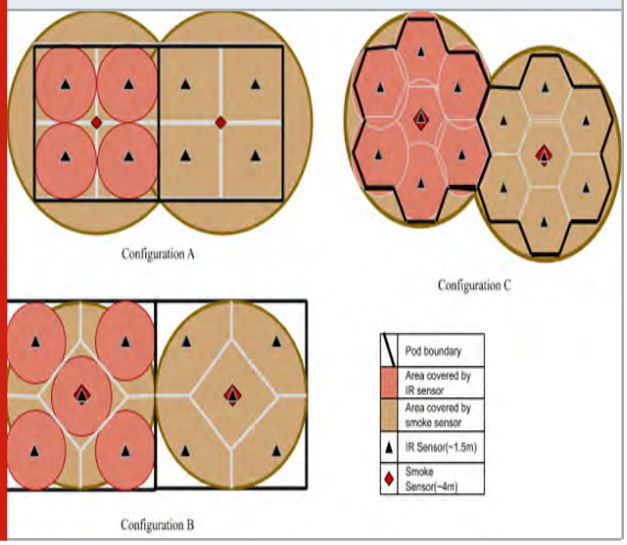
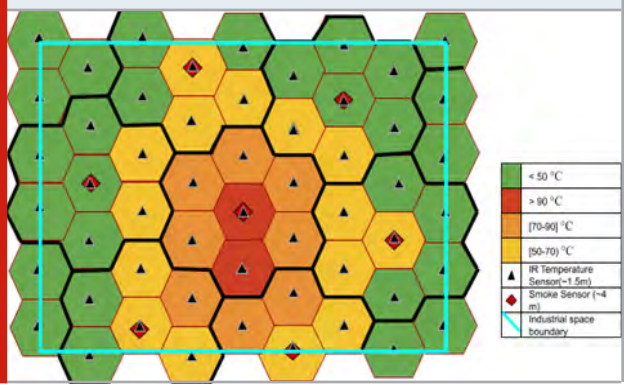


Figure 5: Fire Map



Fire Map Generation: All the wireless nodes are connected to a central node in a star network topology. The central node acts as a hub to communicate and collect information from all nodes. To successfully monitor and localise the fire source, a fire map is generated at the central node. After the successful detection of fire and subsequent collection of localisation information from each pod, a fire map is created as shown in Figure 5. Areas with a high-temperature range of above 90 °C are classified by red and are considered dangerous. Orange(70-90°C) and Yellow(50-70°C) represent milder temperature ranges which are deleterious after long exposure. The green areas represent cells which have room temperature and are completely safe.

Results and Analysis: Range of Smoke sensor - To find the optimum range of smoke detection for MQ - 2 sensor, readings were collected at different ranges from the fire source as shown in Figure 6. It was observed that the MQ -2 gas sensor provides reliable readings until the distance of ~4 meters from the fire source. We chose this as the range of smoke sensors and derived our pod configurations from it. Range of IR Temperature sensor - To localise and get the accurate temperature readings, we employ IR Temperature sensors within their optimum detection ranges. To find the feasible radius of temperature detection with an admissible error range, we measured the temperature at different lengths from the fire source and compared it with the temperature near the fire source(thermometer placed at 10 cm) as evident in Table 1. The IR Temperature sensor does not provide accurate readings for distances more than ~1.5m. To keep the system accurate we use this as the optimum range of the IR Temperature sensor.

Figure 6: Range of Smoke Sensor

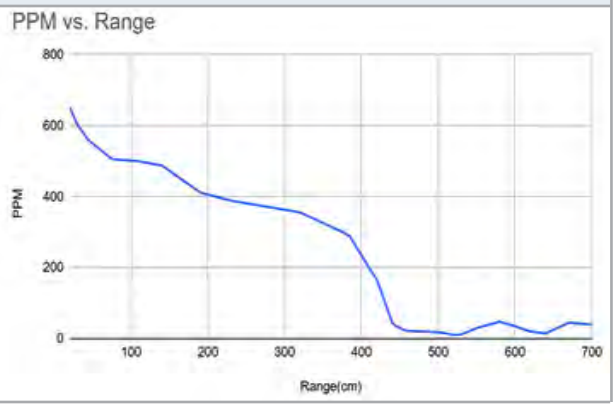


Table 1. Range of IR Temperature Sensor

Distance from the fire source (m)	Temperature Sensor (°C)	Thermometer (°C) At 10 cm from Fire Source	Error
0.1	72	73	-1
0.3	74	73	+1
0.5	72	74	-2
0.7	70	73	-3
1.0	71.5	74	-2.5
1.3	71	75	4
1.5	71.5	77	5.5
1.7	68.5	76	7.5

Configuration Results and Explanation: We provide sample analysis for the three configurations based on the results obtained for the detection range of smoke sensor and localisation radius of IR Temperature sensor -

- Sample Floor Area - 400m2
- Smoke sensor radius ~ 4 m
- Area of Smoke Circle - 50.26 m2
- IR Sensor radius ~ 1.5 m
- Area of IR Temperature Sensor - 7.06 m2

Table 2. Pod configuration analysis

Config	Area of Cell(m^2)	No. of cells in Pod	Area of Pod (m^2)	No. of IR	No. of Smoke Sensor	Total Sensor	Detection %	Localisation %
A	8	4	32	50	13	63	100	87.5
B	16	5	64	31	7	38	78.5	55.1
C	5.8	7	41	69	10	79	100	100

Table 2 represents the analysis of the three configurations. Based on the detection and localisation region, we calculate the number of IR Temperature sensors, Smoke sensors and the total number of sensors for each configuration. The percent of detection area and the percent of localisation area out of the total area of the pod were also calculated for the three configurations. It was observed that configuration C provides 100% detection and localisation coverage for the entire pod area but the number of sensors required is the highest amongst the three configurations. On the other hand, Configuration B requires the least number of sensors but has poor detection and localisation capacity. Configuration A provides full coverage for fire detection and sufficient fire localisation coverage, though the number of sensors required is ~65% more than Configuration B. Configuration C can be utilized in areas with the need for complete detection and localisation such as nuclear facilities, ordnance factories or any other critical facilities where real-time fire localisation is of foremost importance for fire extinguishment and evacuation effort. Configuration B could be deployed in residential and office premises, where fire detection is the chief factor. Configuration A provides a blend of Configuration B and C, it could be primarily applied to a non-critical industrial environment where complete fire detection and adequate fire localisation are required.

CONCLUSION

The presented system provides a scalable, low cost and low power fire detection and localisation system. The proposed system generates a fire map to get real-time information about the fire source and its spread. The combination of Smoke and IR Temperature sensors with varying configurations provide a flexible solution for monitoring fire in different industrial environments. Three configurations were analysed in this paper but further improvements could be made by adding multiple sensors and designing configurations according to the need of the industrial environment. A system for targeted fire extinguishment could be added to stop the fire spread in real-time.

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A Review of FACS: Fluorescence Activated Cell Sorting System

Aishwarya Agarwal[1], Deepak Khushalani[2], Ankita Harkare[3] and Rakshal Agrawal[4]
[1]Research Intern, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[2]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[3]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[4]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Industrial Engineering

ABSTRACT
In this time of pandemic research trend towards finding research solutions requires data collection and processing capabilities so that human life can be improved by providing faster as well as safer means of results. These results related to impurities that have developed related to human health needs to be processed with the angle of machine learning decade. The means of developing this mechanism when in comes to human health care is the main aim of this research review. The data base to be created is of particles that are subjected to a fluorescence activation mechanism know as laser via a microchannel. This subjection to activation and the reaction of these particles are captured by various means of acquisition. This research article provides an review of flowcytometry principle which helps the researcher to provide a data base acquisition system "FACS". The applications that the FACS system can be utilized are also covered in this review article so that the need of development of such system is justified. The system data and means of acquisition to provide for the data base development is the prime essence of this research article.

KEY WORDS: FLOWCYTOMETRY, FACS, ACQUISITION SYSTEM AND MICROFLUIDICS.

INTRODUCTION

Technique of bifurcating and providing analysis of physical and chemical characteristics of a fluid particle or liquid is known as Flow cytometry (FCM) as defined in research journal by Picot J et al., Flow cytometry free dictionary website, Beckman Coulter et al. and Givan, Alice L. The principle mechanism of this technique is that a droplet or a complete fluid via a means of microchannel is activated through a fluorescence laser. This activation leads to scattering of light which can be captured by the an acquisition system which can be optical or digital on the whole. Such active marking scheme has been the source of biological processing and result provision related human health care over few decades. The use of such mechanism from the past decades has been in the fields of results pertaining to cell counting, cell sorting, determining cell characteristics and function, detecting microorganisms, biomarker detection, protein engineering detection, diagnosis of health disorders such as blood cancers and many more as reported in Wikipedia. The mechanism covering the "optical means" of data collection can be better understood by the below diagram.

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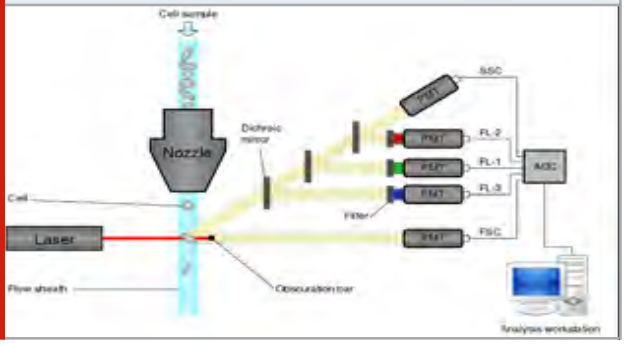
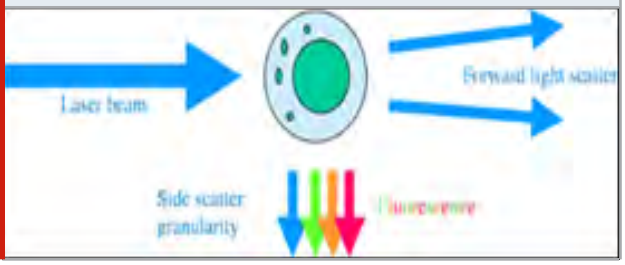
Figur 1: Schematic diagram of a flow cytometer.



This filed and principle can also be utilized to detect adulteration challenges when we talk about fluid flow analysis performed by Prof. Ankita H. Harkare. The research in the field of adulteration is looking up to microfluidics to provide for a lab on chip solution. The means of developing a data base by a FACS system can also a feasibility, as well as protein based analysis in an controlled environment can provide a great breakthrough in these difficult times of pandemic. On developing such data base will provide for a greater good when machine learning algorithms can provide a tremendous breakthrough in terms of timely and safer means of results provision. Hence the researcher thinks that a through review of FACS system is required.

II. Review: A FACS system has three prime components namely fluidics, optics/ imaging and electronic digitization which are embedded together to provide an complete system. systems: fluidics, optics system, and electronics system.

Figure 2: Schematic diagram of light scattering as in journal by Dean, P.N et al.



2.1 Fluidics: The need of this backbone system is provide input under test so that they can be subjected to activation via fluorescence. The sample input is processed and injected to the fluidics chamber that is generally a needle based microchannel that can help us control the flow rate. Research articles report that various configurations of micro channels have been utilized that will help control not only the flow rate but also efficient mixing of the sample under test along with stealth fluids. Stealth fluids are added primarily to keep the sample in the center before laser activation. This mixing is done so that the fluid properties can be maintained when we talk about materials with which the microchannel is being developed by Prof. Ankita H. Harkare and Norasyikin Selamat et al. Material analysis also needs to be done when we talk about subjecting this sample to laser beam for activation. This material analysis is required because of light scattering which will happen when we talk about particle sorting and analysis found in the instrumentation journal by biotech, McKinnon et al., Dean, P.N. et al and Enquire bio portal online. The scattering is subject to forward as well as side scattering as shown in figure 2 below and the means by which data acquisition is done is the second requirement of this FACS system.

Table 1. Common Lasers and their Wavelengths

LASER TYPE	WAVELENGTH (Nanometers)
Argon Fluoride	193
Xenon Chloride	308 and 459
Xenon Fluoride	353 and 459
Helium Cadmium	325 - 442
Rhodamine 6G	450 - 650
Copper Vapor	511 and 578
Argon	457 – 528 (514.5 and 488 most used)
Frequency doubled Nd: YAG	532
Helium Neon	543, 594,612 and 632.8
Ruby	694.3
Laser Diodes	630 - 950
Ti: Sapphire	690 - 960
Alexandrite	720 - 780
Nd: YAG	1064
Hydrogen Fluoride	2600 - 3000
Erbium: Glass	1540
Carbon Monoxide	5000 - 6000
Carbon Dioxide	10600

2.2 Optics System: In flow cytometry recent advancements have overwritten the optical light scattering with digital image acquisition as in Enquire Bio. To avoid the cost factor in developing a system the researcher has restricted the review to optical do maintain the true sense of FASC. The concrete part of the optics is the adducting laser and lens assembly so that the laser scattering and collection can be provided as in journal by Pradeep Kumar et al. The collection lenses and detectors are for providing the light collection means with reference of wavelengths. The amount of energy with subject to activation is also a prime requirement of application which can be understood by fluorescence study in lasers as shown in below table by Robert Aldrich.

2.3 Electronics system: The data provided by the optics system is to be converted from the analog form to its digital format so that the digital data can be utilized and analyzed by the machine learning algorithms clubbed to a dedicated servers to provide enormous fast result processing.

III. Reported Methodology: The review in terms of methodology is required for advanced in research to provides means of striving financial institutions to sponsor means of fast catering services. The prime need of research is clear to develop a system; but the eventual question under test is how and when. A case study needs to be developed for providing block truncation in terms of facts figures and diagrams. In regards to developing a system that offers its utilization in terms of point of care research highlights the efforts that have been carried out to minimize the size the of flow cytometer which inferentially caters for reduction in cost. The main challenge while reducing the size is that throughput of the detector should not be compromised. Hence laminar flow analysis of the sample have to be carried out to rule out the possibilities of accident or untrue events. Literature reports to avoid such problems chevron shaped groups are to be utilized for microfluidic channel so that the sample fluid remains in center and does not scum to impurity. The size of the channel and its effects have been reported by . Norasyikin Selamat et al. where its simulation is carried out on COMSOL Multiphysics software to justify its importance.

Figure 3: Microchannel in COMSOL.

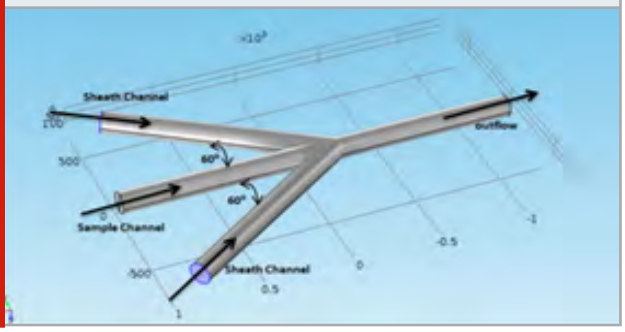
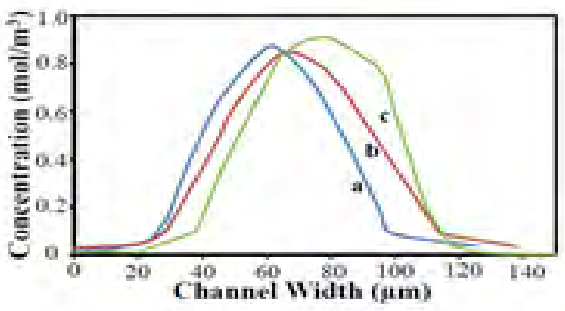


Figure 3: Simulated result for liquid concentration when Qs/Qi is equal to 15/10 at the opening of the focusing channel for three different area, A where; (a) is for A = 12500, (b) is for A = 15000, and (c) is for A = 17500.



The reporting shows that the channels focusing width is made more focused by maintaining the flow rate ratio Qs/Qi = 15/10 in regards to the channel length of 149 m where Qs is the volumetric flow rate of the side channel as shown in figure 3 and Qi is the volumetric flow rate of the inlet channel. So methodology wise flow control is required and the study requires extensive work in regards to the point of care application for example with respect to pandemic study if biological detection or marking is the application especially when we talk of optics or light scattering when activation takes place. Hence in depth study with respect to COMSOL is the first methodological step that researcher needs to carry out to justify the channel material to be made. The study that provides exact analysis is knows as hydrodynamic analysis. Hydrodynamic stability is the study that provides the researcher with the onset of fluid flow analysis. Theoretically and experimentation wise tools that provide fluid flow analysis require solvers that can provide Reynolds number, Euler equations and Navier-Strokes equations which all are available in COMSOL Multiphysics software. Different opening sizes structures have been analyzed based on the concentration levels which are highlighted with respect to below figure 4.

DISCUSSION AND FUTURE SCOPE

Preliminary study respect to microchannel and fluid flow analysis show the strong foothold of COMSOL software but these results are still immature and require integration with a laser activation physics that can help us perform robust and optimized system integration efforts to make the system reliable and feasible. Hence researcher proposes the use of Multiphysics in true sense offered by COMSOL and provide a microsystems solution that can help us develop the database for future analysis.

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Weight Maps Guided Underwater Image Enhancement By Fusion Technique

Saloni Tarhate[1] and Richa R. Khandelwal[2]
[1,2]*Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

The underwater image plays a very important role in today's world in order to explore the unknown underwater world. But the images captured underwater are different from those taken in the air atmosphere. There are lots of problems associated such as haziness, blurriness, non-uniformity, color degradation, etc. All this is due to reflection, refraction, and scattering in water. To overcome these problems enhancement of the underwater image is required to get a better quality image. In this paper, the logarithmic image processing model is proposed as an important part of the methodology for underwater image enhancement. The insight to apply the logarithmic image processing model was taken from the human eye visual concept, as it functions in the logarithmic fashion while the camera functions linearly. A single image approach is used in which a degraded image is taken as an input and then various digital image operations are performed on it to enhance the quality of the underwater image. The insight to apply the logarithmic image processing model was taken from the human eye visual concept, as it functions in the logarithmic fashion while the camera functions linearly. The method is based on the fusion of directly derived images from gamma correction, sharpening, and their associated weight maps. Finally, the fused image is processed through Contrast Limited Adaptive Histogram Equalization (CLAHE) to get the enhanced output. The method is applied on two data set of images, subjective evaluation is computed and results are compared with other methods. To do an objective evaluation, the quality of output image measures through parameters and compared with other available methodologies. The experimental results show that the performance of the proposed method is competitive with that of available methods.

KEY WORDS: CONTRAST LIMITED ADAPTIVE HISTOGRAM EQUALIZATION (CLAHE), FUSION, HUMAN EYE VISUAL CONCEPT, LOGARITHM, UNDERWATER IMAGE ENHANCEMENT.

INTRODUCTION

The fundamental laws of light are different for underwater than the world outside the water. The underwater world has always fascinated humans by its beautiful oceanic beds, coral reefs, underwater spices, shipwreck, etc, and has given rise to the curiosity of what lies within it. About 97% of the planet's water is an ocean and our planet earth satisfies the conditions for the living organism. To understand the underwater environment, its exploration is important, but due to the poor visibility and typical properties of water, it is very difficult to capture a clear underwater image. In underwater image enhancement, the properties of light penetration play an important role that is with every increasing depths there is a loss of color. Water absorbs different wavelengths of light and also scatters color at different degrees. The longest wavelength with the lowest energy gets absorbed first. The first color to get absorbed is red, followed by orange and yellow, the colors tend to disappear on the water in the same sequence as they appear in the color spectrum.

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**Corresponding Author: salonitarhate@gmail.com*
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Because of the disappearing of the colors at different depths, to find these colors in underwater is the most difficult challenge.

Enhancement methods used for underwater images takes image data without knowing or having environmental knowledge. Different enhancement techniques used for underwater image processing and analysis are mainly applied to natural images. They can be broadly categorized as filtering based method, color correction based method, and image fusion based method. The author Arnold-Bos proposed a pre-processing work for the luminance parameter of the underwater image. A method that has multiple filtering steps for the improvement of the non-uniform illumination, correction of color, noise suppression, contrast enhancement is discussed by author S. Bazeille . Adaptive total variation based on nonsubsampled contourlet transform for image denoising of underwater images is proposed by D. Jia .

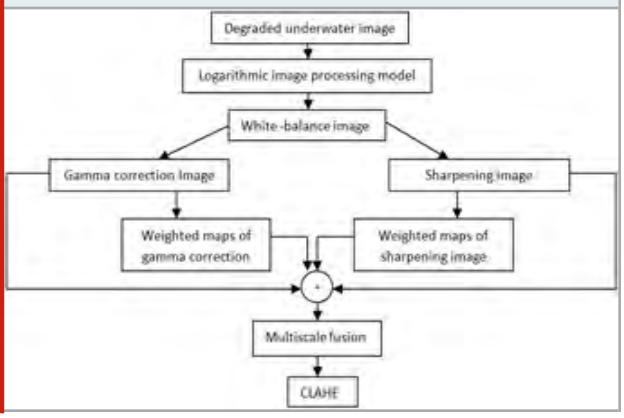
To enhance the image contrast, stretching of color model based on the Rayleigh distribution is presented by A. S. A. Ghani. Integration of contrast stretched RGB color model and saturation & intensity stretched HSI color model is used to enhance the degraded images by K. Iqbal . An underwater image color correction method where objects are assigned color as fully saturated while water area as background assigned low saturation color concept is implemented by F. Petit . Retinex theory by E. H. Land correlates the reflectance of an object with the color of the object perceived in human eyes. A variational retinex model given by X. Fu discusses reflectance and illumination components of the image are enhanced separately and then the final enhanced image is obtained by combining both versions. The author S. Zhang highlights the combination of bilateral filter and trilateral filter which was utilized according to the characteristics of the color channels to get a better image. The white balancing process for the underwater image is explained by author C. O. Ancuti is faster by red channel attenuation.

The author Sophiya Philip in the paper shows the fusion of images which is used to combine the effect of sharpening, gamma correction, etc. This is a single image method and white balancing is used to reduce the blueish and greenish effect in the image. In this paper, an enhancement process is designed to increase the visual quality of degraded underwater images. The logarithmic image processing modeling step is added to keep the method near to the human eye visual system for the enhancement of the underwater images. Gamma correction and sharpening are applied to the white-balanced image. Then these images along with their weight maps are combined to get a fused image. Finally, the quality of this fused image is enhanced through Histogram equalization. The rest of the paper is organized as follows: Section II portrays the methodology, section III illustrates experimental results, and section IV conclusion.

METHODOLOGY

The input degraded image is taken, and logarithmic image processing is done and applied for white balancing. The white balancing helps in removing the unrealistic color cast. This white-balanced output is given to gamma correction and sharpening. Gamma correction is done to sync the image to the human eye of perception biasing it with luminance or say brightness of an image. It can also be said that it is a type of function which maps luminance levels to compensate for the non – linear luminance effect of displaying a screen. The same white-balanced input is given to the sharpening of the image, sharpening of an image is done to get the small details, and also for highlighting the edges. Then weight maps of both outputs of gamma correction and sharpening are computed. The weighted maps of gamma-corrected image and a sharpened image along with the output of the gamma image and sharpening image are fused to form a single image. Then the output multiscale fused image is given to CLAHE, this helps to improve the clarity of an image. The complete process is shown In Figure 1.

Figure 1: Flowchart of the Proposed Method



Logarithmic Image Processing Model: The input degraded image of underwater is taken for image enhancement then it is given to the logarithmic function to change the dynamic range of the image. Each pixel of the underwater image is replaced, it was observed that low-intensity pixel is enhanced which is useful for dynamic ranges that are too large. After applying log functions it is observed that log to the base 2(log2) gives better results compared to the natural log function, so log2 is selected for image enhancement.

2 Weight Maps and Fusion: While using the weighted maps during fusion the weight maps with high values are contributed more to the final result. The weighted maps which are used in the fusion algorithm are Laplacian contrast weight (W_L), Saliency weight (W_S), and Saturation weight (W_{Sat}).

A) Laplacian contrast weight (W_L): Laplacian of an image is used for the regions having abrupt or rapid intensity change.

B) Saliency Weight Map(W_S): It is used for the objects which lose their visibility, appearance, or say prominence in underwater. A saliency weight map can be calculated by taking the absolute value of the difference between the mean luminance value of the image and the Gaussian blurred version of the luminance channel.

C) Saturation weight (W_{Sat}): This weight map is computed as the deviation between color channels (R_k, G_k,B_k) and the luminance (Y_k)of the input.

$$W_{sat} = \{ 1/3((\square_k - \square_k)^2 + (\square_k - \square_k)^2 + (\square_k - \square_k)^2) \}^2 \quad (1)$$

Here = □ = is the luminance component of the image in the YC_bC_r model. Three weight maps are added W_L, W_S, W_{Sat} to get the aggregate weight Map W_k, for each and every input k.

D) Multiscale Fusion Process: Multiscale fusion is the process of mixing the Gaussian pyramid and the Laplacian pyramid. Gaussian pyramid and the Laplacian pyramid can be calculated by using the following equation respectively.

$$G_k = G_l \{W_K (x)\} \quad (2)$$

$$L_k = L_l \{I_k(x)\} \quad (3)$$

$\{I_k (x)\}$ represents each source input, k is no. of input images, G_l is the lth level of the Gaussian pyramid and L_l is the lth level of Laplacian pyramid. Sl is the final output that can be obtained by adding the fuse contribution at all levels. Thus, Multi-scale fusion is very sensitive to the edges and sharp regions which are inspired by human visual systems. This gives better results to underwater image enhancement.

$$\square_l(\square) = \sum_{k=1}^{K} \square_k.\square_k \quad (4)$$

Experimental Results

A. Subjective Evaluation of Processes used for Enhancement: Log2 method was used to convert each pixel value of the degraded input image into logarithmic pixel values. Then white balancing is applied. Two inputs are derived after white balancing. The first derived input is obtained by applying Gamma correction to the input. The second derived input is capable of enhancing edges in the image and to get the small details through sharpening. Weight maps are calculated to avoid artifacts and compute the important features of the derived inputs. The resultant image is fused using derived inputs and weight maps. The fused image is then enhanced using CLAHE. Output images of all these processes are shown in Figure 2. The proposed methodology is tested on the following data sets :

1. Dataset 1: This data set is available at http://puiqe.eecs.qmul.ac.uk/Dataset and the data set is used by authors C. O. Ancuti and S. Emberton. We too have taken images from the ReefnFish dataset. Figure 3 shows the implementation of the proposed method on three degraded input images.
2. Dataset 2: Another data set used for subjective evaluation for the proposed method is from author P. Drews and Wenhao Zhang. Figure 4 shows the visual comparison of the proposed method.

Figure 2: Output of the Proposed Method a) Degraded Input Image, b)Log 2 Image, c) White Balance Image, d) Gamma Image, e)Sharpening Image, f) Gamma Correction Weight Map Image, g) Sharpen Weight Map Image, h) Fused Image i) CLAHE Image

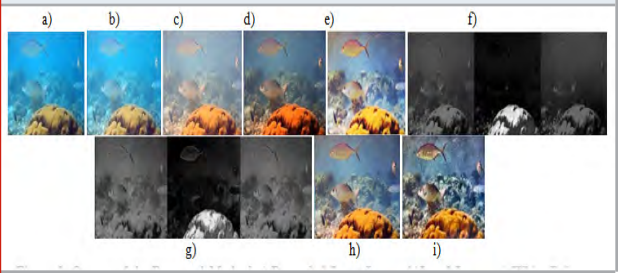


Figure 3: Each Pair of Resultant Images (a,b,c) shows a Degraded Image along with an Enhanced Image

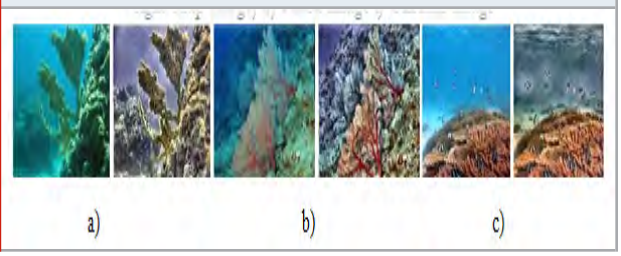
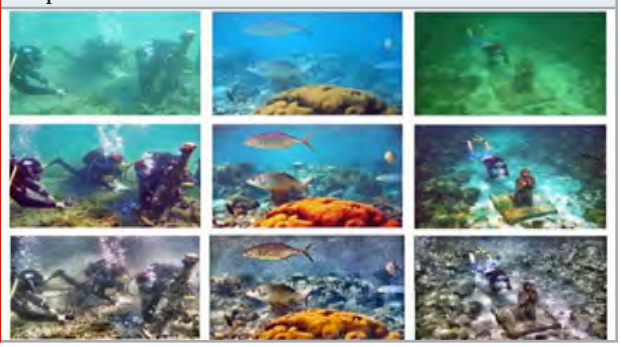


Figure 4: Top Row: Three Raw Underwater Images. Middle Row: Enhancement by [16] Bottom Row: Result by the Proposed Method



Objective Evaluation: For objective assessment, the parameter used in Underwater Image Quality Measure (UIQM) were taken from following authors which are Risheng Liu, P. Sahotra and Chau Yi Li which comprises of three underwater image parameters viz, the Underwater Image Colourfulness Measure (UICM), the Underwater Image Sharpness Measure (UISM), and Underwater Image Contrast measure (UIConM). Table 1 shows the comparison of UIQM value with other methods and also other parameter values of an image.

Table 1. Comparison of UIQM (Underwater Image Quality Measure) Parameters and Detail Values of UIQM i.e Colorfulness, Sharpness, Contrast.

Method	Zhang	Fu	New-Optical	DCP	SID	HE-Lab	Proposed Method
UIQM	1.708	1.625	1.589	1.452	1.336	1.397	1.350882
UIQM value in detail							
UIQM = c1* UICM + c2* UISM + c3* UIConM							
Output image with the proposed method	Colourfulness (UICM)		Sharpness (UISM)		Contrast (UIConM)		UIQM
	1.244726		0.240212		0.356067		1.350882

$$UIQM=C_1*UICM+C_2*UISM+ C_3*UIConM \quad (5)$$

where C_1, C_2 and C_3 are the scale factors having values as C_1 = 0.0282, C_2 = 0.2953 and C_3 = 3.5753 .

CONCLUSION

Weight maps guided fusion technique for underwater image enhancement is implemented. The logarithmic image processing step is added to make the output comparable to the human visual system. The proposed method is implemented in two datasets. The experimental results of subjective and objective evaluations are observed and compared with other techniques. The parameters such as colorfulness, sharpness, contrast which are degraded in underwater due to forward and backward light scattering, are measured and finally, the value of UIQM is calculated. The calculated value of UIQM i.e. 1.350882 of an image taken, is between the values obtained from the HE-Lab method and the SID method.

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A Review of an Intelligent System for Detecetion of Potholes and Humps

Swati K. Mohod[1], Dinesh B. Bhoyar[2], S.S. Khade[3] and K. D. Kulat[4]

[1]*Assistant Professor, Department of EL, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*

[2]*Assistant Professor, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*

[3]*Assistant Professor, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*

[4]*Professor, Department of ECE, Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India*

ABSTRACT

Roads are the major means of transportation and it supports the nation's economy only if they are well maintained. It is necessary to identify homes and potholes so the accidents can be avoided and the damage caused to the vehicle is less. It also contributes in saving fuel. Here is a simple and effective solution regarding the problem of accidents by detection of potholes and humps and help drivers. Detection of potholes will be done by image processing technique and humps would be detected by ultrasonic sensor. Raspberry Pi is the controlling device. Wi-Fi will be used to acquire geographical position of potholes and will be send to the authority to take appropriate measures

KEY WORDS: RASPBERRY PI, WI-FI, ULTRASONIC SENSOR, GPS RECEIVER, GSM SIM 900, CAMERA.

INTRODUCTION

Roads connect numerous cities in Bharat and villages with the cities. They're a vital mode of transport in Bharat. Bharat incorporates a network of over 5,897,671 kilometer of roads. This is often the second largest road network within the world. Bharat has close to 4.87 kilometer of roads per 1,000 people. India's road network carries over 65% of its freight and regarding 85% of rider traffic. It contributed 4.7% towards India's domestic product. In step with ministry of Road Transport and Highways as of March 2019 Bharat had regarding 1,42,216 kilometer of national highways and expressways and another 1,76,166 kilometer of state highways. Major comes being enforced beneath the National Highways Development Project a government initiative. However, on the opposite hand, it's sealed the manner increasing range of RTA (road traffic accident).As per the survey of WHO 1.35 million people died every year due to road accidents. Due to road traffic crashes their gross Domestic Product. Our aim is to develop an intelligent system for detecting the potholes and humps of the road. The same will be inform to the municipal commissioner for taking some safety measures [2]. The road accident due to potholes is shown in figure-1.

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*Corresponding Author: kdkulat@ece.vnit.ac.in
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2. Related work: The Raspberry Pi as shown in figure-2 is additionally a series of little single-board computers developed at intervals the UK by the Raspberry Pi Foundation. The SIM900 is additionally an entire

Quad-band GSM/GPRS answer throughout a SMT module which may be embedded at intervals the patron applications that have Associate in Nursing industry-standard interface; the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax throughout a tiny low kind issue and with low power consumption. With a tiny low configuration of 24mm x 24mm x three metric quantity, SIM900 will match the majority the house wishes in your M2M application, considerably for slender and compact.[6] Ultrasonic sensors generate the ultrasonic waves for measuring the distance between the vehicle and the object. Ultrasonic Sensors consist of two transducers for transmitting and receiving purpose. [4]

Figure 1: Road accident due to Patholes

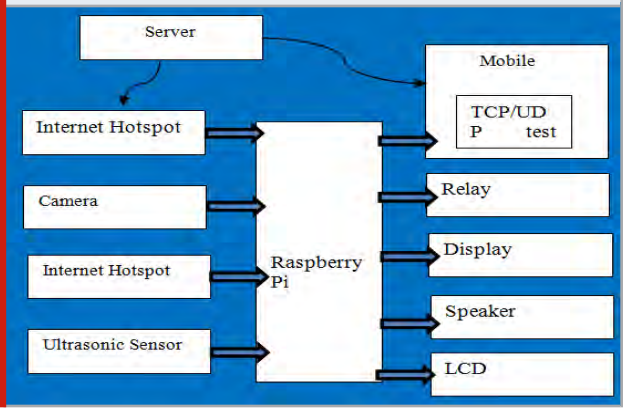
Figure 2: Raspberry Pi Board

For Navigation systems, GPS Module plays the important role. An advanced real-time navigation system developed when Raspberry Pi interfaced with a GPS. The four pins present at the GPS Module are Vcc, Ground, RX and TX. The input power required is about 5V voltage and 100mA current. The TX pin of GPS module connected to the RX pin of Raspberry Pi. The proper grounding of the GND pin of the GPS and Raspberry Pi. Loading the program in to Raspberry Pi opened in the Python editor to receive the serial data. Note- GPS Module must be at least near to the window for perfect signal integrity.

3. Problem Definition: Major challenges are faced in the road transportation because of poor quality of roads, low maintenance, potholes and humps. Due to low maintenance and lack of information regarding damaged road, many accidents takes place. The Potholes on the road are created due to heavy rains and very fast movement of vehicles on the constructed roads. Due to Potholes accident occurs and sometimes loss of human life also. Indian speed breakers are constructed in order to control the speed of a vehicle but sometimes due to heavy rains or various factors, drivers are unable to identify humps on the road and vehicle gets unbalanced. This is the major reason for accidents. Due to the low maintenance and incorrect constructions, accidents may occur. So, all information regarding unwanted potholes and humps should be provided to the municipal corporation for the improvement of road condition. [3] [9]

The proposed intelligent system gathers the information of potholes and humps which is fitted in any vehicle for the real-time detection. It alerts the driver from road accidents and also inform about the road conditions to the higher authorities known as municipal officials through Email. The captured images are given them for the improvement of road condition which eventually helps for the economic development as well. The program to perform the detection written in python language that will be loaded to Raspberry Pi which is a series of small single board computers through USB port.[1]

Figure 3: Block Diagram of Proposed Automatic Detecetion Of Potholes And Humps



a. Potholes Detection: Wi-Fi is used for tracking location of the vehicle. The camera placed in front of the vehicle continuously captures the images of the road through the open source computer vision in a Red, Green and Blue model (i.e. RGB form.). It is difficult to visualize the RGB form of the image; therefore the image is converted into Hue Saturated Vision (HSV) form by the image processing technique. When the captured image matches with the conditions of the program, a GPS module compatible with Raspberry Pi is used to obtain the longitude and latitude information. The information will be provided to the NMC with the captured image. As soon as the potholes are detected, the driver is alerted via speaker acting as a alert system. Information in the form of location and the image of Potholes is saved in micro SD card for further references. The image is show to the driver through LCD display. This process is repeated at every contact of the pothole.[7]

b. Hump Detection: Ultrasonic sensor plays a vital role for continuously measuring the distance between the vehicle and the road. The distance obtained is further compared with the set value of threshold. Each time, when the distance of a vehicle and the hump is smaller than the set threshold then it eventually alerts the driver by speaker as well as by displaying on the LCD screen. This process is carried out, every time the detection is done.[5]. The following block diagram shown in figure-3 gives the proposed automatic detection of potholes and humps

CONCLUSION

The main space of project is to go looking out the potholes. Thus, many efforts being created for the advancing a technology for automatic detection and acknowledge potholes and along contribute towards the event .The mobile application used throughout this system is an extra blessings as a results of it give timely alert concerning potholes and humps . The information inborn from here is being given to the involved street administration specialist through this application for any techniques and action on it. This answer on add time of year once potholes unit full of muddy water as alerts unit generated exploitation determination the information hold on in info. The instructed approach is economic declare detection of potholes and irregular humps as a results of it uses low value unbearable sensors .On these lines driver's security is to boot increased with foundation of location of potholes and hindrance. It would originate totally utterly completely different serves to general security and else for the advancement of the state.[8]

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Low Power & Area Multiplier for Deep Learning Applications

Gouri Morankar*
Assistant Professor, Department of Electronics Engineering, Shri Ramdeobaba College of Engineering & Management, Nagpur, India

ABSTRACT

Multipliers are one of the most important operations in signal and image processing algorithms, artificial intelligence, machine learning algorithms and systems, especially convolutional neural networks in deep learning applications. Therefore it is extremely important to implement hardware intensive multiplier with high speed, regularity in layout, low power and area requirements. These ensure maximum utilization of resources for computational complex algorithms deployed in machine learning applications such as convolutional neural networks. In this paper, design, development and implementation of 16-bit multiplier for hardware intensive application through Baugh Wooley multiplier and Kogge & Stone adder is attempted. Mostly conventional shift-add multipliers are implemented using 2's complement, row & hybrid based adder trees and signal flow optimization techniques, for reduction of partial products through Booth's algorithm. Correspondingly several other techniques for parallel prefix adder are employed for addition in multipliers. However these techniques are less focused on low power and area, regularity in layout and pipelined implementation of multiplier. Proposed 16-bit multiplier employs Baugh Wooley Multiplier and Kogge & Stone adder for addition of partial products that results in pipelined implementation, regularity in layout and achieves higher speed and low power consumption.

KEY WORDS: MULTIPLIER, PARALLEL PREFIX ADDER, LOW POWER, PIPELINED, FPGA IMPLEMENTATION.

INTRODUCTION

Deep learning algorithms through convolutional neural networks (CNN) are computationally demanding with most emphasis on multiplication, division and addition operations. The area and power requirement for these operations is very high and requires considerable time for generating results. Multiplication is one of the most important operations in CNN and plays important role in power consumption and performance of the entire systems. Advancement in integrated circuit technology has enabled researchers and engineers to develop fast, power and area efficient multipliers that results in low power and area, regularity in layout and pipelined implementation. The common multiplication methods employed are through shifting and adding operations that generates partial and final products. The performance of these multipliers is measured through the number of partial products generated which needs to be added periodically to determine final product.

Modified Booths algorithm through its encoding mechanism reduces partial products by 50% that results in reduced area, delay and power consumption. However it essentially requires complex encoding circuitry which generates partial products. Booths algorithm through 2's complement method was implemented to achieve low power dissipation by increasing the probability of partial products becoming zero. A fixed width array multiplier was designed through left to right algorithm aimed to reduce partial products that resulted in low area and power consumption. Further power reduction in multiplier can be achieved by reducing switching activities. Modified shift-add multiplier namely "bypass zero feed A directly

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(BZ-FAD)" was developed and employed for reducing switching activities and low speed applications. Dynamic error-compensated circuit was designed to reduce the complexity of the encoding circuit and increase the speed through Booths algorithm.

The most important apprehension, the conventional shift-add multiplier is implemented through n-cycles of shifting and adding operation. Mainly the process includes partial product generation and importantly addition of partial products. Various parallel prefix adders were designed and developed by researchers with an intension to reduce area and power of the circuit and achieve higher speed of operation. Fast and area efficient adders are developed with different adder structures based on carry lookahead adder (CLA) and Ling equation and its modified versions. Modified CLA equation was reorganized by Kogge and Stone to increase the speed of the adder which can also achieve regularity in layout and employed for summation of partial products in add shift multiplier. Baugh Wooley multiplication algorithm [6] was designed and developed using regular 2's complement multipliers which achieves high speed and regularity in layout. It efficiently handles sign bit for computation of partial products with the use of full adder and ripple carry adder.

In this paper, design, development and implementation of 16-bit multiplier for hardware intensive application through Baugh Wooley multiplier and Kogge & Stone adder is attempted. Mostly conventional shift-add multipliers are implemented using 2's complement, row & hybrid based adder trees and signal flow optimization techniques, for reduction of partial products through Booth's algorithm. Correspondingly several other techniques for parallel prefix adder are employed for addition in multipliers. However these techniques are less focused on low power and area, regularity in layout and pipelined implementation of multipliers. Proposed 16-bit multiplier employs Baugh Wooley Multiplier and Kogge & Stone adder for addition of partial products that result in pipelined implementation, regularity in layout and achieves higher speed and low power consumption. The paper is organized as section 1 introduces to design and development of add shift multipliers and parallel prefix adders. Section 2 discusses the design of Baugh Wooley multiplier and parallel prefix adder using Kogge & Stone adder that results in high speed, low power and regularity in layout. Results are discussed in section 3 and finally concluded in section 4.

2. Modified Baugh Wooley Mulitplier using Kogge & Stone Adder

Let a and b be the two n-bit signed numbers which can be represented as,

$$a = -a_{n-1}2^{n-1} + \sum_{i=0}^{n-2} 2^i a_i \quad (1)$$

$$b = -b_{n-1}2^{n-1} + \sum_{j=0}^{n-2} 2^j b_j \quad (2)$$

The result of multiplication of a and b is represented as

$$\begin{aligned} p &= a \times b \\ &= \left(-a_{n-1}2^{n-1} + \sum_{i=0}^{n-2} 2^i a_i\right) x \left(-b_{n-1}2^{n-1} + \sum_{j=0}^{n-2} 2^j b_j\right) \\ &= a_{n-1}b_{n-1}2^{2n-2} + \sum_{i=0}^{n-2} 2^i a_i \sum_{j=0}^{n-2} 2^j b_j - \\ &\quad a_{n-1}2^{n-1}\textstyle\sum_{j=0}^{n-2} 2^j b_j - b_{n-1}2^{n-1}\sum_{i=0}^{n-2} 2^i a_i \end{aligned} \quad (3)$$

The last two terms in equation (3) are n-1 bits each that are extended from position 2n-1 to 22n-3. Rather than subtracting the last two terms, 2's complement was obtained through last two terms and final product was obtained using addition of partial products. Let p be one of the last two terms, it can be represented in equation (4) with zero padding.

$$p = -0 \times 2^{2n-1} + 0 \times 2^{2n-2} + 2^{n-1}\textstyle\sum_{j=0}^{n-2} 2^j z_j + 0 \times \sum_{r=0}^{n-2} 2^r \quad (4)$$

2's complement of p are obtained, the new bit value for –p is depicted in table 1.

Table 1. Bit values for -p

Bit position	Bit Values
2n-1	1
2n-2	1
2n-3	Z_{n-2}
2n-4	Z_{n-3}
2n-5	Z_{n-4}
...	...
n	Z1
n-1	Z_0+1
...	...
1	0
0	0

Table 2. Bit patterns

Bit position	2n-1	2n-2	n	n-1
+	1	1		1
	1	1		1
Carry in	1	0 / 1	1	0 / 1
Sum		0 / 1		0 / 1

Let z_1 and z_2 be last two terms in equation (3) then addition of $-z_1 + (-z_2)$ results in following various bit patterns depicted in table 2. Hence the product p in equation (3) can be given as.

$$\begin{aligned} p = a_{n-1}b_{n-1}2^{2n-2} &+ \sum_{i=0}^{n-2}\sum_{j=0}^{n-2} 2^{i+j} a_i b_j + 2^{n-1}\sum_{j=0}^{n-2} 2^j \overline{b_j a_{n-1}} \\ &+ 2^{n-1}\textstyle\sum_{i=0}^{n-2} 2^i \overline{a_i b_{n-1}} - 2^{2n-1} + 2^n \end{aligned} \quad (5)$$

Fig. 1 depicts the structure of 4-bit Baugh Wooley multiplier with ripple carry adder which can be potentially replace with Kogge & Stone adder and fig. 2 depicts the internal structure of Baugh Wooley Cells which contents full adder and does not need replacement as carry is propagated to next stage. The design of Kogge & Stone adder can be comprehended using three steps process which includes pre-processing, carry look ahead computation and post processing depicted in fig. 3. The pre-processing steps involves computation of propagate (p) and generate (g) bits using equation (6) and (7) respectively.

$$p_i = a_i \; xor \; b_i \tag{6}$$

$$g_i = a_i \; and \; b_i \tag{7}$$

Carry look ahead computation involves calculation of carry's corresponding to each bit. It uses propagate (p) and generate (g) bits as partial results which are fed to the carry equations for fast computation as depicted in below equations.

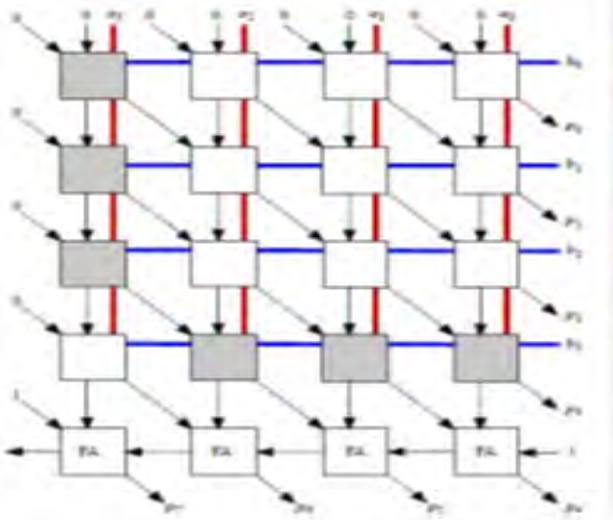
$$P = p_i or \; (g_i and \; p_{i-1}) \tag{8}$$

$$G = g_i \; and \; g_{i-1} \tag{9}$$

Finally the post processing calculates final sum of the addition operation using equation (10).

$$s_i = p_i \; xor \; c_{i-1} \tag{10}$$

Figure 1: Structure for 4-bit Baugh Wooley Multiplier with ripple carry adder which can be potentially replace with Kogge & Stone adder



3.Experimental Results: The 16-bit synchronous pipelined Baugh Wooley multiplier using Kogge Stone adder was coded in VHDL and implemented in virtex 5 FPGA (xc5vlx20t-2ff323) device. The output of the 16-bit multiplier was verified using Xilinx ISE web pack 13.1 simulation and synthesis tool. Table 3 summaries the results obtained after simulation, synthesis and implementation. Table 1 also demonstrates comparison with fully synchronous Baugh Wooley Multiplier (BWM) using full adder and Kogge & Stone (KS) adder in terms of resource utilization, delay, operating frequency and power consumption.

Figure 2: Internal Structure of Baugh Wooley Cells which contents full adder and does not need replacement as carry is propagated to next stage

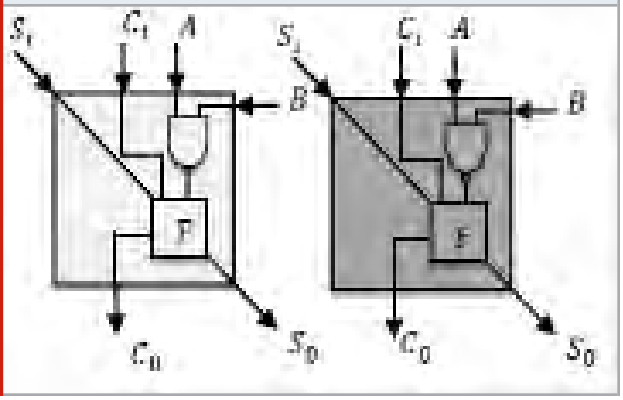


Figure 3: Internal structure of 8-bit Kogge & Stone adder

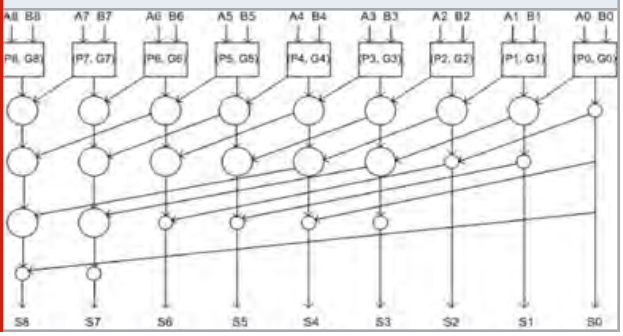


Table 3. Experimental results obtained after simulation, synthesis and implementation on virtex 5 FPGA (xc5vlx20t-2ff323) devices

FPGA Resources/ Parameters	BWM using full adder 16 x 16	BWM using KS adder 16 x 16	No pipelined BWM 8 x 8
Number of Slices	515	490	55
Number of LUTs	503	478	114
Number of FFs	526	526	-
Delay	2.844 ns	2.67 ns	4.172 ns
Maximum Frequency	351.58 MHz	374.53 MHz	239.69 MHz
Clock Frequency	1 GHz	1 GHz	-
Total Power	1.758 W	1.669 W	0.224 W
Dynamic Power	1.421 W	1.349 W	-
Leakage Power	0.337 W	0.32 W	-

The results clearly depicts maximum operating frequency of 351 MHz using ripple carry adder whereas maximum operating frequency of 375 MHz using Kogge & Stone adder with marginally improvement in resource utilization. Implementation results are also compared with no pipelined balanced BWM which clearly demonstrates superior performance of BWM using KS adder in terms of speed. Pipelined implementation of 16-bit synchronous pipelined Baugh Wooley multiplier using Kogge Stone adder in 18 steps dissipates 1.669 W of total power with improvement in 5% compared with conventional implementation.

CONCLUSION

In this paper, design, development and implementation of 16-bit multiplier for hardware intensive application through Baugh Wooley multiplier and Kogge & Stone adder was attempted. Mostly conventional shift-add multipliers are implemented using 2's complement, row & hybrid based adder trees and signal flow optimization techniques, for reduction of partial products through Booth's algorithm. Correspondingly several other techniques for parallel prefix adders are employed for addition in multipliers. However these techniques are less focused on low power and area, regularity in layout and pipelined implementation of multipliers. Proposed 16-bit multiplier employs Baugh Wooley Multiplier and Kogge & Stone adder for addition of partial products that result in regularity in layout and pipelined implementation and achieves higher speed and low power consumption. The multiplier is modelled using VHDL Xilinx ISE web pack 13.1 and implemented using vertex 5 FPGA (xc5vlx20t-2ff323) device. Comparison with conventional implementation results improvement in area, power consumption and pipelined implementation through regularity of layout. It clearly demonstrates that signed Baugh Wooley multiplier with Kogge Stone adder results in better implementation and may be employed in deep learning algorithms using convolutional neural network. Further improvement in optimization in signal flow graph may further improve delay and power consumption.

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Disease Diagnostic System: Abnormalities in Human Nail

Pranav S. Wazarkar[1], Akhilesh R. Tiwari[2] and Richa R. Khandelwal[3]

[1]Student (pursuing 3year), Department of Electronic Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur -440013, India

[2]Student (pursuing 3year), Department of Electronic Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur -440013, India

[3]Dr.Prof.Khandewal at Rcoem En dept, Department of Electronic Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur -440013, India

ABSTRACT

Various body parts or organs can be analysed to identify the different diseases in the human body. Fingernail analysis is one of the ways to identify disease in the human body. Nails are the body part which are farthest from the heart and therefore receive oxygen at last. As a result the nails are the first who show the symptoms of a disease in the human body. Fingernails can be easily captured for diagnosis and there are no heavy equipment or no specific conditions required to use nail image for disease diagnosis, like in other tests and scanning processes. Human nails deliver beneficial information about complaints or any nutritive imbalances in the human body depending upon their shape, texture and colour. In human beings, numerous systemic and skin diseases can be easily analyzed through careful examination of nails of both the limbs. A lot of nail illnesses have been found to be primary signs of numerous underlying systemic illnesses. The colour, texture or shape changes in nails are signs of many diseases mainly affecting nails. Considering all these properties of nails a system is proposed that uses digital image processing (DIP) methods for identifying such changes in the human nail to get more precise results and predict numerous diseases effortlessly. With the emerging Internet of Things (IOT) concept the generated report is made available remotely, this will help users to reduce transportation efforts. As the system has to deal with large and private data, the security of data must be ensured. To keep the data confidential, the Blockchain concept which is one of the most emerging concepts in the field of data management is used. The paper contains the implementation of the digital image processing for feature extraction of nail images, usage of IOT (ThingSpeak cloud) for data storage and implementation of Blockchain to keep the system secured and theft free.

KEY WORDS: INTERNET OF THINGS (IOT), IMAGE PROCESSING, THINGSPEAK, RGB VALUES, MEAN PIXEL VALUES, BLOCKCHAIN, HASH KEY.

INTRODUCTION

Nail is one of the physical investigative tools which are normally practiced in Ayurveda where nail can be a strong indicator of likely complaints happening in the human body [1]. Any change in oxygen level in the human body detected by nails is an effective tool to predict the symptoms of a disease [2]. Nails are made up of keratin and protein, and are the basic outer structure of the skin of fingers. Their growth depends on the nutrients, proteins they get from the body, but due to some disease in the human body or due to some environmental factors nail colour, texture, shape may get changed which is the most important indication of presence of disease in humans. Healthy nails are ruddy, smooth, shiny pink in colour and the root part i.e. lunula is half-moon grey [3][4]. In most of the studies it is understood that every disease shows

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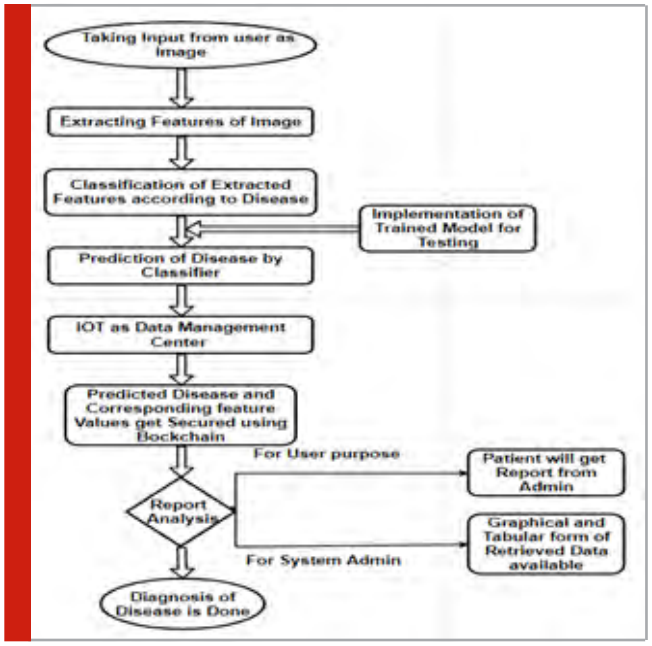
different colours of nails, so any colour change in nails shows an unhealthy status of the human body.



But there are about 16 million colour shades and we as humans hardly differentiate 20-30 shades so it is difficult to diagnose disease on the colour basis in labs, instead of using computers for image processing and differentiating them into the classes of disease is quite simple and efficient. IOT can connect many devices at a time, this makes the system accessible remotely and users can access the report of diagnosis at a remote location. ThingSpeak cloud can be used for accessing IOT to upload data and to retrieve it whenever needed, the retrieved data can be obtained in tabular and graphical form so this will also provide a good analysis of predicted output with given features. The traditional security methods are costly to keep data secured. The emerging concept of Blockchain is always a good option to secure and manage data as it is very difficult to expose the data of blockchain. This paper contributes to predict the disease in the human body based on extracted features of nail image (RGB and mean pixel value) and provides the diagnosed disease based on the prediction made by the classifier. For training and testing supervised vector machine (SVM) classifiers are used. Neural networks can also be used to classify the data [5][6][7].

METHODOLOGY

The designed system takes an image as an input to carry out disease diagnosis, complete process is explained in the following points:-

1. Taking user input as image to system, but to have accurate mean pixel value and RGB value contrast of image should be fixed because as contrast increase or decrease there is change in intensity transfer function which eventually leads to change in pixel value of image or brightness value of image may change. To avoid this we use HSV (hue saturation value) colour space and fix the 'V' value to have constant contrast for each input image. Then the image is converted to RGB space again to do further operation.
2. To get exact colour features from images first have to decide region of interest (ROI). Masking the area except ROI (i.e. nail plate area and some root nail area) by using pixel masking technique gives ROI [8] [9]. OTSU technique used to get clear differentiation between foreground and background of image.
3. At this stage image with masked background having ROI is obtained. Now Figure1: Overview of flow of designed system feature values can be extracted from this image.
4. For training and implementation of classifier a 'Nailyzer' [1] dataset of nail images is used and testing of classifier is done with mixed dataset which contains some images from nailyzer dataset which are not in training set and some images of our own nails.
5. 5) After getting all feature values RGB and mean pixel value, it gets feed into SVM trained classifier to make prediction according to features of image.
6. After completion of the prediction part, maintain the record of this data is very important. To deal with this our proposed system used ThingSpeak cloud; an IOT platform to store data. ThingSpeak provides us with 'read API key' and 'write API key' to read the stored data and to put the required data on cloud respectively.
7. To secure the data i.e. the feature values and their corresponding diseases, data is stored in blockchain with its labelled hash id.
8. System admin has access to user report and all other required analysis. Report of patient is available with system admin.

EXPERIMENTATION RESULTS

The results of the compilation of the above algorithm are as follows:

1) Obtaining targeted image (extracted image):

Figure 2: Compiled images

By using the image processing method the extracted image shown is obtained from the original one (input image).

2) Calculation feature values of extracted image:

Calculation of mean pixel is:

Mean pixel= ((total red pixel value/total pixels) + (total green pixel value/total pixels) + (total blue pixel value/ total pixels))/3

The RGB value of image is calculated by masking two of the colours while calculating one of them, this is called channelization of image. Red pixels are considered as first channel, green as the second and blue as third channel.

3) Scatter plot of response classes (diseases): Before training the data it is necessary to find out which features are working out for the model to get maximum accuracy. This can be analysed using scatter plots of data. In scatter plot the graphical view of classes is shown with respect to the features as shown in fig.3, from which we can get an idea, which features separates our classes more broadly. Then features which are not able to classify the data set and trained data with suitable algorithms are left.

Figure 4: Scatter plot of trained data

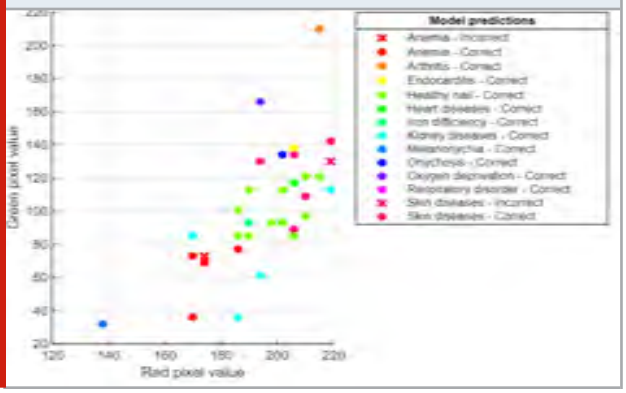
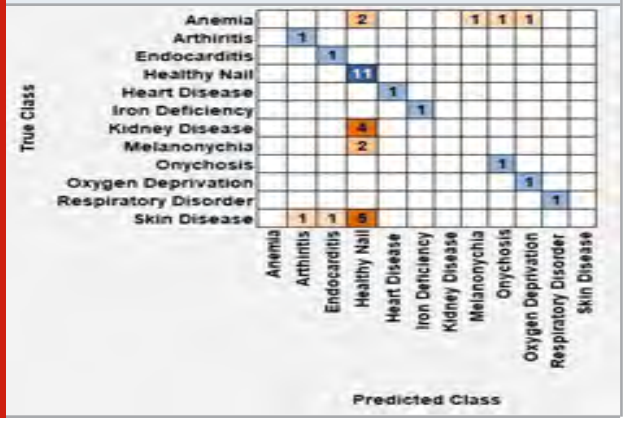


Figure 5: Confusion matrix of trained data



4) Confusion matrix plot: Confusion matrix is used to get analysis of true predicted rates (TPR) and false predicted rates (FPR), blue colour indicate true value predicted and orange or red shows false value predicted. The TPR is the proportion of correctly classified observations per true class. The FPR is the proportion of incorrectly classified observations per true class. In both of the above confusion matrix the number of disease predicted truly is indicted in blue colour and number of disease predicted false is shown in red or orange colour, from this we can calculate the accuracy of prediction of each class also as shown in fig.4 for healthy class the accuracy is 100% and for arthritis is 50%.

Figure 6: Confusion matrix of test data

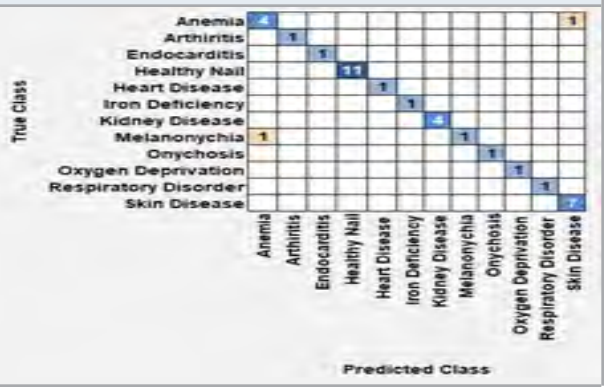
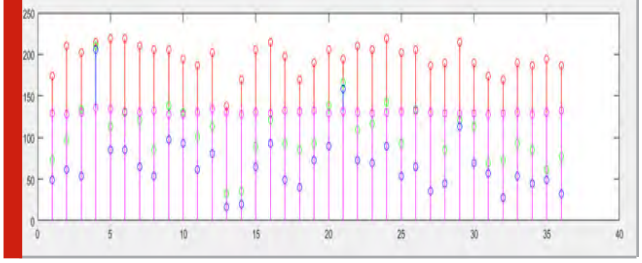


Figure 7: Retrieved data plot from ThingSpeak



5) Showing result of classifier in report format:
Report of the patient

Name of the patient: XYZ
Age of the Patient: XX
Contact No. of the Patient: XXXXXXXXXX
Person might have: 'Skin diseases'

Healthy nail means a person does not have any disease from the predicted class of diseases. In predict function it is very necessary to select prior value distribution. There are two types of prior distribution 1) Empirical 2) Uniform. Empirical probability distribution function is used in this work. Empirical probability uses the number of occurrences of an outcome within a sample set as a basis for determining the probability of outcome.
6) Retrieving data from ThingSpeak using read ID and perform overall analysis of data:

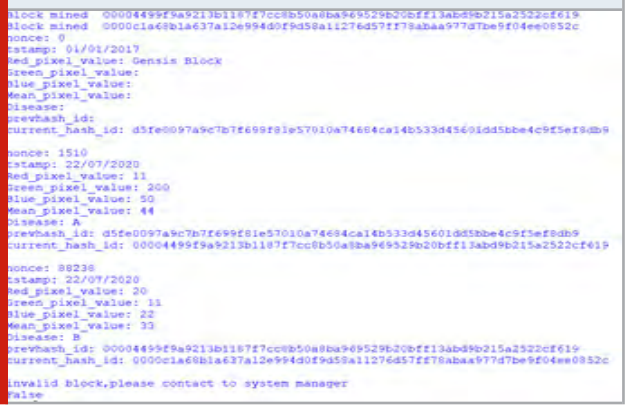
Figure 7 shows the graph between serial no.(of data collection) and its respective feature values, another method of retrieving is tabular which is shown in fig. 11. Serial no. of data entry used as an id for a patient to identify its feature values and disease predicted given in tabular format. Here blue colour represents blue pixel value, red shows red pixel value, green shows green pixel value and pink shows mean pixel value.

7) Securing data using Blockchain concept of hash id: The retrieved data from ThingSpeak is loaded into the Blocks as per entry (i.e. according to serial no.). The blockchain gives each block a unique hash id which is interconnected to each other and data inside is intra

connected. So if someone tries to change the data or change the hash id of the block, the system will throw the warning and the chain will get invalid at the moment. In fig.8 all the data stored in blockchain is valid and chain of blocks is also valid i.e. previous hash id of each block is perfectly linked with current hash id therefore blockchain form is valid and it will give true value at the end. In fig.9 it is shown that if some hacker or unwanted user tries to change the block data then the system will display a warning message and the chain will get broken, this will give false value at the end. In fig.10 it is shown that if a hacker is smart enough to crack the hash id of block and edit the data of block by using the same id, then also the system will give the warning message that the chain form is invalid as the current and previous hash id of next block will not match.

Figure 8: Output of valid blockchain

Figure 9: Output of Corrupted block



8) Tabulated form of retrieve data from Thing Speak: The sample dataset retrieved is shown in fig.11. Admin can retrieve data upto required entries, in same single tabular format.

A) Image processing: In the proposed system an input image is taken from the user, then following processes are performed on the image to get the targeted image for feature extraction.

1. HSV image: Used to adjust contrast value of image.

Figure 10: Output of invalid blockchain

Figure 11: Tabulated form of retrieved data

Sr_no	Red	Green	Blue	Mean_pixel	Diseases
1	174	73	49	128.86	'Melanonychia'
2	210	97	61	128.37	'Healthy nail'
3	202	134	53	130.32	'Onychosis'
4	215	210	206	136.24	'Arthritis'
5	219	113	85	134.19	'Kidney diseases'

2. OTSU image: To differentiate background of image and region of interest of image.[1]
3. Extracted image: To obtain only the image containing the nail part, colour masking technique is used. To make background black in colour masking, RGB values of each pixel of ROI is studied, according to that masking pixel value is decided, if no masking is done then pixel value of background get counted in the mean pixel value and RGB value of image then feature values may get changed and prediction gets wrong.

B) Features Selection: Feature selection is the key step for any prediction model to work accurately. In the proposed model we used first R, G, B channel values [10] of image to classify them in their respective disease class but the accuracy of that model is only about 85% with SVM algorithm used for classification [11]. Then we study the histogram of images in the dataset for future selection of features. In study it is observed that the mean frequency and mean pixel values of nearly each image is different and which can classify the data well into their respective classes. So with R, G, B, features, mean pixel value of image feature is included. Then we get the training accuracy of 95% and testing accuracy of 50% with SVM classifier.

c) Classification Model: The classification model is used to identify the new data on the basis of a trained set of data containing observations whose category class is known to the trained model. The selection of accurate algorithms to classify the data is very important. The features we are choosing and our data set should be compatible with the classification algorithm we are

using for training of our data. In our model we use the support vector machine (SVM) [11] algorithm to train data. SVM tries to make decision boundaries in such a way that the two classes are as wide as possible. This is because our data set contains the features like RGB values, so the minute change in the RGB value changes the shade of image which directly changes the class of disease to which the image belongs [12].

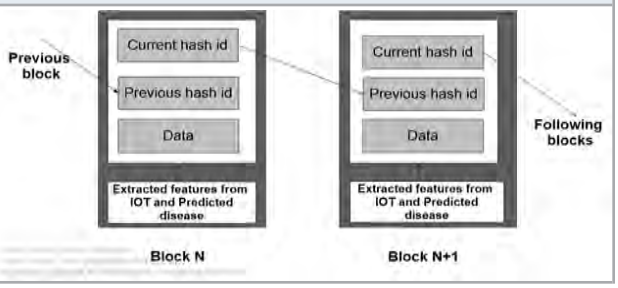
D) Data Management: The proposed system is going to predict the disease on the basis of the input image given by the user and the output is displayed in the software itself. But once the user exits from the system, the display result gets lost. So to overcome this problem we used ThingSpeak cloud to store user data which is an IOT platform. This makes the data available remotely for users. On ThingSpeak cloud we store the feature values of nails as R-G-B and mean pixel value. The ThingSpeak application also features timezone management, read/write API key management. Each channel at this platform is assigned its unique ID called Channel ID. The channel ID and the read/write API key make ThingSpeak a secured IOT platform to store data.

Only a person or organization having channel Id and keys can access the data. ThingSpeak cloud is accessible by MATLAB software. This software provides us with a write and read function as thingSpeakWrite and thingSpeakRead, respectively. Each function comprises the unique channel ID, field number at which data is to be written or read and the respective read/write API key to perform tasks. Data can be retrieved in tabulated form from Thingspeak as shown fig.11. In fig 7 representations of data reading and plotting in the same graphical window with different colour code is shown, where blue colour represents blue pixel value, red shows red pixel value, green shows green pixel value and pink shows mean pixel value.

E) Data confidentiality: Every system which deals with some private data has to take some preventive measures to protect data. As we know IOT has very light shields to protect data therefore we use the emerging concept of blockchain to keep patient personal data secure. A blockchain is a chain of blocks which contain specific information (database), but in a secure and genuine way that is grouped together in a network (peer-to-peer). In other words, blockchain is a combination of computers linked to each other instead of a central server, meaning that the whole network is decentralized. Architecture of blockchain used in system is shown below:

The blockchain architecture contains N number of blocks connected with hash IDs as shown in Fig. 12, the current hash id of Nth block is connected to (N+1)th block's previous hash id. Each block contains the previous hash id, current hash ID and Data, where data contains features extracted from image and corresponding predicted disease. As said earlier the extracted feature values get uploaded on Thingspeak, therefore to make the system integrated and secure we are adding feature values directly from Thingspeak platform to the blockchain.

Figure12: Architecture of Blockchain



CONCLUSION

The system is capable of processing input images given by the user and predict the disease according to feature values of image and providing reports of patients with required entities. As the system is connected to IOT, data can be stored on server and can be accessed remotely whenever needed and due to blockchain usages data remains secured and safe. The data stored on IOT platform can be retrieved using API keys provided by ThingSpeak cloud and analysed whenever the system admin requires. This system requires a little bit of knowledge of software handling and within seconds we are able to predict the disease. If the doctor get acknowledged earlier about a disease through which the patient is suffering or may be going to have some disease it may become easier for them to treat the patient accordingly. The system can be made more user friendly in future. An application can be designed to work on smartphones, tablets or any other smart devices which can give instant report of disease.

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An IoT Based Car Parking System for Supermarkets

Prasenjeet Damodar Patil[1] and Pradip Ram Selokar[2]
[1]*Associate Professor, Department of Electronics Engineering, Sanjay Ghodawat University, Kolhapur, (MS), India*
[2]*Assistant Professor, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur (MS), India.*

ABSTRACT

One of the challenge faced by people living in metropolitan cities of India is parking of cars at supermarkets, shops, theater, hotels, stadiums etc. This problem becomes more serious during weekends and holidays. Solutions provided in earlier work includes, image processing based automatic number plate recognition system, use of RFID tags, QR code, vehicle tracking etc. These solutions are not feasible to implement as they suffer from security as well as implementation challenges or are not cost effective. In this paper, an IoT based solution for parking of cars at supermarkets is presented using NodeMCU ESP8266. Two ultrasonic sensors are placed in each parking slot for checking the car occupancy. An android mobile app is developed which is used for the purpose of displaying available slots, dynamic fare and booking of available slot for the user selected time period. User information is collected, once a particular slot is chosen by the user. A code is generated for each booking and the same is used for validation at the entrance gate of the parking. Complete details are stored on the cloud. The prototype of the system has been developed and tested for booking slot using ESP8266 and google firebase as cloud hosting service. We found that above system is more efficient and economical for booking of parking slots at supermarkets.

KEY WORDS: IOT, NODEMCU ESP8266, RFID TAG.

INTRODUCTION

Automatic parking slot booking system for cars has been area of interest of many researchers. People often find difficulties in parking vehicle at public places. Many a times, it happens that, if the slot is already preoccupied, it not only wastes time, but also causes traffic jam at places like theater, play grounds, supermarkets etc. Conventional systems used in India are based on pay and park system. In this system, person has to pay money to park his vehicle at any available slot. This system suffers from major problem of manually finding the vacant slot for parking car. In parking system with large number of parking slots, sometimes it becomes very difficult to locate the car. Human assisted parking system are available, but still it is difficult to maintain the database of parked car. Such, system also suffers from vulnerability of theft.

With the ever increasing population in big cities & keeping the future demand for automatic parking of cars, Internet of Things (IoT) seems to be promising technology. IoT relies on sensors connected to IoT platforms & sending the data to cloud trough IoT Gateway. It has been said that, limitless devices can be connected through IoT. With IoT enabled technologies it is possible to acquire data, perform data analysis as well as have control of devices. Wide range of IoT platforms are available which includes Arduino, Intel Edison, ESP, Raspberry Pi, Particle, Adafruit series etc. Many of these boards are equipped with features like, large number of I/O pins, high speed

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**Corresponding Author: prasenjeet.patil@gmail.com*
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processor, inbuilt Wi-Fi module, re-configurability, operating system, portability, inbuilt memory, support to external memory & portability. This paper explains the system developed using ESP8266 which is NodeMCU. It has inbuilt Wi-Fi module and it is easy to program. Other useful features of ESP8266 include small size, low power consumption (3.3V), access point (AP) & station node, SPI, UART and I2C pins.

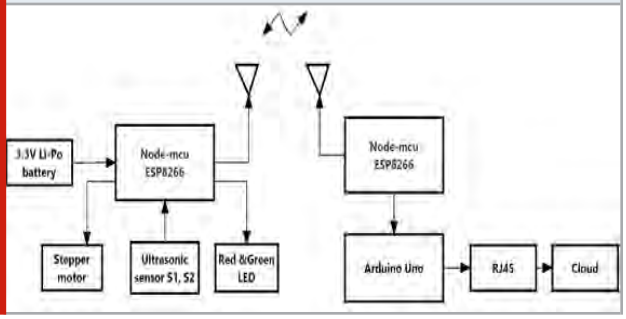
Literature survey: Majority of parking system in India are pay and park based systems, which suffers the problems discussed earlier. Researchers in other countries have tried to provide solution to this problem. S. Banerjee et. al. demonstrated image processing approach for real time car parking system to detect the availability of parking slot. Mohammed Y Aalsalem et. al. has developed car parking and management system using license plate recognition for car parking at university. The system was developed to monitor the cars of students and staff in the parking slot. Vaibhav Hans et. al. proposed cloud based solution for car parking and reservation system. This system was based on image detection camera to detect the car and mobile application was developed for parking slot booking. Ricard Garra et. al. developed a simple pay by phone parking system in which booking can be done by calling the parking vendor. Mahendra B M et. al. developed IoT based car parking system using sensor and Raspberry Pi 3b. Andre Braga Reis et. al. in their paper introduced use of IEEE 802.11p and WAVE technology to track the vehicles.

They have presented comprehensive study on formation of roadside cars by forming network. Chih-Cheng Huang et. al has presented novel approach using GMR sensor, microprocessor and inductive data transfer module to position the vehicle in parking lot. Archika Singh et. al., developed prepaid car parking system using RFID and HDL. The HDL code was simulated in Xilinx Vivado 15.4. Zahid Mahmood et. al. presented fully automated car parking system using image processing. It is consisting of license plate extraction and face detection of driver. A bar code printed ticket was provided at the entrance gate to each driver and payment has to be done at terminal gate. Face recognition & bar code are mapped with the driver using image processing. Other approaches includes use of Arduino, use of drone and line following robot for detection of parking slots. Enamul Hoq et. al. presented QR code based approach for car parking system. Yugesh KC et. al. presented car parking system using location service. In this system mobile sensing unit is fixed in each car and detecting device is placed in each slot. Recently, JOSÉ AZEVEDO et. al. presented evaluation of different strategies of vehicle coordination for different parking scenarios.

METHODOLOGY

Figure 1 shows the block diagram of IoT based car parking system. The system is divided into two modules. The first module is placed in parking slot to detect, whether parking slot is occupied or not. It is consisting of NodeMCU ESP8266 to which, stepper motor, two ultrasonic sensors & two LED's are connected. The information acquired from it is transmitted to the second module which acts as a soft access point. The second module is consisting of NodeMCU ESP8266 interfaced to Arduino Uno, which is connected to internet through RJ45 port. The main task of this module is to collect the information and send it to the cloud. The data collected on the cloud is linked with android app, through which users can check the booking status as well as book the slot. An admin access is provided in the android app to the parking vendor which is used to track the parking details. The station module is battery powered, while access point module is line powered.

Figure 1: Block diagram of Car Parking System



Working: The first and foremost task is to detect the availability of vacant slots accurately. In order to do that, two ultrasonic sensors, one at top wall & one at bottom are kept in each parking slot. The distance threshold is calculated by taking difference between the two read values from the sensors to determine whether the slot is occupied or not. Pair of LED's are used to indicate status of the slot. Depending upon the threshold value either the Green or Red color led is turned ON or OFF. For vacant slot Green LED is turned 'ON' and if the slot is occupied Red LED is turned ON and vice-versa. A stepper motor is interfaced with ESP8266 using A988 module, which is used to lock & unlock the parking slot, thereby providing safety to car against theft as well chances of false occupancy by other car. As shown in figure 2, this ESP8266 module acts as a Station node and relays the information of slot to Access point. The second ESP8266 module interfaced to Arduino Uno shown in fig.3 acts as Soft Access point (AP). This module is connected to internet via Ethernet cable. The prime purpose of this module is to collect the information from all stations and forward it to cloud.

The third part of the system shown in fig. 4 is an android app designed using android studio. This app provides interface to user as well as parking slot vendor. By using this app, user can check the status of available slots and can book it, if it is available. At the time of booking, user information like Name, Phone number, selection of time period for which slot has to be booked & car number is collected. On successful booking, a four digit PIN is provided to the user. The complete information is stored on google firebase which is a free cloud hosting service.

Figure 2: Circuit diagram of Station node

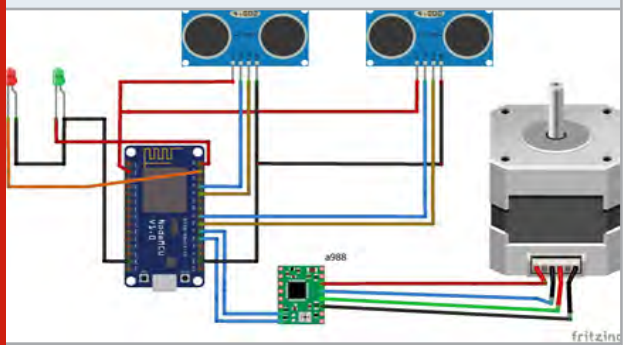


Figure 3: Circuit diagram of Access Point (AP)

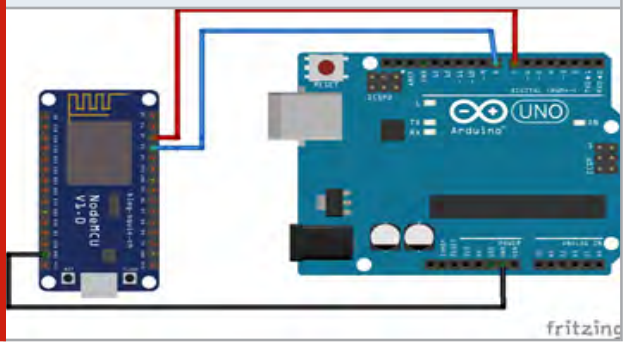
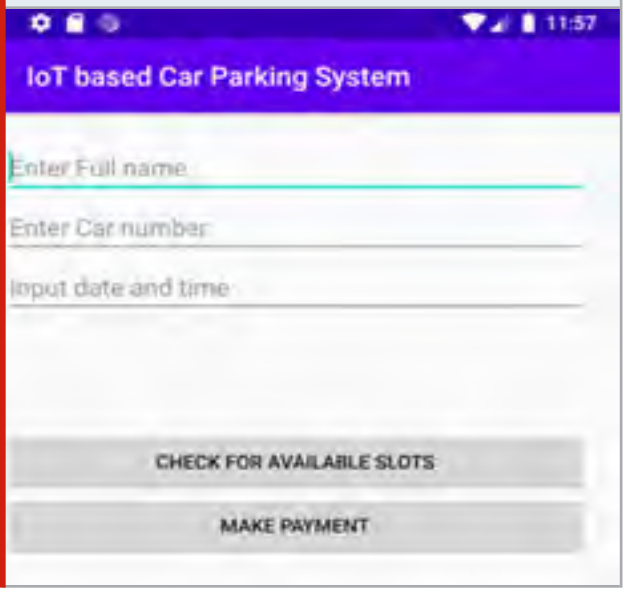


Figure 4: Android app for Parking slot booking



Once the slot is booked, it will be shown as locked or not available to other users on app. When the user arrives at supermarket gate, he has to validate the four digit pin against the car & slot number. Access will be granted only if the four digit PIN matches with the car number. After the validation process is complete, database on the cloud is updated & control information is sent from cloud to the station module. After receiving the control information, the stepper motor connected to station module opens the door of parking slot. Once the slot is occupied, red color led is turned ON. Again the information is updated on the cloud and station node is programmed to go in deep sleep to save battery power. The person at the gate will be having the same app with higher privileges to provide access control, in case of manual control is required.

RESULTS

The prototype of IoT based car parking system has been developed and tested in the laboratory. The results obtained meet the desired objectives. It has been found that, the use of NodeMCU, solves the majority of problems that occur in manual parking system. The benefits of smart parking system go well beyond avoiding wasting of user time in searching for vacant parking slot.

CONCLUSION

It can be concluded that, the designed system is better than pay and park based system, where it is difficult to track the number of users per day. It not only solves the problem of parking, but also keeps the record of everything from user information to payment made. In the future, car tracking can be implemented to trace the car before arrival. Interfacing of payment gateway can be included, by which PIN will be generated only after successful payment is done. Dynamic fare system and early arrival and early departure can be considered as critical problem in future work. With the advancement of technology in the field of IoT platforms, ESP8266 can be replaced with NodeMCU with long range.

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Study and Development of Fuel Adulteration Detection System

Harsh Mahajan[1], Geetesh Mokhare[2], Ankita H. Harkare[3], Deepak G. Khushalani[4], B.A. Neole[5] and Rakshal Agrawal[6]

[1]Research Intern, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[2]Research Intern, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[3]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[4]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[5]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Electronics and Communication Engineering
[6]Assistant Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, India, Department of Industrial Engineering

ABSTRACT

Over the years, the rise in the fuel prices has lead the adulteration market to develop new techniques for blending the inferior adulterants into the highly taxed petroleum products. Despite of various adulteration monitoring techniques existing in place, this illegal practice of profit making by using subsidized fuels as adulterants still persists. The emission from consumption of such adulterated fuels has contributed to the global Air pollution and various health hazards linked to it. This calls for the ease and precision of monitoring techniques. This study reviews the use of emerging fields of technology like microfluidics, metamaterial, microfabrication and fiber optics to develop Adulteration detection systems for Diesel which provides higher sensitivity and portability as compared to the existing lab based methods. Also, experimentation results measuring density of the fuel suggests adulteration above 16.66% is unacceptable.

KEY WORDS: ADULTERATION, DENSITY, FUEL, MICROFLUIDICS.

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*Corresponding Author: mahajanh@rknec.edu
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INTRODUCTION

Adulteration is the introduction of an inferior standard foreign substance into a higher-level substance which demeans the overall quality and devalues the product. This practise is unlawful and unethical. After the addition of such materials the final product doesn't meet the legal standards and distribution of which makes the whole process illegal. According to the Forensic guide for Criminal Investigators by NICFS, if the Petrol or High

Speed Diesel oil (HSDO) fails to fulfil the requirements of the Bureau of Indian Standards Specification no. IS 2796 and IS no. 1460, then it is considered as adulterated. Such products have health as well environmental hazards. The emission from consumption of such contaminated fuel causes mixing of carcinogenic pollutants in the air leading to the various ailments and degradation of air. It also affects the engines, deteriorating their performance and life as explained by Boadu et al.

According to a recent report published in Hindustan times, out of the overall Indian refined fuel sale, diesel consumption occupies 40% of the total. As classified by the Ministry of Petroleum And Natural Gas, Diesel in it's two forms, i.e. High Speed Diesel oil (HSDO) and LDO (Light Diesel Oil) showed a growth of 4.4% and 21.7% respectively in their consumption making a total volume of 84.126 MMT (83.528 TMT HSDO + 598 TMT LDO). This high amount of the consumption gives rise to the economic opportunities for adulteration market as one of the major contributors towards loss of the government's revenue as explained by Economics & Statistics Division.

Table 1. List of Adulterants Found in Diesel (HSDO)

Sr No.	Substance	Source
1.	Kerosene	Marketers
2.	MTO	Refineries
3.	C9 Raffinate	Petrochemicals
4.	Iomex	NA
5.	Aromex	Digboi

Tabel 2. ASTM Test Methods for Monitoring Fuel Adulteration

Tested Parameters	Tests
Cetane Number (Ignition Quality)	ASTM D613
Flash Point	ASTM D93
Density	ASTM D1298
Kinematic Viscosity	ASTM D445
Distilation	ASTM D86

The challenge while testing for the adulterations in fuels is that the adulterants that are being searched are already present in them in their consumed form. There is a range in which their presence is permitted. Instead of the presence, the composition of the adulterated fuel is checked and the results are drawn out by observing the percentage of that adulterant as explained by Bhanu Prasad et al. The existing methodologies that are being used are bulkier and lab based. The tests and standards suggested by The American Society for Testing and Materials (ASTM) are used globally. Some other tests are Paper Filter Test (As suggested by NICFS), Density Measurement (Used mostly in practise). Some of the physico-chemical methods for testing the adulteration are mentioned in Table 2. All these techniques, being lab based, are time demanding and they need trained personals to carry them out.

Moreover, these methods are limited to only the detection. This calls for testing techniques that are fast and equipments that are portable. Multidisciplinary fields like Microfluidics to develop the Lab on Chip solutions to overcome the disadvantages of the lab based testing techniques. Methods involving application of MEMS have also been designed.PDMS moulding techniques have been used to the advantage of PDMS being a low cost material and ease of fabricating micro channels out of it. Rapid bonding along with advantageous optical properties make it a suitable material for prototypes and testing microfluidic systems as suggested by Byung-Ho Jo et al.

MATERIAL AND METHODS

Various methods have been suggested in recent times for adulteration detection. Some of the methods are discussed here for getting an insight into the suggested topic of research.

I.Ultrasonic Radiation: Measuring the speed of the ultrasound through fluids is used as a detection method where Concentration analyzer is used to send ultrasonic pulses through the fluid as medium. Firstly, Diesel is taken as the medium followed by the samples of it mixed with kerosene in known ratios. The observed speed of the sound is then converted into the corresponding adulteration percentage as explained by R.K. Sharma et al. For analyzing the adulteration, the mathematics used to calculate the percentage of adulteration from the observed speed of sound through the Analyzer is given by South Asia Urban Air Quality Management Briefing Note no.7:

X= 0.0072*V-20.397*V+14441
where,
X = Percent of Adulteration (by volume), and

V = Speed of sound in m/sec

R.K. Sharma et al. used pulse echo method to detect the speed of ultrasound in the samples. Figure 1 and 2 suggests the changes in speed of sound and Density of mixture due to increased values of adulteration in the actual fuel. This concept of changes in density of the mixture will be utilized in our experimental set up as well. Though viscosity was not measured but its effect on the speed of sound formed the basis of the experimentation. The test equipment showed precise results and was portable enabling the field testing. Viscosity measurement will be included in the experimental setup suggested by us.

II. Fiber Optics: An optical fiber with a small length of absorbing cladding removed is inserted into a glass container such that the length of the removed cladding is exposed to the test fluid in the container.

The experiment used the concept of refractometry for the experiment. Sukhdev Roy suggested sending a laser light thorough the optical fiber and the difference in the power transmitted and received was observed. Using the power, the absorbance of the medium was found out and the samples are compared on the basis of the calculated absorption coefficient. Figure 3 defines the suggested experiment setup where the sensitivity of the test is a variable and is directly proportional to the length of the exposed region of the fiber (Length for which the cladding is removed). Till 20% of the adulteration, the normalized power decreases and then increases with the increase in the adulteration. The test concluded that addition of kerosene beyond 20% volume by volume, the absorbance of the fuel increases. The experiment gave the variation of bulk absorbance, another physical property on the basis of which the adulterated fuel sample can be monitored. Yet it is not able to tell the extent of adulteration.

Figure 1: Speed of sound in Deisel+Kerosene Mixture

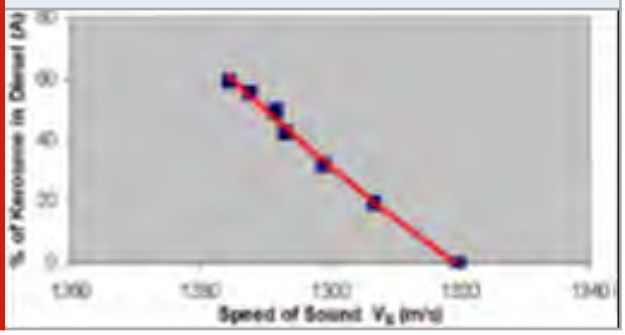


Figure 2: Density of Deisel+Kerosene Mixture

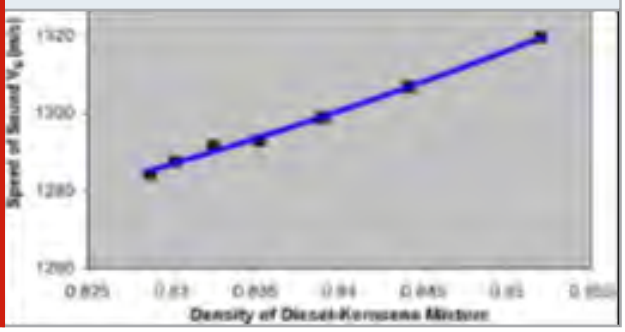
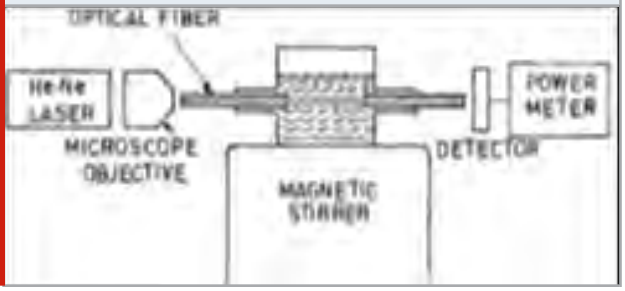


Figure 3: Schematic diagram of the experimental set-up.



III. Lab on Chip Solutions using MEMS and Microfluidics: Lab on chip devices provide miniaturised and more precise solutions to the lab based experimentations for measurement or processing techniques. Microfluidics incorporates the study of fluidic behaviour at a micro level. At the micro stage, the processing or manipulation of material gets convenient. Such devices give in physical as well as technological advantages. The concept of microfluidics provides a technological liberty as there are numerous analytical and processing techniques for analysis the test samples at a micro level. The Y-channel suggested by Ankita H. Harkare will be utilized for developing the microchannel for sample collection.

Figure 4: (a) Y-shaped channel (b) Y-shaped serpentine channel (c) Y-shaped channel with obstacles.

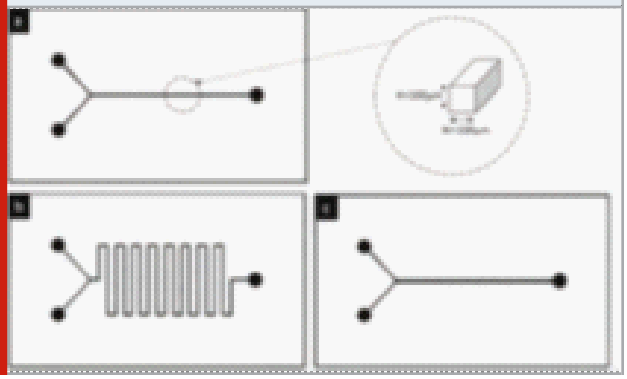


Figure 5: Fabricated Microfluidic chip

As suggested by Mary Salve et al., Image processing can also be an effective approach for developing a readout technique. One such method can be texture analysis of samples captured by camera to analyse the uniformity of texture and using stochastic processes to compute the adulteration. These can be detected very effectively using the methods suggested by Purva patil et al. Here blurring aspect is highlighted while preserving the sharpness and continuity of edges. The noise is removed by averaging and blurring of images at the edges is minimized. Here, sudden transitions in edges are accurately recognized

for visual appeal. Image processing can be employed to examine the micro test samples in microfluidic devices. One such technique as suggested uses PDMS micro channel to perform colorimetric detection methodology to detect detergents in milk samples.

Proposed Design and Experimentation:

I. Microfluidic Channel: The design focuses on developing a Y shaped Microfluidic Hydrometer. Such micro channels cater a better platform for the quantitative analysis. The Microfluidic Hydrometer focuses on detecting the density of the introduced fuel and this will be compared with the Look up table to detect Fuel adulteration in percententages. Using the studies suggested in above methods an effective experimentation setup is suggested which will lead to portable device which can be carried along by the user in order to detect adulteration in fuel.

Figure 6: Block Diagram of Experimentation SetUp

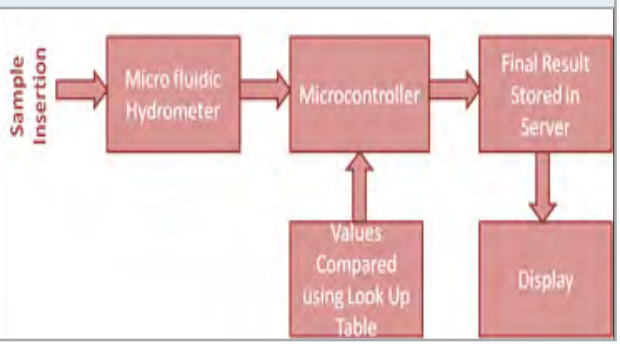


Table 3. Experimentation Results

S.N.	Volume/ Adulterated Sample Mixture	% Adulteration	Density (gm/ml)
1	210/0	0-1%	1.15
2	200/10	5-10%	1.55
3	180/30	10-16.66%	1.16
4	170/34	18-25%	1.171
5	150/60	25-50%	1.18
6	120/90	Above 50%	1.182

II. Sample Preparation: The sample mixtures were prepared using HPCL Diesel and Kerosene from the local vendor. Total sample were prepared by introducing kerosene in diesel by volume. The percentage adulterated sample was then used for measuring the density (gm/ml).

III. Experiment Setup: The experimentation set up is shown in the block Diagram Shown in Figure 6 where the readout setup with require a lookup table which needs to be formulated using experimentation results. The deployment of microcontroller along with RTOS will make it easy to check the adulteration using a handy portable device.The sample experimentation is listed in Table 3. Experimentation results for the density of samples using hydrometer for the development of look up table.

Observations based on the readings suggest that the density of the sample went on increasing with the increase in percentage of kerosene in the sample. The Adulteration of Diesel with Kerosene above 16.66% volume by volume of the sample is not accepted according to the regulations. These readings will be fed in the system as lookup table which will be utilized to check the samples in micro volumes. However, these readings will still have errors and the quality of diesel might vary for different companies. Hence, in order to make a full proof system it also becomes important to include quality improvement techniques such as Six Sigma to ensure better results. Systematic analysis of data along with the process parameter will be completed which will enable us to focus on the correct identification of error and gradually the errors will be minimized to ensure quality improvement after testing as suggested by Sharma et al.

CONCLUSION

This review suggests an operative portable testing mechanism monitor the extent of adulteration by determining the density of contaminated test samples and comparing them with that of look up table (According to the standard regulations). The device is designed in a manner which makes it reusable with the same accuracy with each test. Due to the use of RTOS, the device can be recalibrated in accordance with the fluid to be tested which makes the application versatile. Batch production would certainly reduce the cost and the device can then be deployed for the application.

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Content-Based Image Retrieval Using Customized Convolutional Neural Network

A.P. Nilawar[1], C. G. Dethe[2], A. Jaiswal[3] and J. D. Kene[4]
[1,3,4]*Assistant Professor, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*
[2]*Director, UGC HRDC, R.T.M.N.U., Nagpur, Maharashtra, India*

ABSTRACT

In today's world due to multimedia development, there is a huge image database. Content-Based Image retrieval (CBIR) is a widely used method for image retrieval from a large image database. Existing retrieval methods are based on the basic content of an image like color, Shape, and Texture. The system based on basic features requires more time for processing and provides less accuracy. To reduce time and improve accuracy we are proposing CBIR Using CNN in this paper. CNN is used for feature extraction and similarity measurement Hamming distance is used. In this technique, the user has to provide an image as an input query image. The similar images related to the query image are displayed as a result. The performances of a system are evaluated by precision and mean average precision (MAP). After comparing with existing methods, we found encouraging results that lead to improving accuracy.

KEY WORDS: CONTENT-BASED IMAGE RETRIEVAL, CNN, DNN, LSH.

INTRODUCTION

In this day and age, there is an expansion in the component of interactive media databases. It comprises information like image, sound, video, and so forth. The utilization of images in the area of medicinal, individual, news coverage makes a lot of image databases. In this manner, the Content-Based Image Retrieval system was created to manage huge image databases. Content-Based Image retrieval system restores a lot of images from a progression of images in the database to fulfill the user's need with closeness assessment. The CBIR framework has two fundamental stages in the primary stage: the pre-processing with feature extraction dependent on attributes such as color, shape, and texture. In the second stage assessment of similarity between a query image and indexed images from the database is performed.

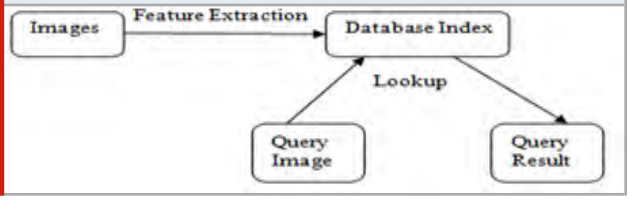

Figure 1: Basic CBIR System

The above figure explains the basic operation of the CBIR System. In the retrieval system, there are essentially three most important fields: text-based image retrieval, retrieval based on visual features, and semantic features. In a text-based image retrieval system images are provided through labels and for retrieval cause similarity of these labels are used. A predominant disadvantage of these types of structures is that a lot of human work evolved for image

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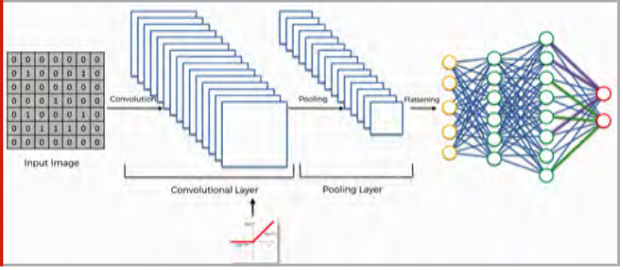
labeling and if the database of images in a massive quantity then it is pretty difficult. And labeling of images is no longer user friendly; it relies upon database creators labeling strategies. Then the visual-based image retrieval systems used for image retrieval purposes and low-level features are considered for feature extraction. The systems are based on visual features along with semantic features in use. The three most important features that exist in an image specifically are color, texture, and shape (Latif, A et. al. and Ganar, A.N et. al.). All the methods utilizing color, text, and shape features are time-consuming because for each feature we require to train the image database then compute the results. Hence CNN is used for feature extraction. Once the pre-training is done it will provide faster results.

2. Literature Survey

2.1 Neural Network: Neural Network is an interconnected network of neurons in which inputs are independent variables and output is dependent on the weighted inputs connected to neurons. The neural network consists of input values, weights, activation function, and output values (LeCun, Y). Generally, four activation functions are commonly used: Threshold function, Sigmoid function, Rectifier function, and Hyperbolic Tangent function. Depending on the application appropriate activation functions can be selected. The weights are estimated by using Gradient Descent and Back Propagation algorithm. The weighted inputs are applied to a neuron to get the output. And inside the neuron activation function is applied to the weighted sum of the inputs present. The output is determined by using initial weights that can be random or fixed. Finally, an error is calculated and a Backpropagation algorithm is applied to fine-tune the weights and reduce the error.

2.2 Convolutional Neural Network: The Convolutional Neural Network is a neural network having four steps. The first step is applying 2D convolution to the input image. 2D Convolution is a mathematical operation in which two matrices are used. For the application of CNN one matrix is an image and the other matrix is a feature detector. Generally, the Feature detector is a matrix of size 3x3 but size may change. In a convolution operation, when a feature detector is applied to an image, a matrix with different values from the original is obtained (Wu, J). In this step, the feature detector is applied to the input image which results in the generation of the feature map. For removing unwanted information in the feature map, the ReLU (Rectified Linear Unit) activation function is used (Kuo, C.C.J). In the second stage, the pooling operation is performed. Three types of pooling are used: max pooling, mean pooling, and sum pooling. Stage three consists of flattening, which generates a feature map. And in the last stage full connection is done. The softmax and cross-entropy are the two functions used for improving accuracy in CNN.

Figure 2: Basic Convolutional Neural Network



The above figure 2 shows Basic Convolutional Neural Network which is used for feature extraction. In this CNN, max-pooling, and ReLU are used. The input for this network is an image. The output is provided by a fully connected CNN network (Simonyan, K. and Zisserman, A).

3. Proposed Method

Figure 3: Proposed Method

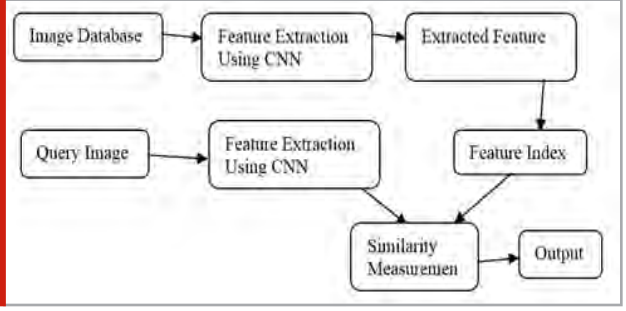
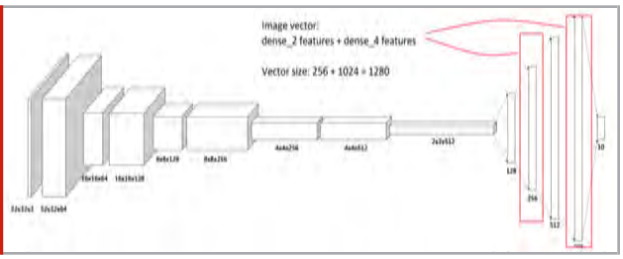
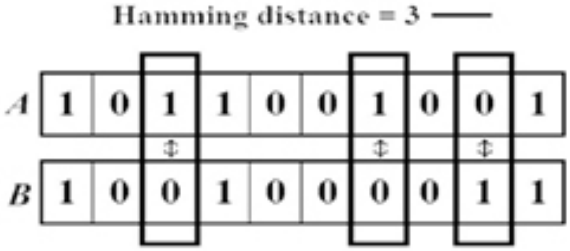


Figure 3 provides the proposed method of data flow. The algorithm for the proposed method is explained below.
Step 1: In an image database several images with different categories are present.
Step 2: These images are fed to CNN for feature extraction.
Step 3: For each image feature vector generated. Each vector consists of 1280 elements.



Step 4: Features are indexed in the database.
Step 6: The user has to provide an input image considered as a query image.
Step 7: Features of a query image extracted using CNN.
Step 8: Using Hamming distance similarity between features of the query image matched with the index.



Step 9: Finally similar images are displayed.
Step 10: Repeat from step 6 for another input.

Performance Evaluation: The performance of the system was evaluated using two parameters Precision and Mean Average Precision (MAP). Precision is the ratio of the number of relevant images retrieved to the total number of images retrieved.

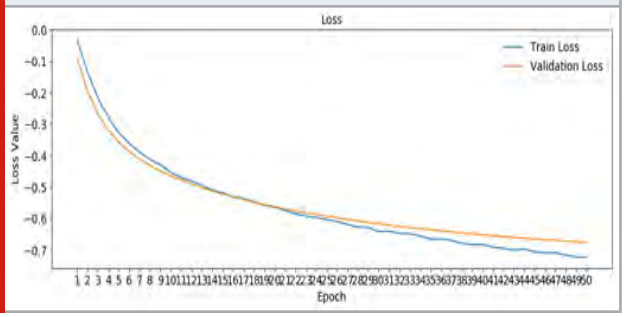
$$MAP = \sum_{k}^{K} \frac{Avg\ P(k)}{K} \quad (1)$$

Where k = value of precision for query and K is the number of query images.

EXPERIMENTAL RESULTS AND DISCUSSION

The image database consists of 60000 images with 10 categories (CIFAR Image Database). The performance of CNN is given in figure 4.

Figure 4: Performance of CNN



After training the model we evaluate the performance of the system by providing a query image. The results show the matched images from the image database. Figure 5 shows sample results that are tested on a few query images.

The database consists of 10 categories and in each category 6000 images. Figure 5 shows sample results of some categories like airplanes, cats, and birds. The top 10 matching images are considered for performance evaluation.

Table 1 represents the performance of the proposed system with precision and MAP. We can conclude that

Figure 5: Sample Results of the proposed system

Table 1. Precision and MAP

Category	Precision
Airplane	90.18
Automobile	90.28
Bird	90.28
Cat	90.70
Dear	90.70
Dog	90.24
Frog	90.20
Horse	90.25
Ship	90.90
Truck	90.85
MAP	90.45

Table 2. Comparisons with existing methods

Methods	Images in Database	Precision %
Color in YCBCR, Color Moment (Dandotiya, Y. and Atre, A)	1000 Images	82.70
HSV Color Histogram and Hu moment invariant (Rajkumar, R. and Sudhamani, D.M)	1000 Images	84.20
CBIR Using Customised CNN (Proposed)	60000 Images	90.45

in all categories results provides promising results. Table 2 provides a compression analysis with existing methods.

CONCLUSION AND FUTURE WORK

We can conclude that the performance of CBIR improves significantly using CNN. Since the existing methods based on image content like color, shape, and texture provides less accuracy as compared to the proposed system. We can use CNN for improving accuracy and retrieval time. In all categories presented in the database, the proposed

system provides significant results. In the future, we can evaluate CNN using different image databases.

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Hyperspectral Image Classification Using CNN12

Mr. Ruhikesh Dhande[1]*, Rohit Miri[2] and S.R.Tandan[3]
[1]*Department of Information Technology, Sipna COET. Amravati, India*
[2]*Department of Computer Science, Dr. C. V. Raman University, Chhattisgarh, India*
[3]*Department of Computer Science, Dr. C. V. Raman University, Chhattisgarh, India*

ABSTRACT

Convolutional neural networks (CNNs) have showed their dominance in hyperspectral image classification (HIS) where spectral embedded with spatial features have provided means for excellent database training when the application is image classification. Different scaling with context of number of layers in efficient neural networks has been the recent topic of research where attention aided and not aided machine learning algorithm have being the elementary topic of vigilance. We have in the paper highlighted an attention seeking CNN 12 layer algorithm that is utilized for efficient labeling the prime aspect of image classification. The raw image provided as input to the network extracts the relevant features in a way that joining feature map created provides better results in terms of accuracy. The frame work created utilizes the available sets of images and compares the parameters that will help in making the algorithm robust and fine tuned with respect to required hyper parameters. The linear transformation that is the main advantage of CNN architecture has made the system more reliable unlike the rule based feature extraction and classification frameworks. In this paper the three dimensional input utilization helps us solve the overfitting problem that is a byproduct of exhaustive layering during training. The way the three dimensional input is handled in terms of CNN 12 layer convoluting is the simple nonlinear function that is the key aspect of this research paper to improve accuracy.

KEY WORDS: IMAGE CLASSIFICATION, HIS, CNN.

INTRODUCTION

Hyperspectral remote sensing via Hyperspectral imagery (HSI) is the requirement of providing multispectral processing capabilities where normal RGB imaging provides insufficient capabilities. This requirement of handling multiple spectral information not only requires a strong back bone of processing speed but no compensation in terms of accuracy can be subdued where minimizing the feature extracted is concerned. HIS has been evolving from the past decade as the hindrances of handling large datasets has been evolving constantly where competition always has been with respect to providing an efficient machine learning algorithm. This algorithm was not only meant to be custom made for the problems of classification but the problem needed to be addressed is also evolving with the needs of making remote sensing solve problems especially in the area of agriculture. The early ear of algorithm and framework development was restricted to spectral classifiers where the machine is to be supervised or non supervised depended totally on the application coverage.

Linear and non linear regression provided a good start but soon multilingual utilization brought demands to extract physical properties hence brought about classifiers like support vector machines (SVM), random forest(RF) etc. These classifiers did the job but custom tailoring these classifiers increased the over fitting problems that required handling capabilities of an efficient trained data base. Recent reporting's have showcased that the

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combination of methods provided better approaches to deal with the spectral as well as spatial data. These methods adaptation was with respect to utilization of advantages of one classification like spectral information and the other classification with respect to spatial. These adjoining feature mapping was possible with respect to various profiles that could be integrated with spatial based methods reported like the joint sparse model etc. The reporting quishuo et all. have utilized a novel two parallel pathway unlike a singular means of CNN structure that is the main motivation of utilizing CNN in our research.

One more immediate recent reported work RadhesyamVaddiet all has utilized a data normalization process to down scale the loss parameters. This not only reduced the computational burden but also provided the required integration facility that CNN architecture promised. This paper is based on Probabilistic Principal Component Analysis (PPCA), Gabor filtering and Convolutional Neural Network(CNN) which is batch normalization approach to improve accuracy. In this work, PPCA, gabor filtering and CNN provided scalar factoring to be merged with batch normalization and dropout mechanism that increased accuracy. The framework is essential and provides excellent breakthrough where in the structuring is restricted by the researcher to three sets of convolution and pooling layers each. This layering and filtering when fed to batch normalization brings about the lower limits on batch size hence the author has restricted his use to 3 layering each. With the goal of reducing computation time and providing further accuracy in this research paper we have utilized and provided a layer normalization function framework instead of batch normalization which peaks out to provide a balance between layering and algorithm in terms of simplicity and accuracy. The paper is organized as Section II is methodology, Section III is implementation and Section IV results and discussion.

METHODOLOGY

The working procedure comprises of HIS classification wherefirst the input acquired HIS data is normalized for the spatial features extracted. The normalization is layer based where in the multidimension input for our case the 3D data corresponds to the feature data in terms of height width and depth in general terms. One of the key difference of layer normalization unlike batch normalization is that it does not require for formulation of running mean and variance. It can be mathematical expressed as shown in the below equations.

Assume the input shape $[m, H, W, C]$, for each channel $c \in \{1, 2, \cdots, C\}$

$$\mu_{i,c} = \frac{1}{HW}\sum_{j=1}^{H}\sum_{k=1}^{W} x_{i,j,k,c} \quad (1)$$

$$\sigma_{i,c}^2 = \frac{1}{HW}\sum_{j=1}^{H}\sum_{k=1}^{W}(x_{i,j,k,c} - \mu_{i,c})^2 \quad (2)$$

$$\hat{x}_{i,j,k,c} = \frac{x_{i,j,k,c} - \mu_{i,c}}{\sqrt{\sigma_{i,c}^2 + \epsilon}} \quad (3)$$

Specifically for each channel, we have learnable parameters γ_c and β_c, such that

$$y_{i,:,:,c} = \gamma_c \hat{x}_{i,:,:,c} + \beta_c \equiv \mathrm{LN}_{\gamma_c,\beta_c}(x_{i,:,:,c}) \quad (4)$$

As each sample to train is an neuron that requires combustive instantiation the researcher utilized multiple channels to be normalized as shown in the figure at pooling. The spectral features are convoluted before fusion with the scale of neuron filtering that is varies with respect to 2N where n is the number of layers from 1 to 12 and filters are required at each layer to control the number of feature maps created for labeling in a convolution neural network. For fusion pooling operation is performed which is responsible to study the non linear properties that are divide at each layer in terms of dimensionality. This pooling is done at each layer so that most relevant information is extracted as down sampling of data is provided on each stride configured.

On general basis the data remains constant at each layer. This is very essential for our algorithm to overcome overfitting configurations at the very base itself. The pooling that we utilize is the average pooling which is required for processing the normalized data Next step is variation in convolution which a measure technique where in the function utilized is bounded. This bounded variation defined as BV function which is determined by real values under bounding extents. Bounded convolution is varied in terms of the axis definition rows and columns that in our case is y axis where x axis is kept constant or neglected for keeping the values finite to hyperplane (hypersurface or hyper parameter tuning). In terms of mathematical equation the bounded variation two measures μ and ν based convolution can be written as shown below.

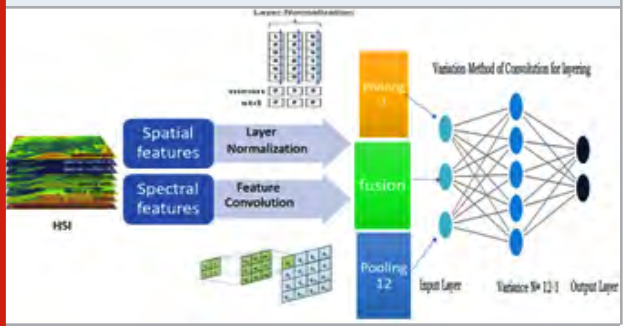
$$\int_{\mathbf{R}^d} f(x)\, d(\mu * \nu)(x) = \int_{\mathbf{R}^d}\int_{\mathbf{R}^d} f(x+y)\, d\mu(x)\, d\nu(y). \quad (5)$$

In particular,

$$(\mu * \nu)(A) = \int_{\mathbf{R}^d \times \mathbf{R}^d} 1_A(x+y)\, d(\mu \times \nu)(x,y), \quad (6)$$

III. Implementation: For the described methodology the desired framework is developed as shown in figure 1 and analyzed on the four standard hyper spectral data sets(Indian Pines, Salinas, Pavia University and Pavia).

Figure 1: Block Diagram of implemented CNN framework



The complete description of the data sets summarized is highlighted in table 1. The experimentation is done considering the spatial resolution size mainly so that the effect of increase in size can be observed on accuracy.

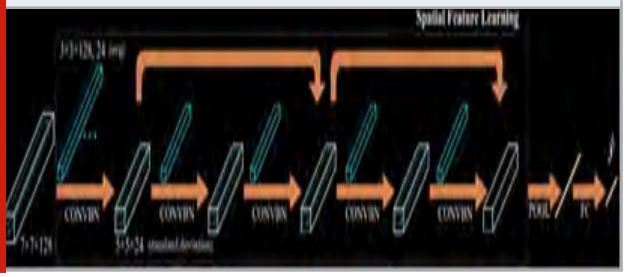
The implementation can be noted down into step of operation as shown below and diagrammatically with respect to figure 2. The python code is developed on the principles of figure 2.

1. HSI classification framework for spatial and spectral feature extraction.
2. Data normalization – with respect to layer.
3. Spatial and Spectral data fusion and pooling.
4. Bounding Variance Convolution.
5. CNN 12 Layer based feature labeling.

Table 1. Data set description

Sr NO	Name of the Dataset	Number of Classes	Spatial Resolution	No of bands
1	Indian Pines	16	145 x 145	224
2	Salinas	16	610 x 340	200
3	Pavia University	9	610 x 610	103
4	Pavia Centre	9	1096 x 1096	102

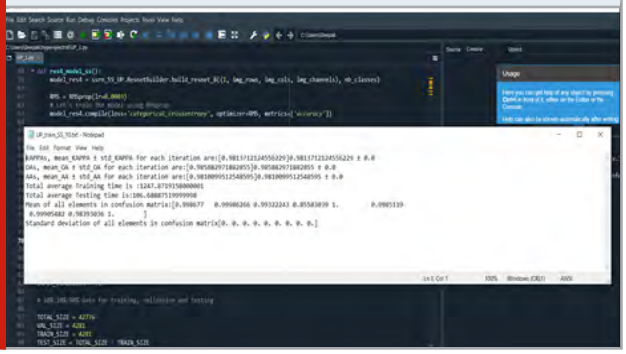
Figure 2: CNN 12 feature Extraction



RESULTS AND DISCUSSION

A demonstration screenshot of result with respect to python output is shown in figure 3. The results of all the databases with respect to group accuracy and loss function is summarized and compared as shown in table 2.

Figure 3 : Implemented output stored in text files.



The output of the proposed model is plotted with the help of matplotlib and the corresponding figures of each data base analyzed is shown in terms of Figure 4.a Ground truth, Figure 4.b Classification Maps, Figure 4.c layer coverage with respect to classification and figure 4.d shows the linear correlation output. The main advantage of using the layer normalization is that the network provides better accuracy in terms of bounding power. The amount of testing time is also improved to approximately 100 seconds as shown in figure 3. The kappa coefficient are the hyper parameter tuning that have improved the loss function as compared to reported literature. The hyper parameter tuning with respect to individual class sub function requires exhaustive testing which is sub due to machine/server capability. Hence exact comparison of the reported literature is the salient setback that brings the user ambiguity in terms of software and machine utilization in true sense. This fine tuning and removal of ambiguity is the future scope of our research.

Table 2. Accuracy and loss calculations

Name of the Dataset	Reference algorithm		CNN 12*	
	Accuracy	Loss	Accuracy	Loss
Indian Pines	0.9902	0.0355	0.9964	0.041
Salinas	0.9994	0.0033	0.9956	0.006
Pavia University	0.9994	0.0032	0.9941	0.008
Pavia Centre	Not Analyzed	Not Analyzed	0.9928	0.009

Figure 4: (a) Ground truth, (b) Classification Maps, (c) Layer Coverage, (d) Linear correlation output.

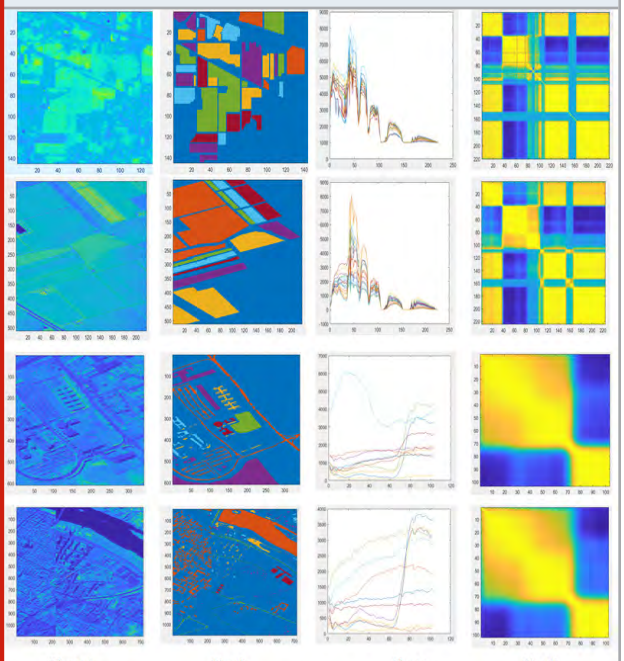


Figure4a. Fig 4b. Fig 4c. Fig 4d.

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Fault Tolerant Triple Modular System Using FPGA

Shubham Anjankar[1], Arihant Dhobe[2], Sagar Pandharpurkar[2] and Parag Jawarkar[1]
[1]*Assistant Professor, Electronics Engineering Department, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*Department Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Fault Tolerant Triple modular Redundancy is a Real-Time Reliable Concept that improves the performance of the systems by reducing the faults in the system. Triple Modular Redundancy is widely used in dependable systems to design high reliability against soft errors. This Experiment defines an approach towards a fault tolerant system using FPGA. Redundancy is an idea that is a copy of the currently implemented design. The proposed system is based on the concept of considering the majority of the real-time system and then giving the output of the system based on the ratio. This System allows us to detect which individual module in the system is at a fault. Triple Modular Redundancy develops a robust system towards Faults. This paper focuses on the implementation of triple modular redundancy on FPGA's and connecting the systems with the help of SPI communication. This paper illustrates how the TMR will be used to speed the fault analysis and use the system in Real-Time Applications and Environment. In this experiment, we use the FPGA system that ensures proper synchronization between the master and the slaves. The scope of his paper embraces the development of TMR various currently ongoing projects related to TMR, Recent projects developed with the help of TMR, Research going on in this field, disadvantages of the systems currently used in projects and appliances, and how Fault Tolerant Triple Modular System using FPGA will be able to solve the problem and can be implemented in the new systems and the test bench, software algorithms, functional simulations, timing simulations in Experiment.

KEY WORDS: FPGA, MISO, MOSI, REDUNDANCY, SPI, TMR.

INTRODUCTION

The Fault Tolerant Triple Modular System Designed with the aim to reduce the faults in the system and achieve task correctness. Triple Modular Redundancy is one of the most commonly used fault tolerant techniques which is mostly used in FPGA. As the probability of faults reduces the reliability of the system increases. At present, the use of real-time system in critical applications like aviation, space exploration, nuclear plants, the manufacturing sector has increased tremendously. For real-time applications the fault tolerant system the minimum performance overhead is very important. For a system to be reliable the system should be equipped with appropriate error detection and meeting the timing constraints.

Error in the system is a sign of fault and a single error may result in numerous faults. Because of the above-mentioned functionality requirements, the FPGA has become a platform to be selected because of their high performance in signal processing tasks, short design process time in developing a system having high complexity [1]. The flexibility and performance make FPGA the choice. FPGA boards using Static RAM feature are reconfigurable and the programs in the device can be changed as the requirements change. FPGA and their

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Integrated Development Environment ease fixing design errors easily. Static RAM-based FPGA's are programmable devices and the cells store the program [2]. This program determines the functionality and routing.

Faults like latch-up and gate rupture and change in silicon structure and changes in the doping can occur in the FPGA and can lead to several defects like change in transistor behavior and timing behavior. The FPGA are generally used in space and because of the intense radiation in the space there are some challenges in using FPGA's in space. FPGA's stores data in static form radiations can harm the static memory in the FPGA. And sometimes the on-chip used sensors can also give faulty output. Hardware Redundancy is used here. The systems are used in a harsh environment so the fault tolerance and the reliability of the model should be very high. The hardware required for a TMR is thrice the hardware required for a simple system[3].

In Avionics safety is given the highest priority and for that correct readings from the sensors should be obtained and process. To improve the reliability Triple Modular Redundancy concept is used and is implemented on the modules of FPGA's. With the development of Science and Technology, the reliability of electronics has been increased in avionics. With the increase in lifetime, reprogrammability has been a stringent requirement in space development. The method by which the FPGA's store data has a high susceptibility to the single event upsets (SEUs). Single Event Transient (SET) is an event in which a current or voltage spike is induced in the circuit. The SEU results in the change in memory bits because of heavy ions, protons, and radiation ion. This contributes to the failure of the system.

SEU is the contributor to device soft failure and so the hardware will give undesired outputs [4-6]. Triple modular redundancy can be used for the hardening of the circuits implemented on SRAM-based FPGAs. LUT (Look Up Tables) are used to map the logic gates on FPGA. The interconnections are also controlled using the data which is to be stored in Static RAM. To apply the TMR on a circuit the device redundancy, system redundancy, module redundancy, and logic element redundancy need to be considered. If a fault occurs in any one of the domains TMR masks the fault by majority voting. The above method provides the correct output masked by the voter and hence makes the system resistant against SEU. TMR is a very widely used concept to improve fault tolerance. The disadvantage of the TMR is that it can handle only if one of the FPGA is not working properly. If two or three FPGA's fail simultaneously then the TMR will not work properly and give unfaithful outputs.

We can also add only the SEU sensitive gates, i.e. the gates that are prone to upset in case of SEU, in the circuits are detected using the signal probabilities of the line and are further hardened with TMR; while those non-sensitive to SEU are not hardened. Because only part of the gates is selectively hardened by TMR, so new developments can be made so that it could significantly reduce the area overhead of the hardened circuit compared to full TMR. If we want to increase the reliability of a circuit, more gates need to be hardened so the area overhead increases too; otherwise, if we want to decrease the area overhead, the number of gates to be hardened by TMR must decrease, so the reliability decreases too in the case of SEU. Therefore, a compromise between the area overhead and the number of functional errors is required. Moreover, faulty domains in the STMR system cannot be repaired [7-9].

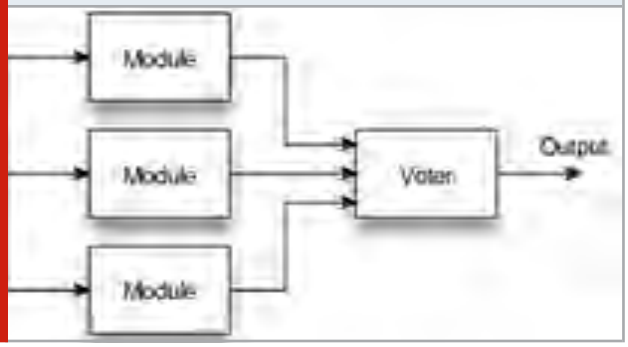
Depending on our requirement the number of functional errors and the area overhead is achieved. The Space programs are now made for a longer duration of time. So, the chances of the damage may increase and it is not possible to make any hardware changes to the FPGA's. If an FPGA is constantly giving wrong output then it can be discarded and the system can be used as a double modular redundancy.

FPGA is also used in medical applications. To give superior patient care to the pulmonary diseased diseases related to the heart the devices used in hospitals are based on the FPGA. There are many applications such as the implementation of artificial neural networks designed with help since the FPGA is a reconfigurable new pattern that can be added in the FPGA program. While using the appliances in the medical field fault tolerance and speed play a very important role. So to reduce the fault and increase the speed we use TMR and SPI communication. Our module has SPI communication between the master and the slave. This type of communication is very fast as compared to other communication protocols. Constant power is needed in the FPGA based devices and in our module, the power consumption will get tripled so it is not possible to make the devices portable with the use of FPGA. The semiconductor products continue to increase in these myriads of products.

Programmable Logic Devices have a much high adoption rate. FPGA offers a viable and powerful alternative to both ASICs especially in medical equipment development [11-13]. The utilization of PLD in this field decreases the recurring cost that is associated with ASICs. FPGA also offers design flexibility and board integration opportunities. Additionally, PLDs can be upgraded as there are changes in the field and a requirement. The cost is a bit high in FPGA but the Programmability, Speed, Flexibility are the advantages. In this, the sleep pattern of a person is monitored and then according to whether the person can have good sleep and healthy sleep. This disease is caused because the lower tongue touches the throat and snoring sound is generated. To give a complete report about that this method is used to get proper results. The inputs are fed to the sensors and sometimes there is a faulty reading so it can be eliminated. There are various sensors involved in this and all are available on the chip. The FPGA is complex and modular to deliver the required needs. To built hardware moreover, the FPGA is also enabled to store data that is obtained from the device. FPGA has a very long-life cycle and is built in such a way that has a long product cycle [14-17].

In modular Redundancy, the multiple replicates of the same modules are employed. The method to approach Correctness in a system is through an N Modular Redundancy (NMR) method. An NMR system replicates a computing source into parallel running N- module and uses voters to mask errors at the output and it is successful until the N/2 systems are concurrently at a fault. In a triple modular system, the value of N=3. As the value of N increases the reliability increases and the fault tolerance of the system increases. There are 3 inputs in the proposed system and the output of each system is feed to the input of the module called the voter. Each of the three devices executes the same particular code with the same variables and constants provided. Since the same code is given to all the systems a similar output is expected from all the N modules. The 3 modules are connected with the voter with SPI (Serial Communication Protocol) communication protocol. The triple modular redundancy system works on the principle of another majority of the values that are input to the system [15-17].

Figure 1: Block Diagram of Triple Modular Redundancy



Mathematical Expression: The Mathematical Expression for the Redundant system is determined by the reliability of the individual modules combined. The Equation considers that the Voter circuit does not fail. The redundant system does not fail if none of the system fails. The reliability of this system can be given by this equation where qM is the reliability of each module and (Ni) is the number of I elements subset of N elements [15-17].

$$R = \sum_{i=\frac{N}{2}}^{N} \binom{N}{i} q_M^i (1 - qM)^{N-i}$$

The reliability of the one module is denoted by Rm and the reliability of the system is denoted by R. Assuming that the failure of the three modules are mutually exclusive.

$$R=R_m^3+3R_m^2(1-R_m) \quad ; \quad R= 3R_m^2-2R_m^3$$

Redundancy does not increase the reliability if the value of R_m is less than 0.5 and the closer the value of R_m to 1 the better is results of the system. Reliability is the probability that no failure will occur. The R_M is the state where no failure will occur. The RM will produce correct output over a given span of time. The System will generate a correct output and a constant exponent function λ which defines the constant failure rate.

$R_M=e^{-\lambda t}$

Consider a simplest reliability models of a system having n modules. R_{sys} is then given by

$$R_{sys}(t)=[R_M(t)]n \; ; \; R_{sys}(t)=[\,^{e-\lambda}t]n$$

We have to note one thing that all the digital modules are independent and reliability of all modules are similar. The fault constant for all the modules I also use is similar. We also assume that the voter is working and giving faithful results. R_I=Probability that all the three modules are functioning + Probability that any two modules are functioning.

$$R_I=B(3:3) + B(2:3) \quad = 3R_M^2-2R_M^3 \quad =3e-2^{t\lambda}-2e-2^{t\lambda}$$

Now we consider the reliability of voter RT.

$$R_{TMR}=R_{Voter}\, R_I; \; R_{TMR}=R_{Voter}(3e-2^{t\lambda}-2e-2^{t\lambda})$$

Field Programming Gate Array: Field Programming Gate Array is a programmable device that is based on CLB via programmable interconnects. FPGA and ASIC can be differentiated based on custom manufacturing for a particular task. Field Programming Gate Array is a custom configured and reliable circuit that can be programmed using Hardware Description Language. Due to programmability FPGA fit for a different market. Various manufacturers different types of FPGA board those designed especially for Wireless Communication, Aerospace, Defence, Medical Field, Image Processing, Automobile Consumer Electronics. High processing speed and control over several channels are some of the advantages. FPGA's have high data to clock rate ratio. Depending on the work and the complexity of computing and the environment to be used there are 3 types of FPGA's available and those are Low Range FPGA, Mid Range FPGA's, and High Range FPGA. A large number of Input and output will-determinism that you can achieve with an FPGA will usually far surpass that of a typical sequential processor [1-4].

In this paper, we are using Xilinx Nexyus4 Artrix 7 FPGA board. It is an application-specific integrated circuit tool. The FPGA uses an array of programmable blocks and those blocks are reconfigurable and inter-wired. Logical blocks can be configured by storing a particular response or action in the form of Look Up Tables(LUT). FPGA Logic Block also includes memory elements which are simple flip flops. The FPGA has a number of reconfigurable LUT and RAM to store and implement different complex computations at a fast rate and can communicate with the number of on built I/O ports. FPGA has a quartz crystal oscillator, an on-chip resistance oscillator, and a phase lock loop. Floor Planning is used to allocate the resources within FPGA to meet time constraints. As FPGA designs employ very fast I/O rates and bidirectional data

buses, it becomes a challenge to verify the correct timing of valid data within setup time and hold time.

One of the big disadvantages of using FPGA in space can be overcome by our module TMR. The method by which the FPGA's store data has a high susceptibility to the single event upsets (SEUs). Single Event Transient (SET) is an event in which a current or voltage spike is induced in the circuit. The SEU results in the change in memory bits because of heavy ions, protons, and radiation. This contributes to the failure of the system. SEU is the contributor to device soft failure and so the hardware will give undesired outputs. The hardening of the circuits implemented on SRAM-based FPGAs is essential. LUT(Look Up Tables) are used to map the logic gates on FPGA. The interconnections are also controlled using the data which is to be stored in Static RAM. To apply the TMR on a circuit the device redundancy, system redundancy, module redundancy, and logic element redundancy need to be considered. The above method provides the correct output masked by the voter and hence makes the system resistant against SEU. TMR is a very widely used concept to improve fault tolerance. The disadvantage of the TMR is that it can handle only if one of the FPGA is not working properly. If two or three FPGA fail simultaneously then the TMR will not work properly and give unfaithful outputs [7-10].

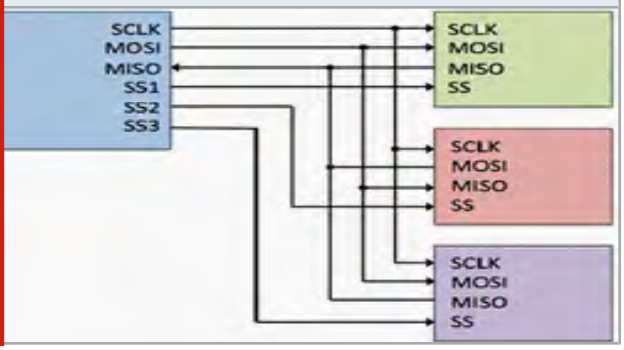
We can also add only the SEU sensitive gates, i.e. the gates that are prone to upset in case of SEU, in the circuits are detected using the signal probabilities of the line and are further hardened with TMR; while those non-sensitive to SEU are not hardened. Because only part of the gates is selectively hardened by TMR, new developments can be made so that it could significantly reduce the area overhead of the hardened circuit compared to full TMR. If we want to increase the reliability of a circuit, more gates need to be hardened so the area overhead increases too; otherwise, if we want to decrease the area overhead, the number of gates to be hardened by TMR must decrease, so the reliability decreases too in the case of SEU. In this way, the effect of radiation on FPGA can be tolerated. FPGA cannot perform the tasks such as complex rare calculations, Sorting, Searching, calculations on Floating-Point Arithmetic properly. The FPGA cannot be battery operated and especially in our case as we are using 3 slaves and master the power consumptions increase by 3 times. Also, the cost of FPGA is high.

IV. Software: Vivado Design Suite is a software for synthesis and analysis of HDL (Hardware Description Language) designs, with the additional system on chip development. Vivado represents a ground-up rewrite and re-thinking of the entire design flow and is a well-conceived, tightly integrated, blazing-fast, scalable, maintainable, and intuitive tool. Vivado in simulation describes the data model, integration, algorithms, and performance. Vivado enables developers to synthesize their designs, perform timing analysis, examine RTL diagrams, simulate a design's reaction to different stimuli, and configure the target device with the programmer. Vivado is a design environment for FPGA products from Xilinx, and is tightly-coupled to the architecture of such chips, and cannot be used with FPGA products from other vendors.

Vivado Hardware Manager is used to load the hardware designs onto the FPGAVivado's Simulator is used to simulate your design is working as expected. Integrated Logic Analyzer act as a virtual oscilloscope Vivado's High-Level Synthesis - This tool reads C based code and converts it to an HDL based design. Xilinx's Software Development Kit is the tool used to write C code that will run on the softcore processor implemented on the FPGA. Vivado is compatible with Xilinx Nexys 4 Artrix 7. General Purpose project is selected belonging to family Artrix7. The sub Family is also Artrix7. The package selected for this project is CGS324 where cgs mean Code Group Synchronization. The speed grade is -3, this speed grade is the fastest.

V. Serial Peripheral Interface: SPI is faster than I2C. SPI is full duplex while the I2C is half duplex. SPI has a requirement of 4 wires while the I2C has requirement of 3 wires. SPI has a single master but the I2C has multiple masters. More power consumption is there in I2C where on the other hand less power consumption is there in SPI. Both SIP and I2C are compatible with Fpga but according to our real time requirements SPI being faster and having full duplex communication we utilize SPI communication.

Figure 2: SPI master Slave



VI. Disadvantages: Triple Modular Redundancy with provide a fault tolerant and robust fault masking system against faults in various fields for different trade-offs between cost, reaction times, fault coverage. The disadvantage of all module level mitigation techniques is that they do not provide a simple and robust recovery mechanism after an error has been detected in one of the modules. In general logic with sequential elements, it is not ensured that the error will be detected until it is manifested on the output of the module where it is compared with the outputs of the redundant modules. The internal state of the erroneous module can at that stage be very much different from the state of the redundant modules. Any further execution will be meaning less since the erroneous state will not be automatically recovered from.

Methods like this have the disadvantage that they consume more resources, a larger space on the PCB and will dissipate additional power. Due to lower gate length technologies used in FPGAs, reliability becomes one of the major issues for mission-critical applications [1]. Though if the system is running correctly but the voter is faulty then there is no use of the system. The voter can be faulty means there are two chances either the voter is not able to take the input properly or the voter's output is faulty.

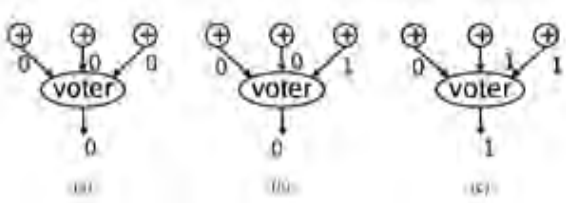
RESULTS AND DISCUSSION

Consider the system with three modules acting as slaves and the voter acts as a master. The master initiates the communication and asks the slave to perform a particular task. The task is performed by the 3 slaves and the particular value as the output is sent to the master that is the voter. Considering the majority of the values the master (voter) gives the output. Consider three independent modules A,B and C connected with Master that is the voter with SPI communication. The following truth table represents the output of the voter with respect to the changes in the slave values.

Table 1. Truth Table of Voter Input and Output

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Figure 3: (a)No fault b)Fault in 1 System with proper output (c)Fault in 2 system Improper Output



The above we see three modules that perform on the same set of inputs and give their outputs. The same code with the same inputs are provided to the inputs and the output is given to the voter. We consider that the voter is perfect and gives correct output. In figure a all the inputs are similar and the and the proper output is given by the system. In figure b the third system is not correct and it gives output other than the what the first two are offering. But due to triple Modular Redundancy the voter masks and the incorrect output and gives the correct output. Out of 3 system 2 are giving correct output and the third one is giving wrong output. Based on the input values the output value Y is determined. Y=AB+BC+AC. Figure 3(a,b,c) shows the simulated output with circuit and implementation diagram.

Table 2. Table According to Boolean Expression

A	B	C	AB	BC	AC	Y
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	1	0	1
1	0	0	1	0	0	0
1	0	1	0	0	1	1
1	1	0	1	0	0	1
1	1	1	1	1	1	1

Figure 3(a): Simulation

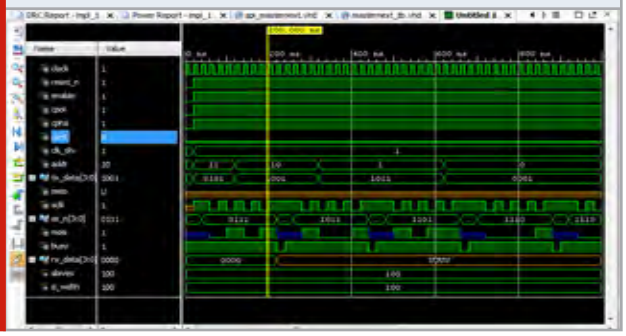


Figure 3(b): RTL schematic

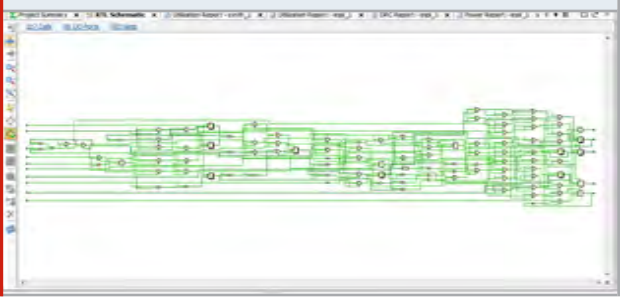
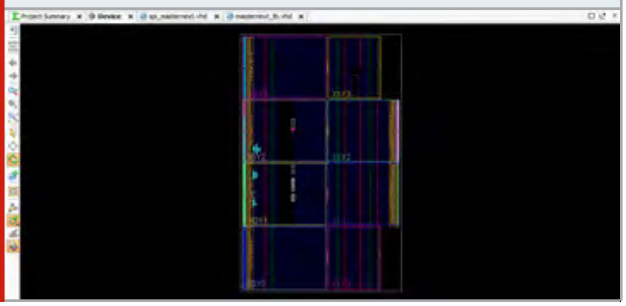


Figure 3 (c): Implementation



CONCLUSION AND FUTURE SCOPE

Triple Modular Redundancy is a good method to mask faulty output. SPI communication provides fast communication between masters and slaves. This system can be used anywhere in which fault tolerance is required. This system can be made more fault tolerant by using a feedback path. Instead of triple modular redundancy, we can use five modular redundancy. This system can be made more robust to survive in avionics by the use of scrubbing. This system is fault tolerant, we can also make this system to correct the fault.

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Water Wastage Control & Monitoring System for Railway Coaches using IoT

Parag Jawarkar[1], Roshan Sinha[2], Amal Pushp[2], Saloni Tarhate[2] and Shubham Anjankar[1]
[1]*Assistant Professor, Department of Electronics, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

The project aims to provide the ubiquitous surveillance system for water wastage control management and monitoring system for Indian Railways. This system provides real-time updates on the output display in every 2 seconds with the help of the Internet of Things (IoT) platform. The agile project management is the plan for specially for premium section trains later will be introduced in all the trains. This will thus help us prevent unnecessarily filling of water, to avoid time delay and give a smooth and comforting experience to all the passengers in their journey.

KEY WORDS: AGILE, INTERNET OF THINGS(IOT), RAILWAY, SURVEILLANCE, UBIQUITOUS.

INTRODUCTION

The railways are the biggest lifeline, important & affordable means of transport in India. Indian Railways is considered amongst the 'Largest railway Networks in the World' as it is ranked at no.4 &tit's operating route length is at 68,525km. As it is the backbone of the means of transportation in India & lakhs of people travel every day. So as a result, lot of water is required for the passengers in the running trains but unfortunately in this process tons of water is also wasted at the railway stations in the refilling process of the watertanks.

The core motivation for the design & implementation of this project is that since we are experiencing an acute shortage of water in around 50% of the cities & villages of India & in thecoming years this problem is going to spread like anepidemic.The project desired to build a solution to this problem, with the help of IoT technology. Detecting the threshold levels of the tank using the ultrasonic HCSR04 sensor, the tank has been divided into 3 levels of low, medium & high respectively. Alternatively this data of the water level status in the tank will be available in real-time monitoring status & control via an online IoT platform. With the help of this system, we will be able to analyze how much water is needed and consumed by passengers in railway boogies each day, this statistical analysis will help us for proper water management. As the system will be continuously monitoring the trains, the trains detected with the lowest water threshold will be given the first priority to fill up the water.

It can possible that the other train boobies have full or sufficient water levels and thus these trains can be eliminated form filling up. By doing this overflowing of this train boobies can avoided and wastage of water can be controlled. As this is a real-time situation various problems can be controlled by this system such as, if the train is running out of the water then prior information will be given to the upcoming station of how much water is required and to which boobies have the lowest threshold of water. This will help to manage up the situation smartly and quickly as the platform authorities will be ready with the required amount of water respectively. If due to some unfavorable circumstances if they are unable to meet up water requirements then this information will

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be pass to the nearest station. The paper is organized as follows section 'A' has flowchart, 'B' section has an Experimental setup, 'C' has a Block diagram, 'D' has Result, and Proposedwork.

METHODOLOGY

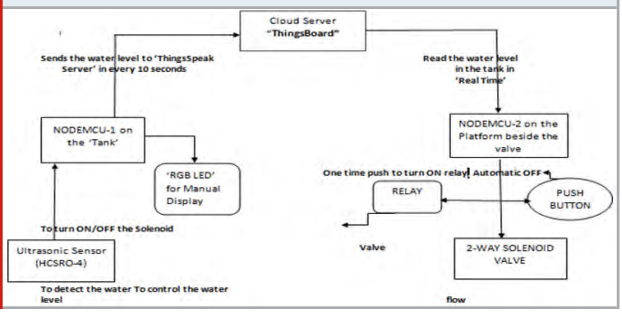
The Block Diagram is shown in figure 1, it consists of the Cloud Server which is Things speak. Through cloud server two microcontrollers are connected which is NODE-MCU. The 1 st NODE- MCU is for train tank and 2nd NODE-MCU is for the Platform. Both are sending the information to the cloud server of things speak. The RGB LEDs which are red, green, blue LEDs are connected to show the status of water levels. Here the sensor used to turn ON and OFF the solenoid is an ultrasonic sensor. The 2nd NODE MCU has the control of the relay and solenoid valve.

a. Experimental Setup & Results

a. One 5 Litre water jar(as a dummy similar resemblance to the coach water tank, jar's height vertically in a horizontal rested position is equal to '22cm'.)

b. 2 ESP8266 Nodemcus(with built inWifi).
c. One 2-way Solenoidvalve
d. Plasto PVC pipeconnector
e. One 2-RelayModule(JQC-3FF-S-Z)
f. PushButton
g. One UltrasonicSensor(HCSRO-4)
h. RGBLED
i. 12V Adapter & jumper, connector, crocodile wires & pins etc.

Figure 1: Systemlow

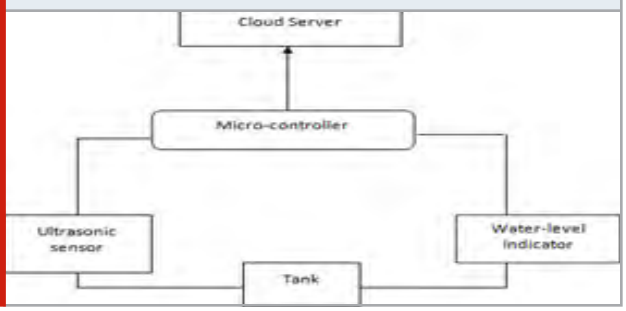


b. Software Used

1. Arduino 1.8.12version
2. Online IOT Platforms:-ThingsSpeak, Adafruit IO, etc.(for online monitoring & continuous real- time transfer of data to the specified user &the display of it via Gauge, Graphs,etc.)
3. The jar has been divided into three levels of water level detection i.e Low, Medium & High & the equivalent values will be coveredfurther.
4. The working execution is divided into two parts that 1 Nodemcu is connected on the jar alongside the RGB LED & the ultrasonic sensor for continuous updating of the water level online via IoT platform & also it can be viewed & tracked manually & live by the staff inside the coach compartment via the RGB LED indicator (3dot digitalswitch).
5. The other Nodemcu has been connected with the solenoid valve, Relay module, Pushbutton & to the pipe available at the platform. This connection will ensure the 'Automatic Turn-Off ' mechanism of the solenoid valve in coordination with the Push button & the Relay module.
6. After the correct connection setup is done, we'll a red light on the RGB LED initially seen since as mentioned above in point 2), we have divided the jar into 3 levels:- From the point, 1a) If the Monitor displays value' 22cm' it means the jar is empty & it will gradually decrease with the increase in the water level from the pipe inlet. i) Low- For water level range from 17-22 cm.ii) Medium- for water level range from 16-9 cm & High- for water level range between 9-0 cm.
7. Now to turn ON the solenoid valve for the filling process, we press the Pushbutton & the Relay state initially being = 0, now after pushing the button & turning the valve ON the Relay State displays = 1 on the Monitor screen to convey that the waterinlethas been allowed inside the jar via the pipe from the valve.
8. As gradually the water keeps filling inside the jar the equivalent color indications will be shown on the RGB LED as from point5)above.
9. The project provides the 'Real-Time Monitoring' of the water level & Relay switch state online via the IoT platform. The 'Field Chart' will display the real-time & the equivalent levels in a continuous graph form. The analog needle type 'Gauge display' has also been provided on the screen initially from the server-side to clearly view the same &it would start from the '22cm-i.e empty' reading to the '0 cm full brim' position beingdisplayed.
10. Finally when the water level approaches towards the 0 cm value, the green light indication is already there at the RGB side from 9 cm onwards & also a message will be initiated online. Just after 1cm reading, the Relay module will automatically disconnect the solenoid valve by giving a 'click sound' indication on the Push button as well & thus the " unnecessary further filling & the water wastage will be monitored &controlled".

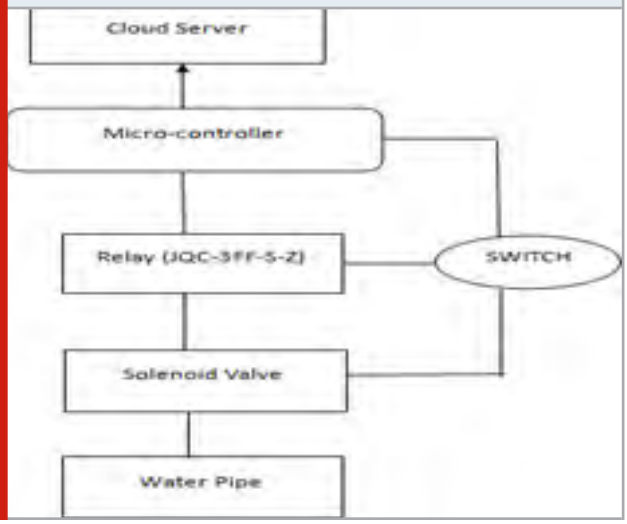
c. Block Diagram for Experimental Setup

Figure 2: Flowchart of Water level indicator connected to cloud server.



The block diagrammatic representation shows the complete set of sequences occurring from the trains' couches water tank side setup from where the water level of the tank is being monitored by the Ultrasonic sensor which is further being shown by the indication on the manual indicator (RGB) and these values being detected by the installed microcontroller (here NODE MCU) are being transferred in real-time via online cloudServer.

Figure 3: Flowchart of Sequences of water pipe controlled, data detection , updating to cloud server



The block diagrammatic representation shows the sequences from the station's platform's pipe filling side where the "Relay-Solenoid valve and switch (Push Botton) mechanism" senses the amount of water required to be filled in the tank and it switch mechanism and here also the data is detected and controlled by the microcontroller (NODE MCU) is beingupdated.

RESULTS

a. Figure 4 in the image works in accordance &in contemporary to the point no. (6) mentioned in the Experimental Setup. Since after the push button is triggered & the valve is ON, the equivalent Relay State displays the 'Relay State' value = 1 on one of the window boxes of the Serial Monitor. Similarly, in accordance with this process continuing as mentioned in point no. (5), the tank initially being empty i. Distance value = 22cm. As gradually this is being filled up with water the value is constantly decreasing from 22cm & this continuous updating is being shown on the 'Distance' heading & after each update the 'Channel update successful' message shows.

b. The figure 5 (a) and (b) shows the image which follows the point no.8) of Experimental Setup, where IoT is deployed on an online monitoring platform on the 'ThingsSpeak Server' & all those processes occurring in the setup & as mentioned above in the first image are being displayed here in 'Real Time' continuous update in the Field Chart & the equivalent level on a more

Figure 4: Serial Monitor's with Relay State & Channel update the successfulvalue.

Figure 5 (a) and (b): Online monitoring platform on the 'ThingsSpeak Server'

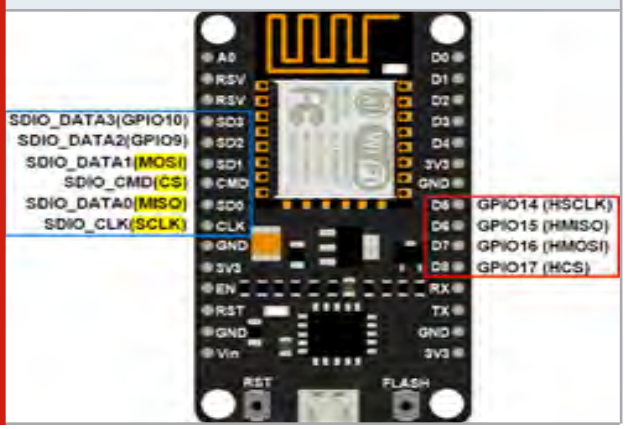
stringently provided 'Field gauge' analog needle meter type display.

4. Proposed Work: Planning to reduce the dependency of the deployed Solenoid valve towards the online Wifi enabled 'Nodemcu-relay' mechanism & trying to convert it to an 'Automatic Off Pressure mechanism', Back mechanism type. These types ofvalvesarealsoknown as 'Automatic Control Valves'. The hydraulic actuators will respond to changes in pressure or flow andwillopen/ close the valve. Automatic Control Valves do not require an external power source, meaning that the fluid pressure is enough for opening and closing the valve.For the transmission & communication purposes for multiple tanks & to avoid ambiguity & reduce the costs we are planning to execute this work process via a minimum of a single control NODEMCU SOC & using the multiplexing concept to good effect with the 'SPI communication protocol'.SPI Interface uses four wires for communication. Hence it is also known as four-wire serial communicationprotocols.SPI isa full-duplex master-slave communication protocol. This means that

only a single master and a single slave can communicate on the interface bus at the same time.SPI enabled devices to work in two basic modes of SPI operation i.e. SPI Master Mode and SPI Slave Mode.

Master Device is responsible for initiation of communication. Master Device generates Serial Clock for synchronous data transfer. Master Device can handle multiple slave devices on the bus by selecting them one by one.Nodemcu based ESP8266 has Hardware SPI with four pins available for SPI communication. With this SPI interface, we can connect any SPI enabled device with NODEMCU and make communication possible with it.ESP8266 has SPI pins (SD1, CMD, SD0, CLK)which are exclusively used for Quad-SPI communication with flash memory on ESP-12E, hence, they can't be used for SPI applications. We can use the Hardware SPI interface for user-end applications. The below figure shows Quad SPI interface pins that are internally used for flash. It consists of quad i/o (4-bit data bus) i.e. four (SDIO_DATA0 – SDIO_DATA3) bidirectional (i/p and o/p) data signals with synchronizing clock (SDIO_CLK) and chip select pin (SDIO_CMD). It is mostly used to get more bandwidth/ throughput than dual i/o (2-bit data bus) interface.

Figure 6: Nodemcu SPI Pins



MISO (Master In Slave Out): Master receives data and slave transmits data through this pin.
MOSI (Master Out Slave In): Master transmits data and slaves receive data through this pin.

SCLK (Serial Clock): Master generates this clock for the communication, which is used by the slave. The only master can initiate a serial clock.

CS (Chip Select): Master can select a slave device through this pin to start communication with it.

CONCLUSION

Water is a non-renewable important natural resource, and one of the most basic elements of needs for all living organisms. But many times this valuable resource is wasted due to unavoidable situations. By designing this project, the main goal of water wastage control and monitoring for Railway coaches using IoT is achieved. The design system will help to provide continuous water distribution in Railway coaches, thus monitoring the levels of water in each coach and also preventing the overflow of water as well as a shortage of water. This will help to avoid unreasonable time delay while filling water in the railwaycoaches.

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MEMS Disk Resonator for 5G Application: An Analytical Case Study

Varad C. Joshi[1], Mandar M. Pimparkar[2] and Prasanna P. Deshpande[3]
[1]*Student, Department of Electronics and Comm. Engg; RCOEM, Nagpur (India)*
[2]*Student, Department of Electronics and Comm. Engg; RCOEM, Nagpur (India)*
[3]*Assistant Professor, Department of Electronics and Comm. Engg; RCOEM, Nagpur (India)*

ABSTRACT

RF-MEMS resonators are being considered as a reliable solution, required by the high-performance passive components in the present 5G communication. 5G protocols demand ultra-high frequency (UHF) ranging from 3 GHz to 30 GHz with reduced time and less power consumption. In this paper, an attempt is being made to show the dynamics of MEMS disk resonator in 5G communication range of frequency using polydiamond material. MEMS technology is preferred due to its high-quality factor and its efficient compatibility to CMOS. The analytical result of 24.2 GHz and of 33.2 GHz in third and fourth mode respectively show the efficient operation of the disk resonator in the UHF range.

KEY WORDS: MEMS RESONATOR, RF MEMS, 5G COMMUNICATION, DISK RESONATOR, QUALITY FACTOR, MEMS TECHNOLOGY, UHF.

INTRODUCTION

Wi-Comm technology e.g. GSM, 3G, 4G etc. has made significant advances since the late 1980s (Basu and Bhattacharya 2011; Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020). Compared with these technologies, 5G communication protocols require very high frequency for operation and transmission so as to have more advancement with minimum hardware and low power consumption (Iannacci 2019). 5G network can accommodate a wide range of connections with respect to the current mobile networks as well as supporting machine-to-machine (M2M) networking, and high communicating capacity approximately 1000 times more than that of the 4G (Iannacci 2019). The generation of high frequency along with high quality factor is still a challenge to fulfil the present constraints in the high speed 4G technology.

The design and developments in RF- MEMS resonator have been proven by the different researchers (Basu and Bhattacharya 2011; Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020; Chorsi and Chorsi 2018). One of the prominent designs is a disk structure. The disk design has a potential to achieve very high frequency with high quality factor (Q) and low power consumption. The fabrication process of such design is a bit complex but cost effective (Chorsi and Chorsi 2018). Resonating disk has infinitely many eigen frequencies depending on the mode of operations. Some theoretical investigations of disk resonators have been made in these articles (Basu and Bhattacharya 2011; Chorsi and Chorsi 2018; Chaudhari and Bhattacharyya 2013; Hao et al. 2004).

However, capacitively transduced bulk acoustic wave (BAW) resonator, also known as contour mode resonator (CMR) is a good option to operate in high frequency range with high Q than flexural mode (Hao et al. 2004). This is due to its larger structural stiffness and

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lesser surface to volume ratio (Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020). In radial disk CMR, the frequency of resonance is directly proportional to the acoustic velocity (√(E_y/D)),where Ey and D are the elasticity modulus and density of the material respectively. The diamond material helps to reduce energy loss through anchors (Chorsi and Chorsi 2018). A systematic account of disk geometry, its modes of vibration, fabricating material, electrical equivalent model, and method for analysis of radial-contour mode resonator is presented in this paper.

METHODOLOGY

The quality of a device depends upon its materialistic properties that are its physical and mechanical parameters. After certain trial of experimentations, the best suitable design parameters were decided according to (Deshpande et al. 2020). The physical design decides the performance parameters like resonance frequency (freso), quality factor (Q) and motional resistance (Re) etc. The low motional resistance transmits the more power (Basu and Bhattacharya 2011; Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020; Clark et al. 2005). To improve these performance parameters, the device geometry such as diameter of a disk and width of the disk must be investigated properly. Also, the proper selection of electrode parameter reduces the anchor loss improving the quality factor further. Table 1 below shows some well-known materials along with their properties.

Table 1. Properties of some structural materials (Huang 2008)

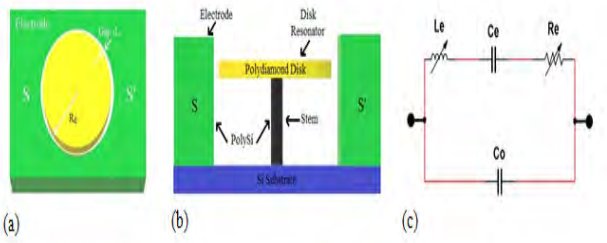
Material	Polysilicon	Single crystal Silicon	Polydiamond	Silicon carbide
Density D (kg m^{-3})	2,300	2,330	3,500	3,200
Elasticity modulus Ey (GPa)	150	130	1,144	415
Temperature of deposition (^{0}C)	588	1000	800	800
Poisson's ratio (σ)	0.226	0.28	0.069	0.192
Electricity conductivity (10^7 Ω^{-1} m^{-1})	0.001	0.00023	0.001	0.00083

Our study involves the radial-contour mode disk resonators, with a polydiamond disk of radius Rd, thickness t, and a polysilicon stem at its centre is shown in Fig. 1 (a). Fig. 1 (b) and (c) represents its cross-sectional view and Butterworth van-dyke (BVD) model respectively. The stationary electrode surrounding the disk is made up of polysilicon with a lateral capacitive actuation gap (Chorsi and Chorsi 2018). A structure using polydiamond material has high acoustic velocity and is able to achieve the desired resonance frequency easily. Electrostatic force shows quadratic dependence on voltage/charge and further behaves non-linearly (Chaudhari and Bhattacharyya 2013). The linearity of the system improves by applying a very small dc bias voltage which exerts a force on the plate and due to which the plate undergoes in plane vibration around its equilibrium position (Basu and Bhattacharya 2011; Chorsi and Chorsi 2018).

By applying V_{ac} sinusoidal voltage, resonator is forcefully vibrated at the resonance frequency freso and a dc-bias voltage V is applied to the stem which in turn produces a time-varying field F2. This field generates symmetrical contraction and expansion of the disk around its perimeter. A time dependent motional current i_m is generated with frequency ω at the load. The applied dc bias voltage V charges the disk-to-electrode capacitor, the generated electrostatic force F' having both constant and time varying components F1 and F2 in radial direction is explained in (Hao et al. 2004; Clark et al. 2005).

$$F' = \frac{1}{2}\left(\frac{\partial c_1}{\partial r}\right)(V - V_{ac})^2 = F_1 + F_2 \quad (1)$$

Figure 1: Contour mode disk resonator with surrounding electrode (a) perspective view (b) cross-section view (c) BVD equivalent circuit (Basu and Bhattacharya 2011; Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020)



The time varying field F_2 is given by

$$F_2 \cong -V\left(\frac{\partial C_1}{\partial r}\right)V_{ac} \quad (\text{for}, V \gg V_{ac}) \quad (2)$$

Where, $\partial c_1 / \partial r$ is the change in the electrode to resonator overlap capacitance per unit radial displacement at input (Basu and Bhattacharya 2011).

$$C_1(r) = C'\left(1 - \frac{r}{d_g}\right)^{-1} \Rightarrow \frac{\partial C_1}{\partial r} = \frac{C'}{d_g}\left(1 - \frac{r}{d_g}\right)^{-2} \quad (3)$$

C' = $C_0$is static electrode to disk capacitance i.e.

$$C' \cong \frac{\varepsilon_0 \theta R_d t}{d_g} \quad (4)$$

R_d is a radius and t is the thickness of the disk, ε_0 is the permittivity in vacuum, de is the static electrode to disk gap and θ is angle of the input edges of the electrode. Now the following approximate expression can be obtained,

$$\frac{\partial C_1}{\partial r} = \frac{\varepsilon_0 \theta R_d t}{d_g^2} \quad (5)$$

The peak radial displacement is a function of (r,φ) and is given by (Hao et al. 2004).

$$D(r,\phi) = AhJ_1(h_r) \quad (6)$$

Table 2. Values for λ_i for the various vibrating modes (Chaudhari and Bhattacharyya 2013)

Mode (ith)	Frequency parameter (λ_i)
1st	1.99
2nd	5.37
3rd	8.42
4th	11.52
5th	14.89

at the perimeter r = R_d. Now, equation becomes

$$D(R_d,\phi) = \frac{Q F_2}{jK_{eff}} \quad (7)$$

The constant h mentioned in (6) is given by

$$h = \sqrt{(\omega^2 D)/\left[\frac{E_y}{1+\sigma} + \frac{E_y \sigma}{1-\sigma^2}\right]} \quad (8)$$

A time varying capacitance is generated due to the input voltage between the output electrode and the disk causing the generation of a motional current i_m at the output electrode which is expressed as:

$$i_m = V\frac{\partial C''}{\partial t} \quad (9)$$

$$i_m = -\frac{Q\omega}{k_{eff}}\left(\frac{\partial C_1}{\partial r}\right)\left(\frac{\partial C''}{\partial r}\right)V^2 V_{ac} \quad (10)$$

At frequency ω, the output current is same as the input current. Thus, for in phase displacement towards the drive electrode, the current is 1800 out of phase w.r.t input voltage. In cylindrical co-ordinate system the design is described and the resonance frequency for radial contour bulk vibrations can be derived in terms of Bessel functions as given in (Clark et al. 2005).

Table 3. Parameters of polydiamond material

Class	Parameter	Symbol	Values	Units
The disk (polydiamond) (Huang 2008)	Modulus of elasticity	E_y	1144	GPa
	Poison's Ratio	σ	0.0691	-
	Density	D	3500	Kg/m^3
	Acoustic Velocity	v_p	18500	m/s
Constants (Akgul 2014)	Haymaker Constant of polydiamond	A	2.2×10^{-19}	J
	Plank's constant divided by 2π	η	1.055×10^{-34}	J_s
	Speed of light	c	2.988×10^{8}	m/s
	Permittivity of Vacuum	ε_0	8.85×10^{-12}	$C^2.N^{-1}.m^{-2}$
Electrodes (Chorsi and Chorsi 2018) Gap (Chorsi and Chorsi 2018)	Static Electrode to Disk Capacitance	C'	35.324	fF
	Span Angle of electrode	θ	360	°
	Disk to Electrode Gap	d_e	40.0	nm

$$\frac{J_0(\xi)}{J_1(\xi)} = (1-\sigma)$$
$$\text{where, } \varsigma = \omega R_d\sqrt{\frac{D(2+2\sigma)}{E_y}}, \xi = \sqrt{\frac{2}{1-\sigma}} \quad (11)$$

On simplifying the above eqn. (11) and obtaining the relation for resonant frequency for ith breathing mode is (Chorsi and Chorsi 2018).

$$f_{reso} = \frac{\omega}{2\pi} = \frac{\lambda_i}{2\pi R_d}\sqrt{\frac{E_y}{D(1-\sigma^2)}} \quad (12)$$

Where λ_i is the frequency parameter for any particular mode, the values for which are provided in Table 2.

RESULTS AND DISCUSSION

The dynamics of the UHF vibrating contour mode disk resonator in various modes of resonance are presented and discussed. All physical constants required for numerical calculations are presented below in Table 3.

Considering these parameters, the two different materials i.e. polysilicon and polydiamond have been used to design radial disk resonator, whose resonance frequencies

has been calculated for different modes including fundamental mode is presented in Table 4.

From Table 4, it can be predicted that, the polydiamond is more prominent and suitable than polysilicon in UHF range. Table 4 also reads that, higher the mode of vibration, higher is the resonance frequency (Chorsi and Chorsi 2018). For further investigation of the quality factor, Q which is one of the important parameters for RF communication, the resonance will be helpful (Basu and Bhattacharya 2011; Deshpande et al. 2018; Deshpande and Pande 2019; Deshpande et al. 2020).

Table 4. Comparison in resonance frequency in various modes for two different materials

Material	Disk radius (R)	Fundamental resonance mode	2nd resonance mode	3rd resonance mode	4th resonance mode
Polysilicon E_y=150GPa, D=2300Kg/m^3, σ= 0.226	16.7μm (Clark et al. 2005)	157.22MHz	424.27MHz	665.24MHz	910.16MHz
	10μm	262.5MHz	708.53MHz	1.11GHz	1.51GHz
	1μm	2.62GHz	7.08GHz	11.1GHz	15.1GHz
Polydiamond E_y=1144GPa, D=3500Kg/m^3, σ= 0.069	16.7μm	343.69MHz	936.09MHz	1.45GHz	1.98GHz
	10μm	573.96MHz	1.54GHz	2.42GHz	3.32GHz
	1μm	5.73GHz	15.4GHz	24.2GHz	33.2GHz

$$Q = \frac{freso}{half\ power\ bandwidth} \quad (13)$$

CONCLUSION

In this article, an electrostatically actuated radial contour mode MEMS disk resonator has been analysed with polydiamond material. The analytical derivation of the system involving electrostatic force is systematically done to derive the output current equation and also the resonance frequency. Capable of operating in UHF range the model has a high-quality factor, low actuation voltage and is power efficient than most of the MEMS resonators. The result shows that the polydiamond is more prominent material suitable to achieve high resonance frequency in third (24.2GHz) and fourth (33.2GHz) modes of operation. The theoretical analysis presented in the paper showcase the influence of various design parameters, which are advantageous for future research and optimization of MEMS disk resonators.

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Design and Implementation of AES Data Security Protocol

Dinesh B. Bhoyar[1], Indersheel Kaur[2], Swati K. Mohod[3] and K. D. Kulat[4]
[1]*Assistant Professor, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*
[2]*PG Scholar, Department of ETC, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*
[3]*Assistant Professor, Department of EL, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India*
[4]*Professor, Department of ECE, Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India*

ABSTRACT
Data Security is in top priority when we transmit the data through internet. In this paper AES (Advanced Encryption Standard) algorithm is implemented using FPGA for security of IoT data. We used symmetric key block cipher for data encryption and decryption. The power consumption and area required for FPGA implementation is less. The Xilinx FPGA device Xc7v285tl-1L ffg 1157is used for implementation

KEY WORDS: AES, FPGA, IOT, ENCRYPTION, DECRYPTION, XILINX.

INTRODUCTION

Security is one of the most important concerns of data transmission through Internet. The internet security protocols take care of the issues related to data security. In IoT [1] through its own architecture and devices it gives the solution to the data secutity. The data security solution has direct relation to the cost and time to market. However, every solution has its own strength and weaknesses. Thus every IoT solution does not require the entire IoT security protocols. The main focus of this paper is to implement the AES [2][3] algorithm using FPGA for security of IoT data. The paper is divided into four different section, the first section gives the introduction whereas second, third and fourth section focuses on the hardware implementation, result and conclusion.

2. Hardware implementation: The Encryption and Decryption process in each round is as per the fig-1.

a. AddSubbytes: Each entry in the S box is replaced by the add sub byte. Non linearity in the cipher is also provided by add sub byte. To derive the S-box multiplicative inverse iGF (28) is used. The combination of inverse function with an invertible transformation gives S-box. While designing the decryption process the inverse of subbytes is used.

b. Shiftrows: In this, the bytes in rows shifted left cyclically. Every row is shifted with respect to the subsequent rows. In AES algorithm the shifting operation will be performed from the second row. The rows are shifted as follows:
2nd row is shifted by 1
3rd row is shifted by 2
4th row is shifted by 3 and so on

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Figure 1: Flow Chart of Encryption and Decryption Process

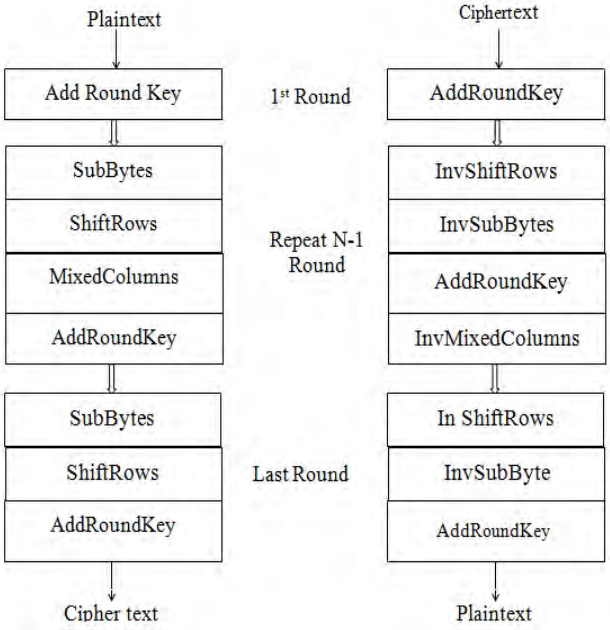
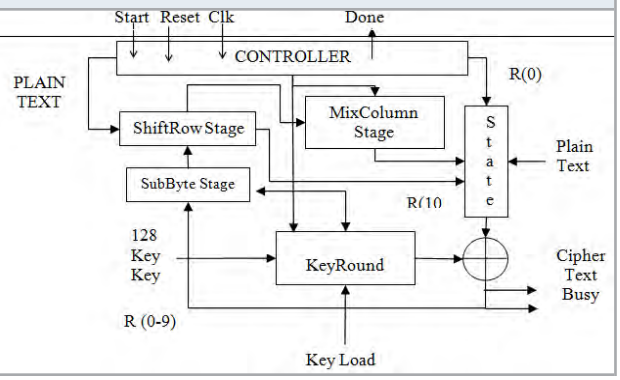


Figure 2: Proposed FPGA Implementation Module [6]



c. Mixcolumns: Each column is multiplied by the fixed polynomial. By using an invertible linear transformation the four bytes of each column of the state are combined.

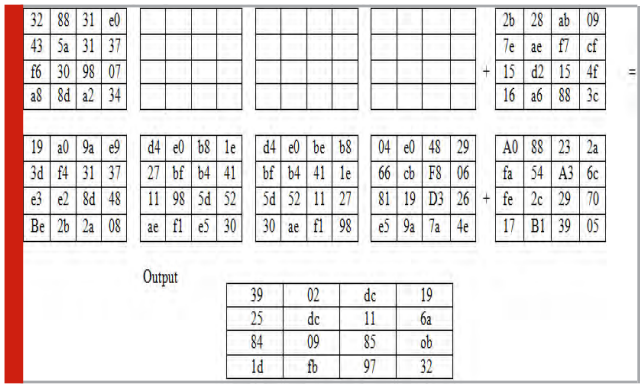
d. Addround key: The XOR operation [4] will be performed between each and every state and 8 bit data of round sub key. The output is combined with the subkey. The subkey is added with each byte of the state. It is done by using XORing operation. A required subkey is derived from the main key.

e. Keyexpansion: The key expansions are based on ROTWORD, SUBWORD, RCON and XOR The key expansion algorithm is used to generate linear array of 44 words i.e 176 bytes. The input to the algorithm is a four word (16 bytes) for generating this. It provides four-word round key which is used for initial operation of AddRoundKey and each of the 10 rounds of the cipher. The key is copied into the first four words of the expanded key to derive the S-box. [5]. The S-Box is the output of the combination of inverse function and invertible transformation. The Decryption operation is exactly reverse operation of Encryptions

RESULTS

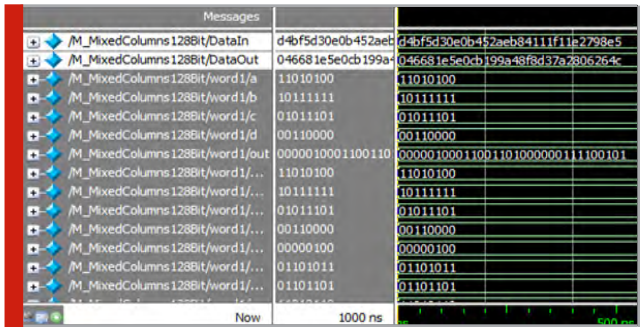
Input = 32 43 f6 a0 88 5a 30 8d 31 31 98 a2 e0 37 07 34

Cipher Key = 2b 7e 15 16 28 ae d2 a6 ab f7 15 88 09 cf 4f 3c

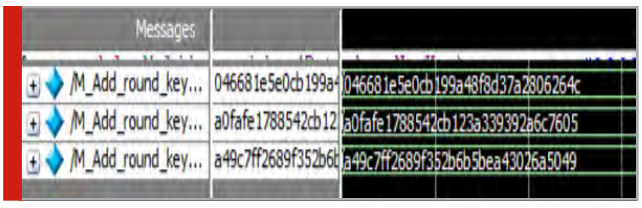


a. Result after subbytes and shift rows

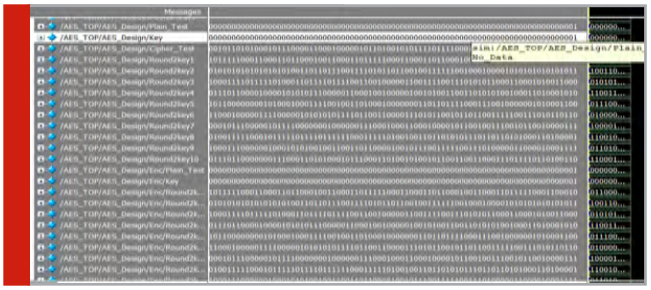
b. Results after mix columns



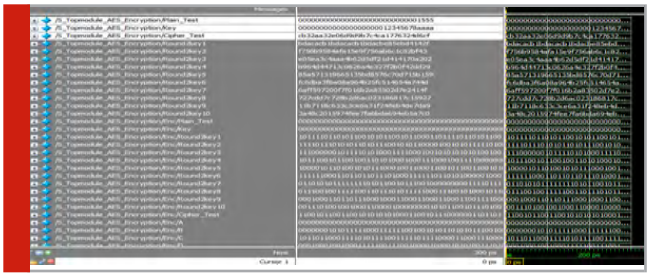
c. Result after adding round key



c. Results after encryption with binary input



d. Result After Encryption with hexadecimal input



e. Result after Decryption

Testing and Verification: The following Table-1 [8] gives the device utilization summary of number of CLBs, IOBs and LUTs used for implementation of the proposed algorithm of AES-128.

Table 1

FPGA Device Allocated Area	Xc7v285tl-1L ffg 1157		
	Available	Used	% of utilization
CLB Slices	357,600	2900	0.8
No. of LUT	178,800	5702	3.1
IOBs	600	385	64

CONCLUSION

The AES is also called as block cipher algorithm. For encryption and decryption 128-bit key is used. The AES code is designed and developed using VERILOG HDL. The final design is verified using XILINX ISE tool. This FPGA implemented design takes less area, less power and operated at a high speed. The developed design can be implemented in ASIC and used in low battery operated devices such as Bluetooth and wireless operated devices.

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A Review of Designing Ventilators Using Different Mechanisms

Monika Bhole[1], Kritika Jain[2], Advait Kolse[3], Pallavi Gadewar[4] and B.M. Hardas[5]
[1]*Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, India*

ABSTRACT

A ventilator is the key medical equipment required during an accident or any disease. It is required when human life is in danger, and the patient feels difficulty in breathing, external support is provided from outside by a machine. With the increase in new lung diseases, it has now been important to build a Ventilator, which will be as effective as available in the clinic and can be provided in large numbers by considering different situations. Since the ventilators available in medical centers are bulky and costly, and the shortage of such critical equipment can lead to threatening human life. In this study, the academic literature reviews various Ventilator Mechanisms and ventilation techniques, mostly considering the positive pressure ventilation and high-frequency ventilation and different parameters to consider. There is a large amount of future work needed to move open source ventilators up to the level considered scientific-grade equipment, and even further work needed to reach medical-grade hardware so that the patients can get proper treatments. With the ongoing pandemic, it is assumed these projects will gather greater attention and resources to make significant progress and have reached a functional system. The paper describes a systematic literature review of peer-performed projects and reviews journal articles published in recent ventilator designs.

KEY WORDS: VENTILATOR, PANDEMIC, DESIGNING, AMBU-BAG, HIGH FREQUENCY, CONTROLLER.

INTRODUCTION

In developed and industrialized countries, Chronic respiratory diseases or respiratory failure is a major public health challenge. Respiratory diseases like Acute respiratory infections, Chronic bronchitis, Asthma, and others are very widely spread all over the globe. These diseases are increasing very rapidly and are having an economic impact. Various critical technologies are generally available in the medical field, but they are not available in a large amount.

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**Corresponding Author: bholemv@rknec.edu*
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There are various ventilators mentioned by researchers. They have been differentiated based on their ventilation supports which can be categorized based on high frequency jet ventilation, positive pressure ventilation and negative pressure ventilation, the mechanism used for breathing i.e. mechanical or electronic or electro-mechanical, and parameters that control them. During pandemic like COVID-19, specialists are facing a shortage of medical supplies. Hence, people are dying because of COVID-19 and the lack of these supplies. The shortage of one of these medical supplies which is most important during this pandemic is low-cost and portable ventilators. Hence, there is a critical need for designing the ventilator that is low in cost, portable and easy to use anywhere with and without any higher medical authorities.

Design And Ventilation Techniques: The first ventilator is a machine-controlled respiration process. They divided the device into three parts- electronic, pneumatic, and mechanical. The electronic system consists of interfacing and sensing components, whereas the pneumatic system

has components that control the airflow. The authors used 2 actuators in the pneumatic system to control the Peak Inspiratory Pressure (PIP) and Positive End Expiratory Pressure (PEEP). These are used because if the pressure in the lungs is more or less than the standard values, it may lead to lung damage.

The right pressure of air to the lungs can be set using the tidal volume and IE(inspiratory to respiratory) ratio which are continuously displayed on the LCD screen inserted in the device. The researchers used arm cortex architecture as their microcontroller and Keil Uvision for cross-compiling. This whole system runs in closed-loop control, which is constantly rectified by a PID controller algorithm. By constant feedback, the machine adjusts itself to the I:E ratio the patient demands, to avoid any damage to his lungs. This prototype was simulated and the results founded with regards to the pressure maintaining parameters showed little deviations.

Other researchers used an AMBU bag for ventilation. It is mostly used because of its auto relaxation property. The authors used 2 servo motors and 2 cam arms. The 2 cam arms placed in "V" shape are pulled towards each other by cross connection of servo motors, causing the AMBU bag to squeeze. An Arduino along with buttons is used to select from 3 modes-child, pediatric, and adult. By adjusting the I:E ratio, tidal volume and respiratory rate we can make a single device work for different ages. The amount of air squeezed out from the bag is decided by the angle created between the "V" shape which holds the Ambu bag. This amount of air is measured by a flow meter. A similar design was used by a Pakistan university, but instead of 2 servo motors and 2 cam arms, they used a single geared motor along with a rack and pinion mechanism for squeezing the bag. They used Thermistor for the detection of breathing. Both the researchers claimed that it is an energy efficient, portable and affordable ventilator.

Another type of ventilator proposed by Taiwan University is the high-frequency jet ventilator. This is a pressure-controlled ventilator. The high-frequency jet ventilator is generally preferred over conventional ventilators because of its smaller tidal volume. Mostly, conventional ventilators cause barotrauma, i.e. excessive air enters the lung and damages the alveoli. Another reason for its selection is, it uses a thinner tube that replaces the endotracheal tubes, which constantly injects small volumes of gas through it. This system is divided into 2 parts: the main unit and the feedback unit. The main unit consists of flow control valves, flow meters, check valves, a gas chamber, a solenoid. valve. Whereas, the feedback unit uses flow control valves, a gas chamber, a pressure sensor, and control circuits.

The flow control valve and flow meter are used to regulate and check the amount of air/oxygen that has been delivered to it. After altering it to the required rate, this mixed gas goes into a gas chamber to blend. Later, this blended gas is delivered to the output of the ventilator through a solenoid valve. Whenever, there are problems like instability of airflow, an insufficient supply of oxygen, or standard I:E ratio is not maintained, then the feedback control comes into action. A programmed microcontroller checks the value that is set by the clinician with the measured value that is brought back into the system, if they are found to be unequal it alters the setting of the flow control valve to achieve the desired value. This system also has an LCD for display and buttons for alteration purposes. It was tested on an animal and it proved to be effective.

Scientists of Dr. APJ Abdul Kalam Missile Complex, RCI, DRDO-Hyderabad designed a ventilator named "DEVEN". This ventilator design has microcontroller operated solenoid valve and very precisely measure important parameters like inspiratory pressure, respiration (breathe) rate, I:E ratio, tidal volume, and percentage oxygen (FiO2). This design is developed by using HRCS(hot gas reaction control system). HRCS is achieved by actuating solenoid valves through a microcontroller to control the flow of oxidizer as well as fuel. Solenoid valves are controlled for Inspiratory and expiratory lines by existing controllers. All the parameters of the ventilator are controlled using manual valves/touch screen and are displayed using serial communication link onto a touch-screen LED display. The doctor/hospital attendants can vary these parameters depending upon the patient's breathing requirement. Different categories of patients have different respiration rates and hence require different inhalation and exhalation of air as well as oxygen.

All the parameters (except FiO2) are controlled on the touch screen which in turn controls the opening and closing times of the solenoid valves. FiO2 is controlled manually by suitably positioning the knob of a three-way valve. Air and oxygen enter through this valve at two inlets and a mixture of both air and oxygen comes out from the outlet of this valve and this mixture of both gases is subjected to the patient through the inspiratory solenoid valve. DEVEN ventilator system has two modes of operation:(a) Hospital mode. (b) Stand-alone mode. In hospital mode, DEVEN draws compressed air and oxygen, both available at 5 bar pressure from centralized hospital compressed air and oxygen supply lines. In standalone mode, compressed air at 5 bar pressure is supplied from compressor and air reservoir, and oxygen is supplied from an oxygen cylinder, through a pressure regulator. This pressure regulator reduces the pressure of oxygen (from cylinder) to 5 bar.

Authors also tried to bring precision in breathing using analog sensors. The researchers demonstrated the use of these analog sensors in a closed loop, in both volumes controlled and pressure-controlled techniques. Here DC air pump was used along with a buck converter and 2 MOSFETS to control its speed. The analog flow rate sensor and analog pressure sensor were input to a comparator along with a sawtooth signal generator. The output of the comparator was a PWM signal. The amount of air traveling through the flow rate sensor was calculated by an equation. The pressure was also

calculated by using an equation that was then modelled by a transfer function. These equations were obtained by using CFTOOL (X, Y) in MATLAB.

In the volume-controlled technique, the flow rate sensor was used as a feedback path, whereas for pressure-controlled technique, pressure sensor was as the feedback path. The preset data would come from Raspberry Pi which the researchers used as an interfacing platform and this data would be compared with the data from the sensors in a microcontroller. Later the difference between them served as an input to the PID controller which would correct the values and prevent the lungs from any injury. The noise was created due to the variable duty PWM, so to remove this the authors used a Low pass filter on it. The research team proved their accuracy by providing graphical results of the device.

Researchers also prepared a device that prevents Ventilator-associated Pneumonia (VAP), a nosocomial disease, which happens due to the use of endotracheal intubation during mechanical ventilation. It is an AI-driven-cost effective device. The device, named VAPCare, basically senses the secretion and performs a mouthwash to prevent bacteria from entering the lungs. It is divided into 2 parts- the main unit and the sensing unit. The main unit is where all interfacing takes place, which consists of a screen, keypad, and knobs. The sensing unit senses the secretion or bacteria and sucks it into a container.

The suction is performed by applying negative pressure and can be adjusted accordingly for each patient. It has a range from 45 mmHg to 120 mmHg. Later, a container with medicated disinfectant, i.e. lavage, is sprayed at that region concurrently sucking back the extra lavage. This sensing and spraying of lavage have a default frequency which it takes place (30 min and 50 min correspondingly), but can be altered by using the frequency buttons. This prototype wasn't performed on any human. The authors ran benchtop testing with 3-6 months of constant use. They provided results stating that the machine removed 80 % of the secretions produced.

RESULT ANALYSIS

Paper Title	Types of Patients	Cost Effective and Portability	Safety Measures	Ventilation Technique	Mechanism Used	Feedback System	Analysis
Design, Modelling, Prototyping and Closed Loop Control of a Mechanical Ventilator for Newborn Babies	Only applicable for Neonates or New born babies.	Portability is easy as the packaging is compact but it is not cost effective.	This does not have any emergency stop button.	It uses Positive Airway Pressure.	It uses an oxygen cylinder for respiration.	Closed Loop control system is used with the help of sensors.	The microcon troller, LPC1768, is more complex, has fewer libraries and is costly. Whereas, Arduino DUE, is cheaper, easy to use and has the same architecture.
Designing an Electro-Mechanical Ventilator Based on Double CAM Integration Mechanism	It is applicable for all types of patients, i.e. Adult, pediatric and neonate	It is cost effective as well as compact so that it can be used anywhere	To prevent Bacteria and germ attack a filter is used at the inlet of the bag, which could be changed regularly.	It uses Positive Airway Pressure ventilation.	Used a bag-valve -mask ventilation mechanism.	There is no provision for any feedback system.	Although these ventilators maintain respiration functionality, this is often accompanied by organ damage due to the large volume of the air injection

Continue Table 1

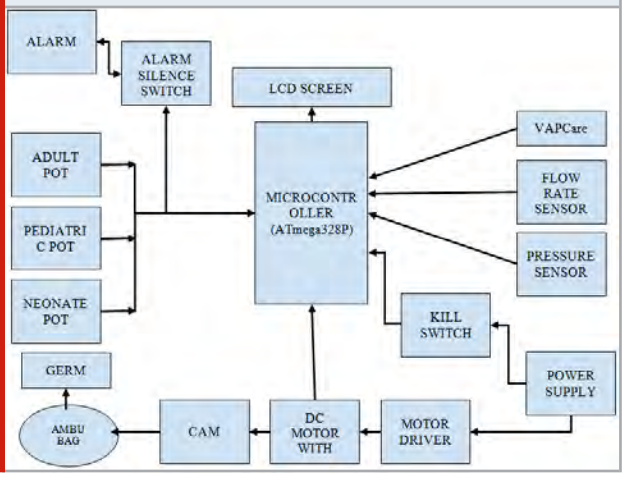
Design and Study of a Portable High-frequency Ventilator for Clinical Applications	This ventilator is applicable for all types of patients, i.e. Adult, pediatric and neonate	It is portable but not cost effective.	It injects Smaller tidal volume which reduces the chances of chronic lung injury in the long-term treatment	The ventilator uses High Frequency Jet Ventilation	A switchable capacitor array was used to reach a constant injection frequency.	A pressure feedback technique is implemented to adjust the air flow and I:E ratio for the required levels.	To make it a perfect ventilator device like VAP care could be used along with it, to prevent nosocomial infections.
Technical Evaluation of an AI based Secretion and Oral Hygiene Management System for Ventilator-associated Pneumonia	Applicable for all types of patients, i.e. Adult, pediatric and neonate	Portable and cost effective	It is a device which prevents any nosocomial infection during endotracheal intubation.	None	None	Since it is AI driven, on detection of any infection lavage is sprayed.	It can be used along with ventilators to prevent infections.
Prototyping of Artificial Respiration Machine Using AMBU Bag Compression	Can be used for all categories of patients.	Low cost ventilator. This ventilator system is compact, so portable	It beeps when there is a pressure change or gives trigger alert at regular intervals of time for respirations pattern	It uses Positive Airway Pressure ventilation	Used two different mechanisms for compression of AMBU bag: Chained Plank and Camshaft Mechanism	No feedback system was used.	Instead of a thermistor and CO2 sensor, flow rate sensor and pressure sensor could be used for breath sensing purposes.
Portable, Low Cost, Closed-Loop Mechanical Ventilation Using Feedback from Optically Isolated Analog	For all categories of patients	This prototype is a low Sensors cost and portable ventilator	This device does not have any emergency button or a bacteria filter for its safety.	It uses Positive Airway Pressure ventilation	A DC air pump along with a buck converter is used to supply air for respiration.	Feedback is generated from Optically Isolated Analog Sensors	A LCD screen and buttons could be used instead of a Raspberry Pi to make things simple.
DEVEN	Applicable for all types of patients, i.e. Adult, pediatric and neonate	Portable and Low Cost	It has high - and low-level alarms for inspiration pressure, tidal volume, BPM, I:E ratio, FiO_2 and PEEP.	The ventilator uses High Frequency Jet Ventilation	Compressed air from compressor and air reservoir is used and oxygen is	Solenoid valve to control Breathing rate and I:E ratio is used. Also,	Filters can be used in Inspiratory and Expiratory limbs and near the patient inlet.

Continue Table 1

	A 'Patient disconnected' alarm in case the inspiratory or expiratory limbs are disconnected accidentally. 'Ventilation abnormal' alarm in case the breathing pulse is not detected and a 'Power failure' alarm.	supplied from an oxygen cylinder or oxygen supply lines.	Pressure sensor, O2 Sensor and Flow meter is used for feedback.

PROPOSED METHODOLOGY

Figure 1: Proposed Block Diagram



We are proposing that we should use Positive Pressure Airway compressions of AMBU Bag with the given components because these components are readily available and low in cost compared to the ventilators of the other researchers. The Arms of the CAM can be made up of acrylic sheets and laser cutting instead of 3D printing as 3D printing is costlier, provided the laser cutting and acrylic sheet gives the same precision and strength.

Fig.1 shows that we have interfaced microcontroller Atmega328P with LCD screen for display of control signals and different mode. A pressure sensor(NXP MPX2200DP) is interfaced for measurement of pressure so prevent barotrauma. Key ventilation specification for the maximum Airway pressure should be around 40cm H2O. So, if pressure exceeds an alarm is interfaced so that it can alert the attending. And to switch it off, a switch is also given. Which when noticed should be manually put off.

The flow rate sensor (NXP MPX2200DP) is interfaced to measure tidal volume. For both flower Rate sensor and Pressure sensor we can use the same type of sensor (NXP MPX2200DP). A VAPCare is used to prevent nosocomial infection caused due to endotracheal intubation. For power supply we are using SMPS and a Battery backup system can also be implemented. A motor driver is used to drive the motor and the motor will control the arms, so that it compresses and decompresses the AMBU Bag. A germ attack filter is used to filter out the germ that can contaminate the inlet of the AMBU bag harming the patient's organ. Here we have used three modes which will be used for different settings according to the patient's age and criteria. For precession of respiratory rates a encoder attached with the motor is used so that the compressions and decompression can be monitored. And the CAM arm can make moments in particular angles. We also have provided a KILL Switch so that at emergencies the attending nearby can close the system immediately.

CONCLUSION

The ventilators mentioned by all researchers were effective and proved their capability while testing them. The AMBU bag technique could be used for emergency cases only, like in the ambulance but not for continuous ventilation purposes. The point that it can't constantly maintain the I:E ratio can cause barotrauma. With some new techniques in future it is possible to eradicate this problem. On the other hand, high frequency jet ventilators are durable and inexpensive with very little error margin. Devices like VAPcare can be used with mechanical-ventilators to prevent bacterial infection during ventilation. With current research in this field due to the COVID-19 pandemic, it is expected that an errorless ventilation mechanism will soon come.

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Overview On Optimization Methods of Rectangular Dielectric Resonator Antenna

V. Lakshmi Parvathi*[1], Rajesh. B. Raut[2] and Biswajeet Mukherjee[3]

[1]*Research Scholar, Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[3]*PDPM, Indian Institute of Information Technology, Design and Manufacturing, Jabalpur, India*

ABSTRACT

This paper presents a brief review on the Rectangular Dielectric Resonator Antennas (RDRAs) for Sub-6 GHz band of frequencies. Various resonant modes, feeding mechanisms, bandwidth and gain enhancement techniques and size reduction methods have been discussed. Comparisons and advantages of dielectric resonator antenna over microstrip patch antenna have also been presented.

KEY WORDS: RDRA, CIRCULAR POLARIZATION, RESONANT MODES, BANDWIDTH, GAIN.

INTRODUCTION

Modern wireless communication systems require suitable antennas to operate at higher frequencies such as microwave and millimetre wave frequencies. Traditional microstrip patch antennas are not suitable for these frequencies due to considerable conductor losses at those frequencies. Dielectric Resonator Antenna is a microwave antenna consists of a ceramic block of materials with higher permittivity values which work efficiently at these frequencies. When the dielectric resonator is not enclosed by a metal cavity and with proper excitation, it radiates efficiently and thus becomes a radiator. After vast research, in 1939, R.D. Richtmeyer theoretically demonstrated that non-metalized objects can resonate and function as an antenna, and these are named as Dielectric Resonator Antenna [Petosa et.al.,], [R. S. Yaduvanshi et.al.,]. In 1980s, Long, McAllister and Shen started the study of dielectric resonators as an antenna element with an analysis of characteristics of hemispherical, Cylindrical, and Rectangular shapes along with its material properties. DRA offers advantages like high impedance bandwidth, high gain, and most importantly freedom from metallic losses [Biswajeet et.al.,]. The fields of the mode must not be strongly restricted within the resonator and hence, it can be easily fed to generate efficient radiation [K. W. Leung et.al.,].

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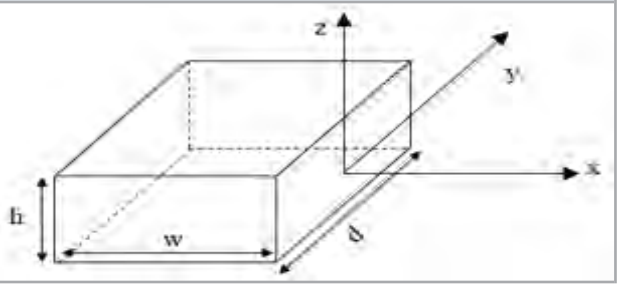
2. Rectangular Dielectric Resonators: The dielectric resonators have numerous advantages than microstrip patch antenna. In microstrip antenna radiation occurs due to the narrow slots only whereas in dielectric resonator the radiation is due to the whole surface except the grounded part. The limitations of patch antenna such as low gain, narrow bandwidth and narrow beam characteristics can be eliminated with rectangular dielectric resonator antenna by operating in higher modes and hybrid modes and most importantly DRAs don't suffer from surface waves [Petosa et.al.,]. Dielectric resonator antenna with a rectangular cross-section having length w, width d, and height h as shown in fig (1) offers greater design flexibility to achieve desired profile and radiation characteristics for a selected dielectric constant and resonance frequency by choosing different aspect ratios such as length/width and length/height independently [Petosa et.al.,], [R. K. Mongia et.al.,].

Figure 1: Isolated rectangular dielectric resonator antenna [R. K. Mongia et.al.,]



One more feature with rectangular shape compared with other structures is that the mode degeneracy can be overcome with proper selection of aspect ratios, thus limiting the excitation of undesirable modes and can lower cross polarization levels. As per the literature review, mainly two approximations are available to analyse the rectangular dielectric antennas, namely;

(i)- Magnetic wall model by Okaya and Barash [Okaya. A & Barash]
(ii)- Dielectric waveguide model

The DWM method utilizes both Marcatili's approximation and EDC approximation for the characteristic analysis of rectangular dielectric resonator.

Resonant modes: RDRA with a 3-dimensional structure supports various modes for numerous applications. Resonant modes represent the radiating phenomena of E and H field patterns to predict the radiation characteristics of the antenna [K. W. Leung et.al.,]. Okaya and Barash [Okaya. A & Barash] described the resonance modes of an isolated rectangular DRA into two categories, namely, TE and TM modes. But the existence of TM modes in rectangular resonator was not proved experimentally [K. W. Leung et.al.,], [R. K. Mongia et.al.,]. Van Bladel classified the modes as confined and nonconfined types and these modes satisfy the below conditions at the surface of the resonator:

$$\vec{E}.\hat{n}=0 \quad (1)$$

$$\hat{n}\times\vec{H}=0 \quad (2)$$

The modes which satisfy both equations (1) and (2) are known as confined modes, while those which satisfy equation (1) are called nonconfined modes [Biswajeet et.al.,]. Van Bladel also stated that the dielectric objects like cylindrical and spherical shapes with the body of revolution only can support the confined modes. Since rectangular DRA is not a body of revolution, it supports nonconfined modes only. In general, the DRA in rectangular shape has a greater number of modes compared to its cylindrical and hemispherical shapes and this feature helps to improve the impedance bandwidth when adjacent modes have the same radiation phenomenon. One common approach to predict the modes in rectangular DRA is the direct waveguide model (DWM) method. By using this method, the E and H-field propagation of $TE^{x}_{\delta mn}$ mode of RDRA is approximated [R. S. Yaduvanshi], [Biswajeet et.al.,] as given below:

The transcendental equation is as follows:

$$k_x \tan\left(\frac{k_x d}{2}\right)=\sqrt{(\varepsilon_r-1)k_0^2-k_x^2}$$

Where

$$k_x^2+k_y^2+k_z^2=\varepsilon_r k_o^2,\ k_0=\frac{2\pi f_0}{c},\ k_y=\frac{\pi}{w}\ and\ k_z=\frac{\pi}{2h}$$

Where k_x, k_y, k_z and k_0 are wavenumbers in x, y, z-axes and free space, respectively. w, d and h are length, width and height of the RDRA, respectively.

2.2 Feeding mechanisms: The type of feeding technique and its location plays a major role in determining which modes are excited and how much power is coupled between the port and the antenna. This, in turn, will determine the input impedance, resonance frequency, Q-factor and radiation characteristics of RDRA.

The RDRAs can be excited by various techniques as stated below:

2.2.1 Aperture Coupling: This type of feeding network offers the advantage of low spurious radiation from the feed line by providing isolation between the aperture and feed network, consequently increasing the polarization purity of the RDRA. The amount of coupled power and strength of the magnetic field at the slot position can be affected by the slot position. An increase in the slot length can increase the coupled power but decreases the resonance frequency. This feeding technique provides a relatively narrow bandwidth. Aperture coupling may not be suitable for lower frequencies due to the realization of the large size of the slot.

2.2.2 Probe Coupling: In this coupling, the probe can be placed either inside the RDRA or adjacent to the RDRA. The advantage of the probe inside the RDRA is that high coupling can be achieved results in high radiation efficiency. The drawback of this structure is that a hole needs to be drilled inside the RDRA and the hole dimensions need to be matched with probe length and width otherwise the dielectric constant of RDRA will get effected causing the resonance frequency shift. Probe adjacent to the RDRA results with weaker coupling to RDRA.

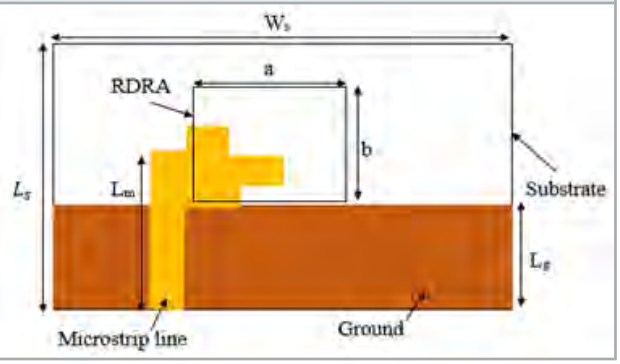
2.2.3 Microstrip Line Coupling: By using microstrip coupling we can excite the TEδ11 mode of the rectangular DRA. Stripline determines the coupling strength and mode of excitation. Strong coupling can be achieved by choosing strip length slightly shorter than one quarter wavelength of the resonance frequency. Microstrip line can be etched on the same substrate to provide planar structure but introduces an undesired air gap between rectangular DR and substrate.

2.2.4 Coplanar-Waveguide Coupling: With this coupling, good efficiency of the antenna can be achieved by resonator antenna from substate. Coupling can be enhanced by altering the shape of the coupling slot. This technique is best suitable for antennas operating at millimetre wave frequencies.

2.3 Circular Polarization in RDRAs: Circular polarization is often used to overcome the polarization rotation effects due to atmospheric effects such as multipath fading and reflections from the obstacles. The circularly polarized antennas are independent to transmitter and receiver positioning. Circular polarization can be generated by following single point feed, dual point feed and sequential rotation methods. Various circularly polarized antennas are proposed for satellite, radar and wireless communications [Jamaluddin. M. H et.al., & R. K. Gangwar et.al.,].

A rectangular dielectric resonator antenna fed by H-shaped conformal metal strips is designed for satellite and WiMAX applications [Jamaluddin. M. H et.al.,]. Due to metal strips, a pair of degenerate modes $TE^{x}_{\delta 13}$ and $TE^{y}_{\delta 13}$ are excited achieving a broad CP impedance bandwidth of 20% along with wide beamwidth and with a peak gain of 6.8 dBi. Circular polarization using single point fed can be achieved by following various techniques like modifications in the basic DRA shapes, loading a monopole antenna into the resonator structure or by using different feed shapes. Authors in [R. K. Gangwar et.al.,] reported a rectangular dielectric resonator antenna fed with flag shaped microstrip line. By creating notches in the feedline excites TE^{x}_{111} and TE^{y}_{111} orthogonal modes to generate circular polarization.

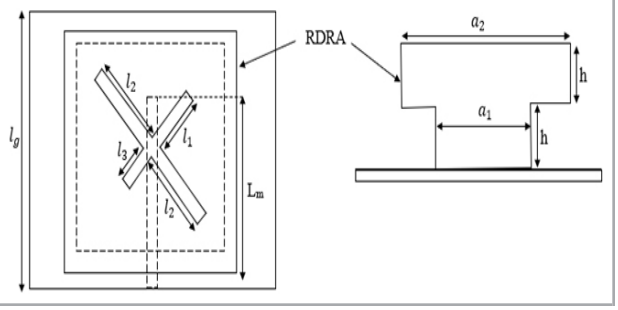
Figure 2: Structural representation of the proposed circularly polarized rectangular DRA [R. K. Gangwar et.al.,]



The impedance bandwidth achieved is 58.36% along with 3 dB axial ratio bandwidth of 47.27% at 2.5 GHz shown in fig (2). Researchers proposed a stacked rectangular dielectric resonator antenna for dual band operation [Zou. M & Pan. J]. The resonator is fed with cross slot of unequal arm lengths so as to achieve the wideband circular polarization. If the cross slot with an arm length of half guided wavelength is chosen, resonance modes will divide into two degenerate resonance modes with equal amplitude and opposite phase angles. With this mechanism, the structure shown in fig (3) achieved a lower band AR bandwidth of 9.7% and upper band AR bandwidth of 20%.

A notched rectangular dielectric resonator is proposed fed with stair shaped slot to obtain wide axial ratio bandwidth [Pandey. V. S et.al.,]. Furthermore, two notches are introduced diagonally on the sides of the DRA to enhance the CP bandwidth. The top notched corner is coated with conductive metal layer. This layer acts as parasitic element and adjacent 3-dB bands are merged for further enhancement in axial ratio bandwidth. The impedance bandwidth and AR bandwidth of 66.45% and 55.22% are obtained at resonance frequency of 4.75 GHz with a gain of 2 dBi.

Figure 3: Cross slot aperture coupled circularly polarised RDRA [Zou. M & Pan. J]



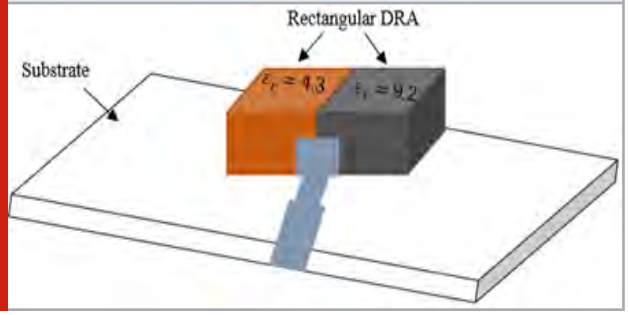
Parameters enhancement: In this section, techniques for enhancement of parameters such as Bandwidth and Gain have been discussed.

3.1 Bandwidth enhancement techniques: Numerous technologies have been evolved to enhance the bandwidth to fulfill the requirements of the large impedance bandwidth, high data rates etc., As the bandwidth of the resonator antenna is inversely proportional to dielectric constant, by choosing the dielectric material with high dielectric constant (εr) value we can increase the impedance bandwidth of the DRA. By introducing an air gap between the ground plane and the resonator, the surface area/volume ratio gets reduced and impedance bandwidth is enlarged from 50.3% to 81% in [A. K. Roy & Sukla Basu]. The air gap is discussed in [L. E. Davis et.al.,] with improved bandwidth by lowering unloaded Q-factor.

One approach to enhance the bandwidth is by stacking two or more layers with different dielectric constants and is discussed in [Krishsagar. P et.al., & Gebril. K. K]. In [Krishsagar. P et.al.,], two different dielectric materials having different resonance frequency are kept side by side to attain the operational bandwidth of 131%. The defected ground structure is used with a rectangular cut in the middle of the ground at an angle of 450 as shown in fig 4. In [Gebril. K. K], [Abedian. M et.al.,], stacked configurations are proposed with high aspect ratios in order to shift the frequency of higher order mode

towards the dominant mode to make a vast change in the bandwidth of the antenna.

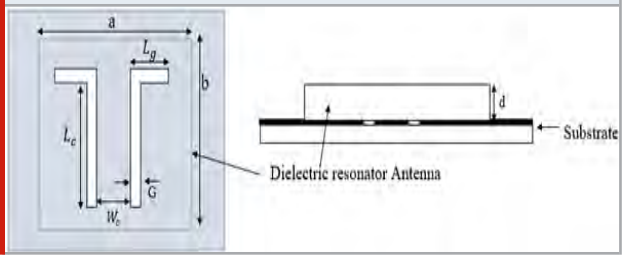
Figure 4: Two segment UWB rectangular DRA [Krishsagar. P et.al.,]



Another idea to improve the bandwidth is by using perforations. The perforation technique alters the effective permittivity of the dielectric material depending on the hole radius and spacing between the holes. In [Patel. P et.al.,], the circular polarization is achieved with four square shaped slots etching at diagonals of RDRA and in [Patel. P et.al.,] another perforated configuration based on edge grounding is proposed. The resonator is chopped to half of its volume by placing a metal plate at the edge. With this topology, 56% impedance bandwidth at 2.4 GHz is achieved along with considerable weight reduction. In [Petosa. A et.al.,], the perforated topology is designed for array applications using a single dielectric sheet. This structure eliminated the discontinuities between the resonators and provides ease of fabrication.

Hybrid RDRAs is one of the suitable methods for bandwidth enhancement. For hybrid topology either the feed network also acts as a radiator or another structure is used as a radiator. In [Yuan Gao et.al.,], a rectangular resonator is designed with centre fed CPW inductive slot which can work like a radiator and feed network simultaneously as shown in fig 5. By tuning the inductive slot length and DRA height, resonances of two radiators are merged and hence achieved an impedance bandwidth of 28.9% at 5 GHz frequency.

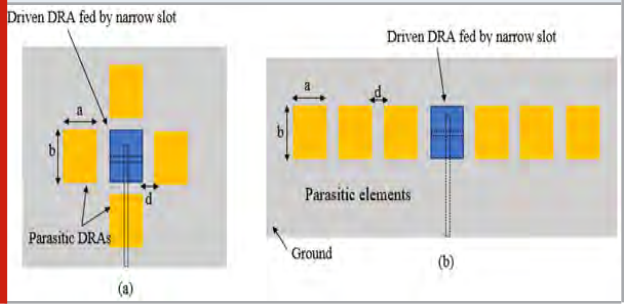
Figure 5: Top view and Side view of the Wideband Hybrid RDRA [Yuan Gao et.al.,]



3.2 Gain enhancement techniques: A novel MTM-loaded RDRA is designed [Killamsetty. V. K et.al.,] with metamaterial as a superstrate layout consisting of 50-unit cells of eight-shaped copper strips arranged in a 5×10 manner. The increment in gain is due to the lensing property of the MTM cells in the far field region and achieved a peak gain of 14 dBi and impedance bandwidth of approximately 16% at 7.8 GHz with low cross polarization levels. This antenna is a good candidate for radar systems, satellite communications.

A. Petosa et al., designed a simple rectangular DRA array prototype [Petosa & Thirakoune] for high gain applications. In this array, each element is excited for different resonant modes by choosing different aspect ratios. High gain of up to 10.2 dBi is achieved by exciting higher order modes. In the case of higher order modes, the rectangular DRA radiates with a more directive pattern and by properly selecting the aspect ratio, the radiation pattern can be controlled. In [Kishk. A. A et.al.,], a high gain RDRA arrays using parasitic elements is proposed in two configurations (i)-linear array of seven elements structure arranged as H-plane array and (ii)-five element cross shaped structure shown in fig 6. For both cases, the parasitic elements are electromagnetically coupled with a driven element and the centre dipole is fed with aperture coupling. As a result, two beam shapes were obtained namely, vane beam and broadside radiation patterns. In broadside mode, the five-element structure achieved 10.1 dB gain and 610/410 E/H-plane beam width and in the case of seven-element structure, the gain and beamwidth are 11.14 dB and 1000/280 E/H-plane respectively.

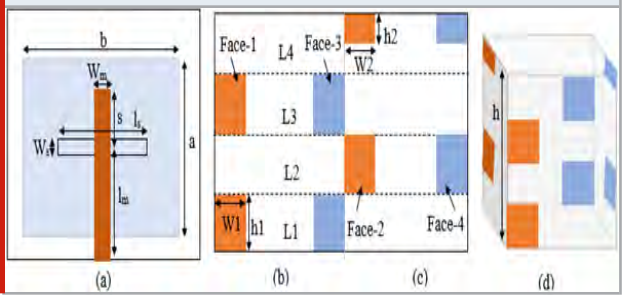
Figure 6: Geometry of aperture coupled parasitic DRA arrays, (a) five element cross-shaped array (b) seven element linear array [Kishk. A. A et.al.,]



In [Fakhte. S et.al.,], grooves are introduced on the sidewalls of the rectangular dielectric resonator antenna to increase the boresight radiation patterns and to narrow the main beamwidth. By carefully adjusting the notch depths (dx) the maximum peak gain achieved is 9.6 dB in the boresight direction and the increment in the gain is due to the electric field magnitude in the notch regions. Exciting the DRA into higher order modes increases the antenna gain to fulfil the requirement of the high frequency applications. At higher frequencies, the wave gets attenuated due to atmospheric conditions. Circularly polarized DRAs are more suitable at these situations and do not depend on transceiver positions. So, a two layered circularly polarised rectangular dielectric polarised antenna is designed to operate in higher order mode [Abdulmajid. A. A et.al.,]. In this structure, a high permittivity dielectric resonator is incorporated into a lower dielectric medium. The outer dielectric layer is responsible for bandwidth enhancement. The RDRA

is excited to higher order mode TE11,11 by attaining maximum gain of 11 dBi at 11.3 GHz.

Figure 7: Miniaturised CP RDRA (a) Top view (b) Front and back view (c) metal strips on resonator sides [Varshney. G et.al.,]



4. Miniaturization of RDRAs: Nowadays, low profile antennas are the major requirement in wireless communication. The antennas can be made compact by using various techniques such as the selection of high permittivity material, applying some modifications to the regular structures or by selecting high surface to volume ratio etc., In general, the size of the DRA and its dielectric constant have inverse relation($_{\lambda\alpha\varepsilon}$-$^{1/2}$). So, by selecting high dielectric constant material, the size of the DRA can be reduced. Along with size reduction, high dielectric constant has a negative impact on impedance bandwidth. So, there is a trade-off between size and bandwidth. In [Mongia. R. K et.al.,], aperture coupled RDRA with high dielectric constant ($_{\varepsilon r}$=100) is proposed for low profile applications with approximately 3% reasonable bandwidth.

Table 1. Radiation characteristics of the reference rectangular antennas

Reference /Year	Dielectric constant (ε_r)	Coupling Mechanism	Resonance Frequency (GHz)	Impedance Bandwidth (%)	Peak Gain (dBi)
[Jamaluddin. M. H et.al.,]/2019	10	H- shaped conformal strips	3.85	27.7	6.8
[Pandey. V. S et.al.,]/2018	12.8 66.45	Stair shaped slot 2.67	5.8		
[Krishsagar. P et.al.,]/2017	4.3 & 9.2	Conformal microstrip feed	10	131.24	10
[Gebril. K. K et.al.,]/2011	15 & 30	Microstrip line	5.8	12	5.1
[Patel. P et.al.,]/2015	10.2	Coaxial probe	2.82	56	6.2
[Abdulmajid. A. A et.al.,]/2018	3.5 & 10	Cross slots	11.1	21	11
[Mongia. R. K et.al.,]/1994	100	Aperture coupling	7.72	3.24	NA
[Kiran. D. V et.al.]/2020 * NA- Not available	9.8	Microstrip line	6.35	23.3	5.6

To increase the impedance bandwidth along with miniaturization other techniques are proposed with low dielectric constants. In [Varshney. G et.al.,], the antenna is proposed with metal strips on the sidewalls of the rectangular DRA as shown in fig 7. The interesting feature of the applied metallic strips in a specified manner is the dual band circular polarization response due to the generation of first and third order degenerate modes. The proposed prototype can be used for satellite communication of 6/4 GHz frequency bands.

In [Abedian. M et.al.,], a low-profile rectangular DRA using high permittivity ($_{\varepsilon r}$=20) material is proposed. In this geometry, two identical rectangular shaped dielectric layers are joined back to back with microstrip feeding technique inserted in between the two resonators. The lower DRA is embedded within a cut in the substrate to achieve the compactness. Slotted ground plane, open end microstrip feedline fitted in between the two resonators are used for wideband characteristics. Finally, the obtained results are 88.2% impedance bandwidth with omni directional radiation pattern at 4.8 GHz frequency. Another approach for compact structures is the fractal technique.

In [Kiran. D. V et.al.,], Sierpinski and Minkowski fractals are simultaneously applied for rectangular resonators to reduce the size of the antenna. Along with size reduction, band width can be improved with fractals since with an increase in the fractal iterations one can reduce the quality factor. In this prototype, two rectangular resonators with different dielectric materials are positioned concentrically. Higher permittivity resonator (DR1 with $_{\varepsilon r}$=10.2) is embedded inside the lower permittivity material (DR2 with $_{\varepsilon r}$=4.3) to introduce the dual band operation. The DR1 is undergone with the Sierpinski fractals and the DR2 is undergone with Minkowski fractals with two iteration levels. For each iteration, the bandwidth is improved further and the final impedance bandwidth achieved is 66% (3.5-7.02 GHz).

DISCUSSION

From the literature study, it is learned that the rectangular dielectric resonators are best suitable antennas due to its design flexibility compared with other structures. RDRAs can be controlled with two aspect ratios and by properly choosing them, the radiation characteristics can be optimised. For instance, by choosing a high aspect ratio,

one can design high impedance bandwidth structures by effecting field distribution [Abedian. M et.al,]. RDRA with improper dimensions excites unwanted modes nearer to desired modes causing high cross polarization levels. With an appropriate feeding mechanism, the feed network also acts as a radiator and the geometry works as a hybrid topology for low profile and wide bandwidth applications. Feeding source and location also shows an impact on the excited modes of the antenna. High gain antennas can be realised by making changes in the basic shapes or by exciting higher order modes etc., High permittivity material reduces the antenna size but at the cost of bandwidth.

Recently circularly polarised antennas are drawing more attention because these antennas are independent on transmitter and receiver orientation and having less multipath fading effects due to atmospheric conditions [Kiran. D. V et.al.]. Different techniques are available to alter the radiation characteristics of the resonator and some of reference topologies are listed in Table1.

CONCLUSION

This article provides an overview of the rectangular dielectric resonator antenna in comparison with the microstrip patch antenna. A brief analysis of resonance modes has been presented including field distributions. Various coupling methods have also been studied. Case studies about wide bandwidth, high gain and size reduction of the rectangular dielectric resonator by various techniques have been discussed. Different models on circular polarization generation have also been listed. Finally, it has been observed that Rectangular DRA with probe coupling is best suitable at lower frequencies and aperture coupling is preferred at higher frequencies, higher order modes correspond to higher resonance frequency and higher antenna gain, circular polarization achieves long range communications.

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A Multi-Class Classification Based Approach for Remaining Useful Life (RUL) Prediction of Li-Ion Battery

Yuvraj Gupta[1], Partho Ghosh[2], D.J. Dahigaonkar[3] and P.A. Dwaramwar[4]
[1, 2]Student, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[3]Associate Professor, Department of Electronics and Communication Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[4]Associate Professor, Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India

ABSTRACT

Estimation of Remaining Useful Life of the battery reduces the risk of battery failure and also helps in the optimization of the battery life by proposing its replacement at a proper time. This paper proposes a new RUL prediction technique based on the Multi-Class Classification approach. In order to predict the group membership of data instances, we have utilized the classification approach of the Machine learning technique. To simplify the issues related to classification, a neural network approach is deployed. To estimate the RUL, multiple measurable data features from the battery monitoring system are considered such as capacity, voltage, current, and temperature charging/discharging profiles. This research work utilizes the Li-Ion battery dataset of NASA Prognostics Center of Excellence Data Repository to verify the efficacy of the proposed machine learning model. The proposed method eliminates the need to rely on complicated battery electrochemical principles. This is very crucial as the technique can be deployed for various types of batteries. Accordingly, the RUL estimation tool proposed in this paper may benefit the upcoming automotive industry, particularly to the electric vehicles.

KEY WORDS: REMAINING USEFUL LIFE (RUL), BATTERY, MULTI-CLASS CLASSIFICATION, MULTI-LAYER NEURAL NETWORK.

INTRODUCTION

In today's world, battery is a daily necessity. Without battery the gadgets like mobile phones, laptops, remote controls etc. are no conceivable. We mechanically make use batteries in everyday life. The battery performance over long durations gets deteriorated due to many factors such as various chemical reactions, increase of service life, loss of battery material, etc. which may change the normal operation of electrical devices. Therefore, the battery states like Remaining Useful Life (RUL) of a battery and the State of Charge (SOC) of a battery has become a topic of research in engineering domain. Out of the many types of batteries available in the market, the Lithium-ion batteries are most preferred due to its convenient size & weight, longevity and high energy density. Since batteries are a significant component of many electrical systems, their failure can degrade the power system performance and may result in the system failure and increased costs. The RUL is a predictive technique that assures safe and stable condition of a battery to the users. An effective method to predict the RUL of a Lithium-ion battery is discussed in this paper. RUL estimations can be based

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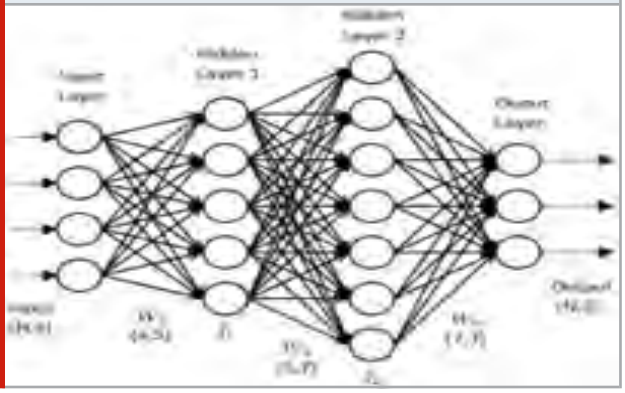
on estimation of the properties of battery capacity and the state of charging and discharging, with the given failure threshold. Out of these, we have utilized capacity as battery health indicator for RUL predictions as the change in battery capacity directly indicates the battery health condition.

Figure 1: Artificial Neural Network



2. Related Algorithms

a. Multi-Layer Neural Network: Multi-Layer Neural Network comprises one or more concealed layers (excluding one input and one output layer). The advantage of multi-layer perceptron over single layer is multi-layer perceptron can be trained for non-linear functions too. The input to this neuron can be x1, x2... x3 (and a + 1 bias term) with outputs f (summed inputs + bias), where f (.) is called as activation function. In addition to the customary inputs that the node receives, the main function of Bias is to furnish every node with a trainable constant value. Every activation function takes a solitary number and executes a distinctive fixed computation thereon.

Multi-Class Classification Using Deep Learning Model: Multiclass classification function contains more than two classes. In such classification, a sample can only have one class out of the multitude of accessible classes. The classification adopted in this work has many coaching examples which are separated into K separate classes, and based on this approach, a machine learning model was deployed to predict previously unseen data belongs to which of these classes. The training data helps to assimilate patterns unique to every class and use those patterns to forecast the membership of future data.

A neural network can be used as a classifier by just appending a softmax function onto the last layer. This function culminates a probability distribution over K classes and raises an output vector of length K. The probability that the input belongs to the corresponding class is specified by each element of the vector. The probable class is then chosen by selecting the index of that vector having the foremost effective probability.

Multi-Class Classification And Softmax Regression: The method of logistic regression could be a binary classifier naturally. However, it may also be used for multi-class classifications with K > 2 classes. First, the strategy of One-Vs.-Rest (1VR) is accustomed to convert a K-class problem (K > 2) into K binary problems. Specifically, we regroup the K classes C1,...,CK into two classes C(+)= C_i and C- ={C_j |j=1,...,K,j≠i}, and get the corresponding discriminant (decision) function f(x) of the binary problem:

$$if\ f_i(x)\begin{cases}>0\\<0\end{cases},then\begin{cases}x\in C_+\\x\in C_-\end{cases}$$

which represents quantitatively how much a given x belongs to class C_+= C_i, instead of C- containing all remaining K-1 classes. This process is repeated K times for all i = 1 ... K to get

$$f_k(x)=\max\{f_1(x),\dots,f_K(x)\},(k=1,\dots,K)$$

which indicates x belongs to class C_k, instead of any of the remaining K-1 classes.

As a substitute, One-Vs.-One (1V1) is another strategy to change a twofold classifier over to a multi-class classifier. In view of this method, an unlabeled x is assessed into a category that receives the utmost votes out of the (K (K-1)) /2 binary classifications between every pair of the K classes. Instead of converting the binary logistic regression, we will also generalize it into multinomial logistic regression, or softmax regression, for multi-class problems. In view of this case, the variable quantity y could be a categorical variable that takes anyone of K distinct values representing K > 2 different classes. While in logistic regression the logistic function σ is utilized to show the likelihood of the function of y = 1 by a softmax work characterized as:

$$p(y=i/x)=\emptyset_i(w_i^Tx)=\frac{\exp(w_i^Tx)}{\sum_{k=1}^{K}\exp(w_k^Tx)},\sum_{i=1}^{K}\emptyset_i=1$$

Note that when K = 2, the above becomes logistic functions:

$$\emptyset_0(w_0^Tx)=\frac{\exp(w_0^Tx)}{\exp(w_0^Tx)+\exp(w_1^Tx)}=\frac{1}{1+\exp(-(w_0-w_1)^Tx)}=\sigma(-w^Tx)$$

$$\emptyset_1(w_1^Tx)=\frac{\exp(w_1^Tx)}{\exp(w_0^Tx)+\exp(w_1^Tx)}=\frac{1}{1+\exp((w_0-w_1)^Tx)}=\sigma(-w^Tx)$$

Where w= w_0- w_1

Now the hypothesis function is:

$$h_w(x)=\begin{bmatrix}\emptyset_1\\\vdots\\\emptyset_K\end{bmatrix}=\frac{1}{\sum_{k=1}^{K}\exp(w_k^Tx)}\begin{bmatrix}\exp(w_1^Tx)\\\vdots\\\exp(w_K^Tx)\end{bmatrix}$$

The model parameters w_1,...,w_K can be considered as the column vectors of the parameter array W= [w_1,...,w_K]. We note that these parameters are redundant as only K – 1 of the K components are independent, due to the constraint $\sum_{i=1}^{K}\emptyset_i=1$.

Given the training data $D=\{(x_n,y_n),n=1,\dots,N\}$

, we get the likelihood function:

$$L(W/D) = \prod_{n=1}^{N} p(y_n/x_n) = \prod_{n=1}^{N}\prod_{i=1}^{K} p(y_n = i/x_n)^{1\{y_n=i\}}$$

Where we have defined:

$$1\{y = i\} = \begin{cases} 1 \; if \; y = i \\ 0 \; if \; y \neq i \end{cases}$$

The log likelihood is:

$$l(W/D) = logL(w/D) = \sum_{n=1}^{N}\sum_{i=1}^{K} 1\{y_n = i\} \log p(y_n = i/x_n)$$

$$= \sum_{n=1}^{N}\sum_{i=1}^{K} 1\{y_n = i\} \log\left(\exp(w_i^T x_n) \Big| \sum_{k=1}^{K} \exp(w_k^T x_n)\right)$$

$$= \sum_{n=1}^{N}\sum_{i=1}^{K} 1\{y_n = i\}(w_i^T x_n - \log \sum_{k=1}^{K} \exp(w_k^T x_n))$$

To find w_j's that maximize this log likelihood function, we use gradient ascend method based on the gradient

$$g_l(w_j) = \frac{d}{dw_j} l(W/D) = \frac{d}{dw_j} \sum_{n=1}^{N}\sum_{i=1}^{K} 1\{y_n = i\}(w_i^T x_n - \log \sum_{k=1}^{K} \exp(w_k^T x_n))$$

$$= \sum_{n=1}^{N} 1\{y_n = j\}(x_n - \frac{exp(w_j^T x_n)}{\sum_{k=1}^{K} exp(w_k^T x_n)} x_n)$$

$$= \sum_{n=1}^{N} 1\{y_n = j\}(1 - p(y_n = j/x_n))x_n = \sum_{n=1}^{N} 1\{y_n = j\}(1 - \emptyset_i)x_n$$

Given the gradients g_l (w_j)(k=1,...,K), the gradient descent method can be used to find the K weight vectors that minimize the cost function. Whether we should use softmax regression or K logistic regressions for a problem of K classes C_1,...,C_K depends on the nature of the classes. The method of softmax regression is suitable if the K classes are mutually exclusive and independent, as assumed by the method. Else, K logistic regression binary classifiers are more reasonable.

Table 1

Charging			Discharging		Operating Conditions		
Constant Current (A)	Upper voltage limit (V)	Cut – off current (mA)	Constant Current (A)	Cut-off voltage (V)	Operating temperature	Initial Capacity	EOL Capacity
1.5	4.2	20	2	2.7	Room temp.	1.86	1.3

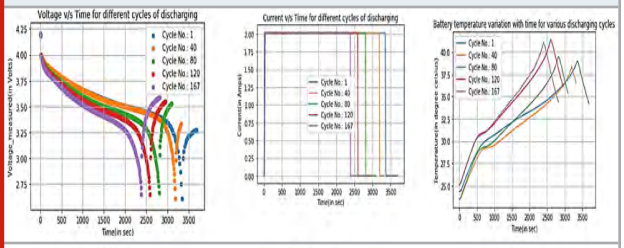
Table 1: Battery #5 Specs (Courtesy - NASA Prognostics Center of Excellence Data Repository)

3. Experimental Results

a. Battery Data Description And Visualization: Li-Ion battery dataset of NASA Prognostics Center of Excellence Data Repository is being employed, which consists of three distinct operating profiles of charging, discharging, and impedance at temperature. Constant current mode was used for charging purpose. A constant current of 1.5 Ampere was supplied till battery voltage become 4.2 Volts and later switched to constant voltage mode till charge current dropped to 20mA. Repeated charging & discharging cycles result in early aging of the batteries. The experiment was terminated when the batteries reach end-of-life criteria, which was a 30% fade-in rated capacity.

For the visualization purpose of the battery dataset, NumPy, Pandas, and Matplotlib libraries of Python language is utilized, and therefore the realization of appropriate programs for the visualization purpose was applied within the Jupyter Notebook Environment. Exploratory data visualization proved to represent quite an essential part within the development of an algorithm for battery RUL predictions because it helped in understanding the degradation nature of assorted battery parameters notably Voltage, Current and Discharging Capacity as a function of Cycle number in case of discharging cycles and Voltage and Current in case of charging cycles.

Figure 2: Battery discharging profiles for various discharging cycles



b. Remaining Useful Life (RUL) Prediction Of Battery Using Artificial Neural Network: The RUL prediction algorithm development problem was being approached as a multi-class classification problem, typically meaning that there are more than two distinct classes to be

predicted. For example, there are a total of 167 distinct classes in the NASA Li-Ion Battery #5 dataset. The key here for the development of the novel algorithm is the fields mentioned in Table #2 classified as input labels and the output/target label consisting of a total of 167 classes numbered from 0-166. The apparent problem is efficiently implemented with the adequate help of a multi-layer neural network because the multi-class values typically require specialized handling.

Figure 3: Battery charging profiles for various charging cycles

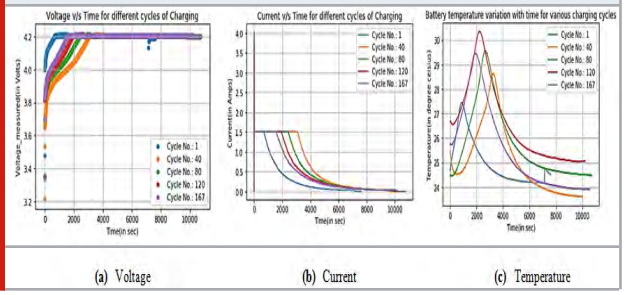


Figure 4: Capacity degradation over charging/discharging cycles

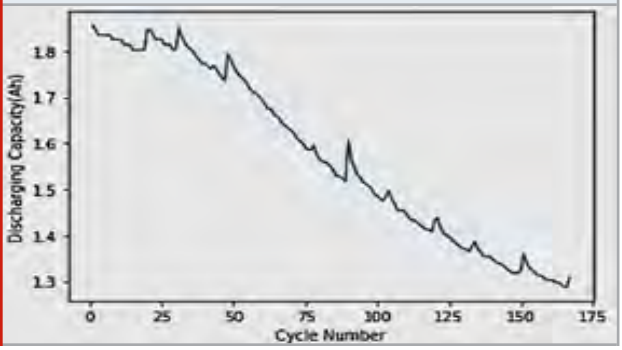
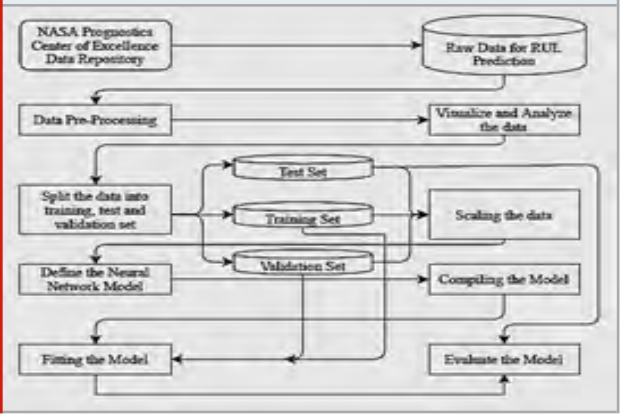


Figure 5: Overall workflow for prediction of Remaining Useful Life



There is an identified total of 49,595 samples present in the dataset after carefully performing the data-preprocessing operations. These sample points can be further divided into training, validation, and test dataset.

The data fields available in the discharging cycle are represented respectively in Table #2.

Table 2. Data fields containing the measurements

	Voltage_ measured	**Battery terminal voltage (Volts)**
Input Labels	Current_measured	Battery output current (Amps)
	Temperature_ measured	Battery temperature (degree C)
	Voltage_charge	Voltage measured at charger (Volts)
	Time	Time vector for the cycle (sec)
	Discharge_ Capacity	Battery capacity for discharge till 2.7 V.
Output Label	Remaining_Cycles	Numbers of Discharging/ Charging Cycles left till battery reaches its End Of Life (EOL) criteria i.e., 30% fade in its original capacity from 1.8Ah to 1.3Ah.

c. Preparing The Data And Designing The Model: The dataset can be loaded as a pandas data frame. Models in Keras are defined as a sequence of layers. Create a Sequential model and add layers one at a time until the desired network architecture is not achieved. Once the dataset is loaded, it can be categorized into a training set, validation set, and test set.

To understand the layers & their types: Trial and error sometimes may lead to discovery of simple network structures. A network to be deployed should be adequate to capture the structure of matter. In this work, a fully connected network structure with three concealed layers is arranged. The layers are defined using the dense class. The numbers of nodes in the layer are specified as the first argument along with activation functions using activation argument. The Rectified linear unit activation function 'ReLU' is used on the primary three layers and the Softmax function was used within the output layer.

d. Compiling and Fitting The Model: In the system deployed, the backend itself selects an appropriate mechanism of network representation for training and supports predictions to operate on the system hardware. Training a network literally means identification of appropriate set of weights and mapping input-output of a dataset. The loss function accustomed to judging a bunch of weights must be considered. An optimizer is used to select appropriate weight for the network, considering optional metrics. The sparse categorical cross-entropy

is utilized in this work due to the loss argument. The training procedure consists of adequate iterations on 'epochs' dataset that utilizes epochs argument. The total dataset rows considered prior to the model weights are updated within each epoch is termed as batch size that utilizes batch_size argument.

4. Evaluation of the Model: A neural network is trained on the training dataset and therefore the model is evaluated on the test dataset using the evaluate() function. The test dataset is passed as input and output i.e., X_test and y_test. This generates a prediction for every input and output pair and collects scores, including the average loss and metrics like accuracy. The evaluate() function returns a listing with dual values. The primary is going to be the loss of the model on the dataset and the secondary is going to be the correctness of the model on the utilized dataset. Figure #4 depicts the loss and accuracy plot of the model implemented by us. Table #4 indicates foremost classification metrics report. The metrics are expressed as a macro and weighted average. The metrics are calculated by using true and false positives & negatives for the anticipated classes. In order to ensure accuracy of the predictions, Precision, Recall & F1 score are utilized.

Figure 6: Loss and Accuracy Plots

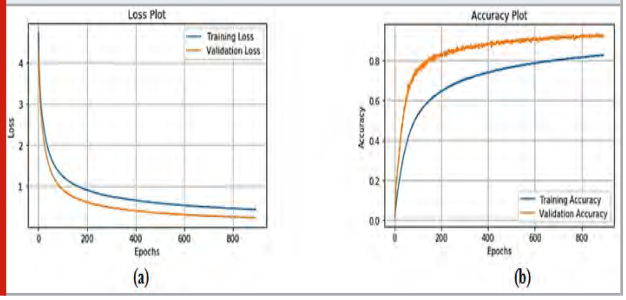


Figure 7: Comparison between true and predicted cycle numbers

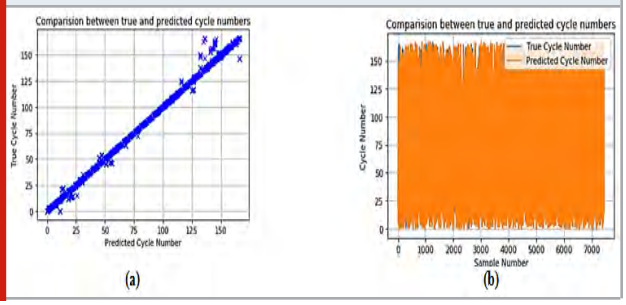


Table 3. Deviation between True and Predicted value for misclassified samples

True Value of Remaining Discharge Cycles	Predicted Value of Remaining Discharge Cycles	True RUL (%)	Predicted RUL (%)	Deviation from the expected output with sign	Deviation from the expected output without sign
51	45	30.54	26.94	6	6
139	140	83.23	83.83	-1	1
151	150	90.42	89.82	1	1
149	148	89.22	89.22	1	1
151	150	90.42	89.82	1	1
19	20	11.38	11.97	-1	1
58	59	34.73	35.33	-1	1
155	134	92.81	80.23	21	21
161	160	96.40	95.81	1	1
139	140	83.23	83.83	-1	1

Table 4. Classification Report

	Precision	Recall	F1-Score	Support
Accuracy			0.94	7440
Macro average	0.94	0.92	0.92	7440
Weighted average	0.95	0.94	0.94	7440

Precision: Precision is an ability of classifier to avoid false positives. It is a ratio of true positives to the combined true and false positives[8].

$$\text{Precision} = TP / (TP + FP)$$

Recall: How effectively a classifier can detect all positive occurrences in every class is termed as recall. It is the ratio of true positives to the aggregate of true positives and false negatives .

$$\text{Recall} = TP / (TP+FN)$$

F1 score: The F1 score is a weighted mean of precision and recall. A good F1 score is indicated by 1 while worst by 0. Typically, F1 scores are estimated to be lesser than exactness measures due to use of accuracy and review.

F1 Score = 2*(Recall * Precision) / (Recall + Precision)

Table #3 summarizes the True RUL (%) and Predicted RUL (%) and also the deviation between the true and predicted values for some of the random samples. And Figure #7(a) approximates to linear nature whereas in Figure #7(b) True Cycle Number curve almost overlaps with the Predicted Cycle Number curve. The above-mentioned results justify the prediction efficacy of RUL by our model.

CONCLUSION

A novel RUL prediction model based on Multi-Layer Neural Network which performs Multi-Class Classification by appending a softmax function to the last layer is illustrated. The reproduction result shows an optimum accuracy score of 93% when six layers are used in the network. Experimental analysis indicates a decline in the accuracy when the number of layers deviates. The proposed technique does not rely on complicated battery electrochemical principles resulting in better versatility and can be deployed for RUL prediction of numerous kinds of batteries. According to the model metrics, the proposed method can be suitably deployed for RUL estimation of electric vehicle batteries. Moreover, by the virtue of cloud technology, a real-time RUL prediction about the battery and its maintenance timeline is possible. The RUL estimation tool proposed in this paper may benefit the upcoming automotive industry, particularly for electric vehicles.

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Detection and Classification of Traffic Signs for Driverless Cars

Palash P. Thakur[1], Sharayu R. Choudhari[2] and Vikas R. Gupta[3]
[1]*Student at Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[2]*Student at Shri Ramdeobaba College of Engineering and Management, Nagpur, India*
[3]*Assistant Professor at Shri Ramdeobaba College of Engineering and Management, Nagpur, India*

ABSTRACT

Better autonomy will reduce the risk of dangerous driving and accidents. Driverless cars require robust and error free architecture in order to ensure the maximum safety of a person. Hence it is important for every driverless system to be able to identify traffic signs with maximum accuracy. In order to solve this problem, we have proposed a robust solution to detect and classify traffic signs for self-driving driverless cars. It is two stage architecture with a detection algorithm used to detect traffic signs followed by a classification algorithm which classifies detected traffic sign into 43 categories. Canny edge detector is used to detect the edges of the localized traffic sign and to draw shape-based boundary around traffic sign. The detection algorithm used here is YOLOv3 which is state of the art detection algorithm and it is used for real time detection of objects. The classifier architecture is build using CNN (Convolutional Neural Networks) and it is trained on 86,989 images, each of size 32x32 with 3 color channels. The original dataset is the German Traffic Sign Detection Benchmark (GTSDB) with 50,000 images and imbalanced classes, and with the help of equalization of images and some pre- processing it is converted into balanced dataset. The training and testing of detection model is performed on the German Traffic Sign Recognition Benchmark (GTSRB).

KEY WORDS: TRAFFIC SIGN DETECTION, DETECTION AND CLASSIFICATION, CONVOLUTION NEURAL NETWORK, YOLO, CANNY EDGE DETECTOR.

INTRODUCTION

Advanced driver assistance system (ADAS) requires robust and accurate architecture. Any driverless car must be able to identify all the major objects that comes under its surrounding. One of the most important task in designing Advanced Driver Assistance System(ADAS) is the accurate detection of traffic sign. Since there are large number of traffic signs available, it becomes difficult task for one to accurately detect and classify traffic signs with the same accuracy of driver enabled cars. If any ADAS is deployed without the traffic sign detection architecture, it may result in fatal accidents. There are many traffic sign detection architectures available that deals with the individual set of problems. In referenced paper, CNN aggregate network is used with limited set of data and the model is only able to detect circular and triangular traffic signs. In another paper, the traffic signs are classified into 5 classes, but individual classification is not performed, SVM (Support Vector Machine) is used for detection and CNN is used for classification. In one of the paperYOLOv2 is used for detection task, CNN architecture is used for classification of only 16 traffic signs. German traffic sign dataset is used with no preprocessing as the dataset contains class imbalance problem and model is trained with imbalance class.

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*****Corresponding Author: thakurpp@rknec.edu
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The most challenging task in traffic sign recognition is that it occupies very little space in a frame and it becomes difficult task to detect such small object in a given frame. Currently there are many state of the art detection algorithms is available that can detect any object it is trained on. The challenge comes when the detection in done in real time. Even though most of the detection architecture are state of the art, but they fail to deliver fast and real time detection of objects. If we consider Faster R-CNN, it has complex architecture inspired from VGG16 and it cannot be used for real time applications. Whereas YOLOv3 has simpler architecture and can be used for real time detection of objects.

YOLOv3 is single stage detector and it compromises with the accuracy while detecting and classifying at the same time. It is good in detecting small objects like traffic sign in our case but fails to classify them due to its architectural design. Tasks where detection and classification both are involved; multistage methods are proven to be more effective as compared to single stage. Training any model requires a good quality of sufficiently large dataset. GTSRB and GTSDB is the German traffic sign benchmark dataset for both detection and classification and it is used in most of the problems which deals with traffic signs.

In this paper our ultimate goal is to overcome the flaws that previous papers have and create a combined architecture that detects, classify and draw bounding box around the traffic sign based on its shape. We have used YOLOv3 to detect location of traffic signs on a given frame of video and designed a shallow multilayer perceptron architecture with convolutional layer to classify traffic signs into 43 categories and Canny edge detector is used to detect boundaries of traffic signs. Dataset used to perform detection and classification is German traffic sign dataset but with some preprocessing to overcome class imbalance problem.

Proposed Approach: The intuition behind developing the model is to create a solution that solves multiple problems in a single pipeline, and consume least hardware resource and is fast and accurate too. We have partitioned entire model into two parts where each part performs the task assigned to it. The two phases are detection phase and classification phase respectively. The detection phase detects the images from given frame and return actual location of image from given frame and classification model classifies the detected part of image into respective category of traffic sign and returns the name of predicted class along with the probability. Instead of drawing rectangular bounding boxes we have performed shape detection for which we have used Canny edge detector.

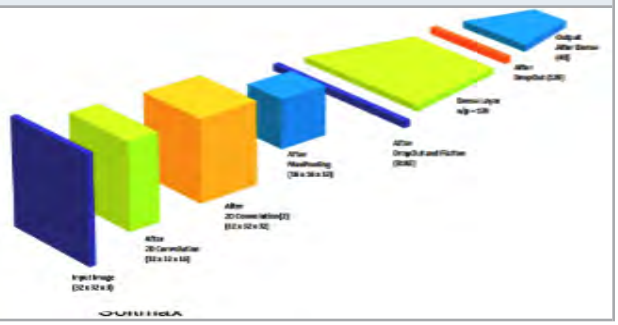
A. Detection Phase: There are large number of state of the art detection algorithms available. They detect and classify large variety of objects and are trained on very huge dataset. But while dealing with the tasks related to driverless cars, real time and fast detection plays a very important role. Many state of the art algorithms are proven to be ineffective in real time detection due to their complex architecture. While all other algorithms fail, YOLO is promising in real time and fast detection of objects. For the detection task we have used darknet framework in order to train our detection model. The YOLO weights are trained specifically for the detection of traffic signs. We are using YOLOv3 as a detector model. The traffic signs are divided into 4 random categories so as to perform detection task on them. Since as per the architecture of YOLO we cannot keep only one class in detection. The formula for determining batch size is:

Batch size = Number of Classes * 2000

Figure 1: Yolov3 actual architecture

	Type	Filters	Size	Output
	Convolutional	32	3 × 3	256 × 256
	Convolutional	64	3 × 3 / 2	128 × 128
1×	Convolutional	32	1 × 1	
	Convolutional	64	3 × 3	
	Residual			128 × 128
	Convolutional	128	3 × 3 / 2	64 × 64
2×	Convolutional	64	1 × 1	
	Convolutional	128	3 × 3	
	Residual			64 × 64
	Convolutional	256	3 × 3 / 2	32 × 32
8×	Convolutional	128	1 × 1	
	Convolutional	256	3 × 3	
	Residual			32 × 32
	Convolutional	512	3 × 3 / 2	16 × 16
8×	Convolutional	256	1 × 1	
	Convolutional	512	3 × 3	
	Residual			16 × 16
	Convolutional	1024	3 × 3 / 2	8 × 8
4×	Convolutional	512	1 × 1	
	Convolutional	1024	3 × 3	
	Residual			8 × 8
	Avgpool		Global	
	Connected		1000	
	Softmax			

Figure 2: CNN architecture



At the same time batch size should not be less than 2000, hence we cannot keep only one class in detection as well, so to avoid this error and to increase batch size we divided traffic signs into 4 parts prohibitory, danger, Mandatory and other. Yolov3 has 53 layers stacked with more 53 layers making total of 106 layers. It has ability to detect small objects and retain low level features, as in our case traffic signs occupy very little space in any frame. There are various types of Yolo architectures are available, we used 416 x 416 model from darknet.

Input to the network= (n, 416,416,3)

Where n= Number of image
We are requiring to re calculate number of filters after every convolution layers. The formula to calculate filters is

filters = (3*(5+4))= 27

In Yolo detection is done at three stages (layers):82,94,106.

At each stage image is down sampled by 32. Every stage is responsible to draw 3 bounding box around that object. With the help of non-maximum suppression and the IOU (Intersection over union) the correct bounding box is predicted. fig. 1 shows the architecture of YOLOv3.

In our model we are taking the coordinates of traffic sign from given image so as to crop the part of image containing traffic sign and then passing that part to our classification model.

B. Classification phase: In the detection module, the output we get is the part of the image that contains the traffic sign. But this traffic sign is unclassified. For classification of the Traffic signs into its classes, we use a Neural Network that can classify the given image of traffic sign into 43 unique classes. The Neural Network Comprises of several of the following layers:

1. Convolutional Neural Network
2. Max Pooling
3. Flatten
4. Dropout
5. Dense

These Neural Networks perform various major tasks in classifying the input image in the 43 classes. The Output of the Detection Phase i.e. the YOLO network is first preprocessed, resized into an input image of 32 x 32(x 3 channels) and given as an input to our classification Neural Network. The Neural Network architecture is shown in fig. 2.

The Convolution Layers retains the properties of the image that is been given input. The series of 2 Convolutional Layers were given an input of (32 x 32 x 3) and Output as (32 x 32 x 32). In this case we haven't reduced the size of the image using 2D Convolution since we have used a MaxPooling layer for reducing the image. The MaxPooling Layer Reduces the size of 2 axes of the input to half in this network, without retaining the major properties. The input shape is (32 x 32 x 32) and Output (16 x 16 x 32). The DropOut layer ignores a small percentage of training data so as to avoid overfitting of the model on the training data. Overfitting associates with high accuracy on training data but a significantly lesser lower accuracy on testing data. The DropOut layer is followed by the Flatten Layer which converts the 3D array into a 1D Array i.e. (16x16x32) to (8192). This converts the 3D array to an input for the Dense Layers.

Dense Layers consist of many layers which convert Input into a desired output shape having many trainable weights. Here we converted (8192) shaped array into (128) shaped array. This is again followed by a DropOut layer for avoiding overfitting. Adding a Dense Layer again, output shape is (43). These 43 Output are the probabilities of the 43 classes where we take the highest class probability and classify the image.

The Output layers are Categorical classes, so the Activation Function for the Output Layers have SoftMax activation function We train this Neural Network by using a Dataset which is shown later in this paper. While training the Network, the time required to train and the accuracy of the model depends on the following factors,

1. Optimizer used.
2. Number of Epochs.
3. Correct Loss function

Figure 3: Accuracy vs Epochs

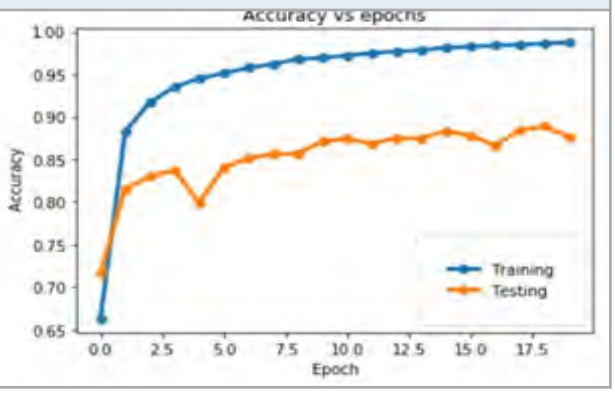


Figure 4: Different classes of traffic signs

We use Adam Optimizer in this case. Adam optimizer is a combination of Gradient decent with momentum and RMSprop optimizers. It combines the benefits of both the optimizers into one. The v t part of the formula refers to the Gradient Decent part and the s t part refers to the RMSprop part. The number of epochs for which the Network is trained determines the accuracy. The more it is trained it is the better is the accuracy. But after some

particular number of epochs, the accuracy saturates and increases very slowly. This is the ideal point. The fig.3 shows accuracy vs epochs plot for training (blue line) and testing (orange line) dataset.

The output consists probability distribution in between 43 different classes, so use of relevant classification loss function i.e. Categorical Cross Entropy is used. This gives the system the correct Loss function according to the data.

C. Edge Detection: As discussed in the approach, we are drawing the edges or the approximate boundaries of the traffic signs with the help of their original positional coordinates that are returned by Yolov3. By default, we can draw rectangular bounding box around the detected traffic sign but it gives no information about the edges, shape and orientation of traffic sign. There are large number of edge detection algorithms are available. Sobel, Canny, Prewitt, Roberts, and fuzzy logic methods are common methods to detect edges. In this model we used Canny edge detector.

III. Dataset: Any deep learning problem requires a huge amount of good dataset that can be used to train, validate and test our algorithm for its speed, accuracy and error. There are various types of datasets available when dealing with traffic sign. In one of the paper, authors have used Japanese dataset for training their model. Same way Chinese data too is available and it is open source. In our paper, we are using German traffic sign dataset [German paper] which is benchmark for traffic sign detection and classification. The dataset is German traffic sign detection benchmark (GTSDB) and German traffic sign recognition benchmark (GTSRB). The GTSDB dataset is used to train Yolov3 for the task of detection of traffic signs. The dataset comprises of total 900 images out of which we are using 800 for training and 100 for testing. The images are labeled and provided with the coordinates of bounding boxes on that image. The sample images are as shown in fig. 5:

Figure 5: Representation of training dataset for detection task with bounding boxes around traffic signs

The images for training has resolution of 1360 x 800. Since Yolov3 down samples the image into 416 x 416 we do not need to be worried about the resolution of images. The detection model is trained on this dataset. Classification model requires very large amount of images of traffic signs. Since we are aiming to categories 43 classes, dataset with very low number of images are not going to give us the good result. The GTSRB dataset is used for classification without extra preprocessing.

The problem with the original dataset is that the classes are highly imbalanced. Imbalance in class will result in unequal distribution of weights to the traffic signs and result is false accuracy.

We have trained the classification model with the original dataset and the training and testing accuracy is 99.9 %, the dataset has 50,000 images. However, we cannot give more priority to accuracy when we know that the classes are highly imbalance and we are training on imbalance classes. Before start training, we have to make sure that the classes are equally distributed. For this we applied rotation and brightening to all the images to create new samples. The sign of the dataset has increased to almost 87,000 after applying this technique of data augmentation. Histogram of the classes of traffic sign against their frequency in the dataset before and after equalization by adding transformed images (brightness and rotation) from original dataset is shown in fig. 6. Sample of dataset containing different classes is shown in fig. 3. After training the classification model, the training accuracy is 98% and testing accuracy is 90%.

Figure 6: Histogram of dataset before and after preprocessing

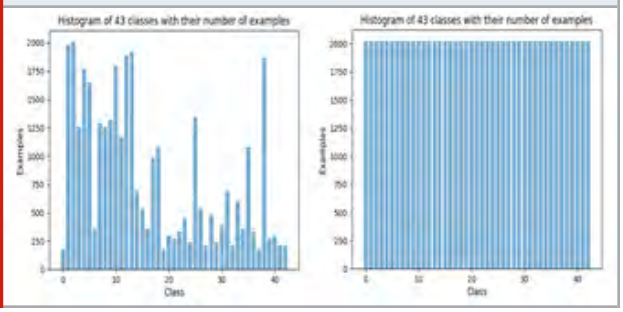
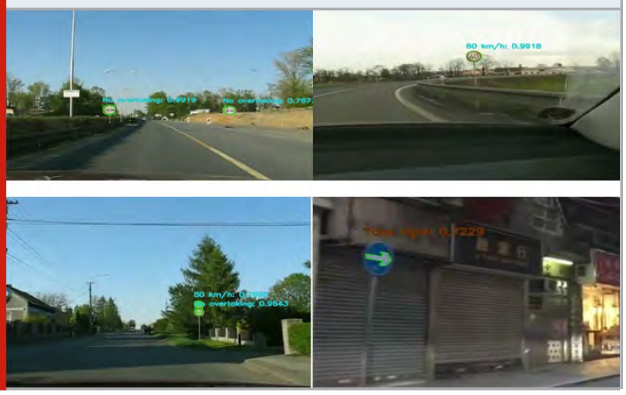


Figure 7: Detected traffic signs



RESULTS

The network when given an input of an image or video, gives out the image with localised Traffic sign and its class. The model works efficiently in most lighting and weather conditions and is tested on such conditions. For a better visualization of the traffic sign, the edge detection model is also applied for localization. The detection model has mAP (mean Average Precision) of

93 %. The classification model has testing accuracy of 90%. We can see the sample output images in fig.7. The darknet framework (YOLOv3) can compute using CPU as well as GPU power. In this case we tested it on both. CPU took approximately 1 second to process 1 frame (Intel i5 9 th gen) and GPU took approx. 0.28 second to process 1 frame (GPU by Google Colab) The GPU setup takes 0.28 seconds to process 1 frame. So, the processing speed is approx. 3 fps (Frames per second) on GPU. On CPU it is 1 fps.

CONCLUSION

In this paper, we have detected and classified traffic signs out of raw images. These signs are classified into 43 classes and then are localized using edge detection technique. Here, two stage model is used. One for classification and one for detection. The model is able to detect images in both bright and low light condition. This approach led us to compromise with speed but it is delivering better accuracy. The use of two stage model is done because of lack of good quality of sufficient dataset and computing power, which is required to train a detection model. The speed of model can be improved significantly by using only one model. The model sometimes fails to detect traffic signs from very high resolution videos. Training it on a larger dataset with a better and more diverse resolutions will be done in future. Improving the classification dataset by increasing the variety of resolutions and the number of classes of the training dataset to improve the classification accuracy. The maximum processing performance obtained is 3 fps whereas the real- time input usually works on 25-30 fps. Optimising the performance using known techniques will be done. A new architecture similar to this using shape detection specially designed for detection of traffic signs can be implemented to decrease the noise that will be the input of the Architecture, hence increasing accuracy.

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DC-DC High Voltage Multiplier for Small Satellite GPR

Ravi K Tanti[1], Saurabh Warathe[2] and Sharmik Admane[3]
[1,2,3]Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management Nagpur, Maharashtra, India

ABSTRACT

The purpose of research in this paper is to satisfy the power constraints of small satellite missions and rover equipped with GPR's. As a large number of rovers are solar powered and battery-operated generating output voltages between 28V to 32V. The GPR works on high voltage Radar pulses hence we require a circuit converting the low voltage of battery to high voltage and for the same, we have proposed a DC to DC converter that converts few Volt to few Kilo Volt which is required by various applications such as RF antennas for transmission of data and making the GPR's suitable for small space missions. In this research, the concept of voltage multiplier is used and a modified Dickson charge pump is designed to generate 400V DC from 30V DC and is ideal for battery operated applications. The main advantage is that the overall size of the booster circuit is very small and hence adequately fits the weight constraints which are favorable for small space missions and can fit into small compact rovers and satellites.

KEY WORDS: CHARGE PUMP (CP), GROUND PENETRATION RADAR (GPR), HIGH-VOLTAGE-GAIN DC-DC POWER ELECTRONIC CONVERTER, MODIFIED DICKSON CHARGE PUMP, VOLTAGE MULTIPLIER (VM).

INTRODUCTION

The electromagnetic (EM) waves are the key components innumerous applications such as communication, medical instrument, and scientific exploration. Ground Penetration Radar is one of the applications which operates on the principle of propagation of EM waves. In the real world, GPR based equipment's used by civil engineers, archeologists, ore miners and bomb/mine detectors and several more. To conduct scientific experiments for extraterrestrial missions along with rovers, GPR was used to investigate interior geological structure. In 1973, Apollo Lunar Sounder Experiment (ALSE) carried under the US Apollo mission program with the help of multiband GPR. A GPR uses a non-destructive method in which a nano second pulse of very high magnitude is transmitted by a narrow band antenna and which encounters with the surface.

When the electromagnetic pulse strikes the surface, a fraction of pulse gets absorbed, remaining gets reflected as shown in Fig 1. The reflected portion is then collected by the broadband receiving antenna. On analyzing the reflected waves, the results are usually presented similar to seismic data, where the hyperbolas are observed. By processing the data, we can determine the depth and the dielectric constant of material. The reflection component is the factor of power which is reflected after scatting and absorption which is given by equation (1) where the reflecting component depends on material dielectrics constant K1 and K2.

$$R = \frac{\sqrt{K1}-\sqrt{k2}}{\sqrt{K1}+\sqrt{K2}} \quad (1)$$

Where R is the reflected power coefficient and K1 and K2 are the dielectric constants of the material.

The reflected pulse after filtering is sampled, which will give us the reflection time and by which we can determine

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the dielectric constant of material using equation (2). Whereas (nS) is reflection time, distance is in (feet) and (σ) is dielectric constant.

$$\frac{nS}{ft} = 2 * \sqrt{\sigma} \quad (2)$$

Figure 1: Transmitted and reflected component of Incident wave

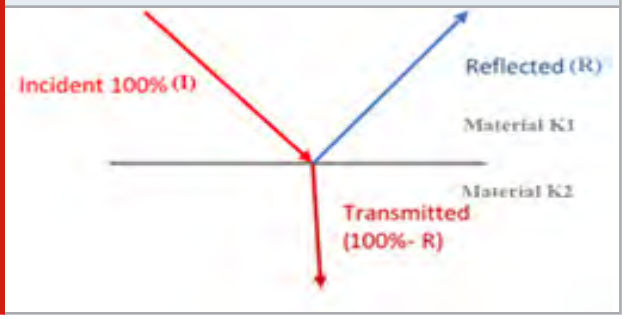
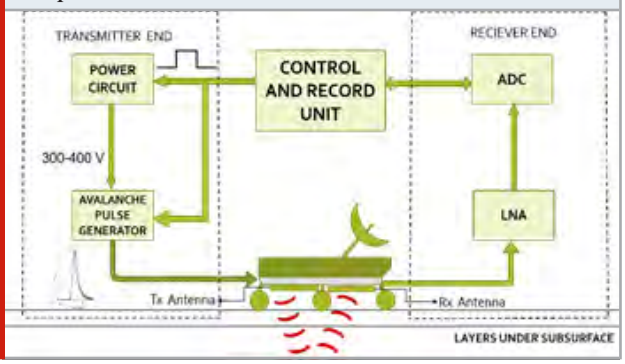


Figure 2: Block diagram of the GPR system and its main components.



To generate a high voltage (HV) nanosecond pulse of 350V to 400V in the transmitter for GPR, Avalanched Pulse Generator is used as shown in Fig 2, which consists of HV and low current power circuit. As this GPR would be installed in small rovers or nanosatellites, there is a stringent constraint and hence there is a need for efficient and lightweight voltage booster circuit. According to a literature work, to boost the voltage Dickson CP can be used, as regardless of many different topologies the conventional boost converter has advantages like few numbers of components which translate into system cost reduction, as the rover is battery operated and has limited power, battery will drain at a faster rate therefore traditional Dickson CP cannot be used, therefore a modified circuit is proposed in section II of this paper.

With the help of rover equipped with GPR we can easily detect permafrost present beneath the surface without actually digging. In 2013, YUTU rover was deployed by CNSA wherein on the lunar surface which operated on frequencies 40–80MHz and 250–750MHz. The Marx bank in the rover produced a pulse of peak amplitude 398.2 V at a 100 Ω load. The planetary GPR discussed above in this paper uses a simple impulse generator with an operating frequency of 500MHz, since lower the frequency, more the depth and lesser the resolution, for which the pulse width is 2ns and has a peak voltage of 350-400V. This narrow pulse of energy is fed to the transmitting antenna having a center frequency of 500MHz, which acts as a filter and produces a wave that is broadcasted. Then the reflected waves are collected by the receiving antenna as a function of time.

Research work proposed in has achieved a similar objective to generate 400V from an input of 30 V. But when considering celestial mission's, size plays a vital role in designing any system. As this design uses heavy and bulky components like transformer and switches which contributed to the main loss of power in circuit. Therefore, a similar design is proposed in this paper which removes the necessity of transformer and can work efficiently with only two switches as shown in Fig 3.

Figure 3: Block diagram for power supply in GPR

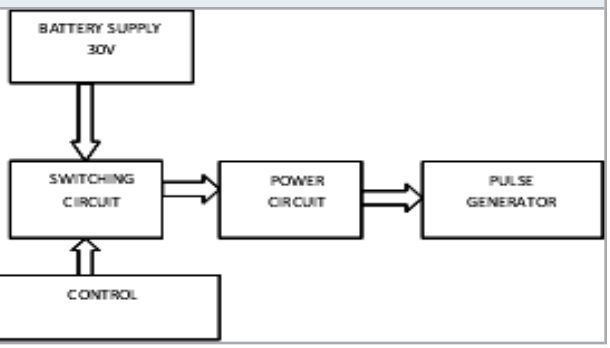
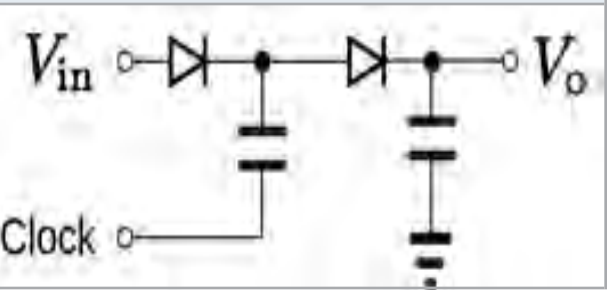


Figure 4: Dickson charge pump.



Dickson CP can be used to generate a voltage from few volts to few kilovolts for electronic appliances, it offers better efficiency, higher reliability at an improved power quality and low cost compared to AC distribution systems. This circuit can be used in applications requiring variable high voltage having weight constraints such as small payload satellite, data transmitting antenna, power delivery to multiple processors, and GPR. The use of classic boost and buck-boost converters require high duty ratios, which results in high component stress and lower efficiency. Isolated topologies like fly-back, forward, half-bridge, full-bridge, and push-pull converters have discontinuous input currents and hence, would require large input capacitors.

2. Dickson Charge Pump: Distribution systems working at 400 V DC have been gaining admiration as they offer enhanced efficiency and greater reliability at an enriched power quality, and low cost compared to AC distribution systems. The Dickson CP or Dickson multiplier consists of a cascade of diode/capacitor cells with the bottom plate of each alternate capacitor driven by a train of the clock pulse. However, a voltage doubler, shown in Fig 4, requires only one stage of multiplication, only one clock signal is required.

The Dickson CP is not preferred for space missions because of its exiguous size constraints. In a previous research work the value of VM capacitors and output capacitor was 60nF and 22nF respectively, and hence the overall size of the circuit increased. The Dickson CP requires two high-frequency clocks for driving the circuit which are in different phases which leads to difficulties in matching the frequencies. Therefore, a rectified and modified version is proposed such that it fits the weight limitations as well as the problem of frequency matching and the requirement of two clock cycles were also resolved.

3. Proposed Dickson Charge Pump For Battery Operated Appliances: The proposed Dickson CP circuit shown in Fig. 5, offers high DC voltage while conserving battery power. The input voltage is a modified square wave (MSW) having a peak of voltage equal to VIN. The voltages of the capacitors in the Dickson CP double at each stage as one transfers from the input-side capacitor to the load-side capacitor. Voltage increases with the stages which give the flexibility to run different equipment having different voltage requirements with a single power source. For an output voltage of VOUT= 400V. In Fig 5, there is a controlling element present between VIN and the CP. For RADAR application and GPR's the signals need not be sent continuously hence no continuous power supply is required. As the pulse generator requires high voltage for a very small instance of time so, it draws power from source/battery for the time required to reach 400V and for the time required to transmit data. As soon as the data is transmitted, the supply is disconnected from the circuit and hence power is not wasted.

Figure 5: Proposed Dickson charge

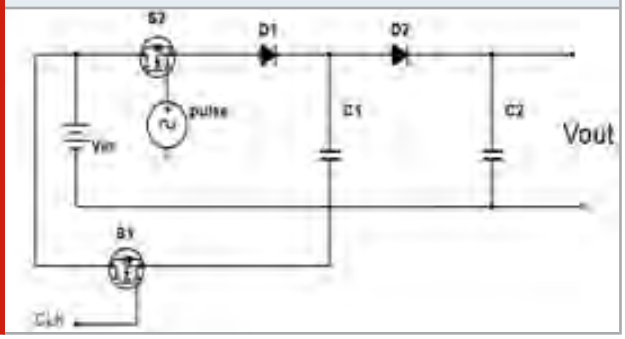


Figure 6: Output curve for the given input.

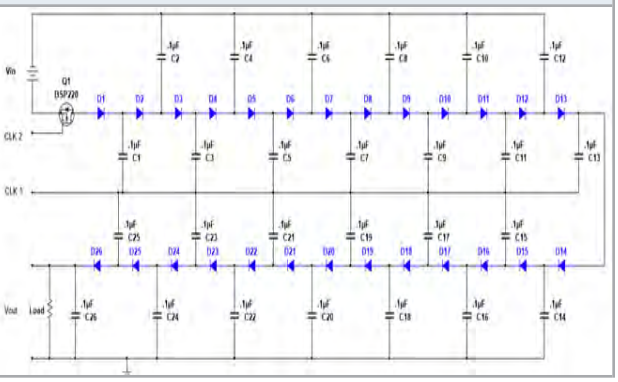
4. Topology And Operation: The improvised converter provides a high voltage gain using the modified circuit. It is composed of cascaded diode and capacitors, where each alternate capacitor is fed by a continuous square wave through switching MOSFET S1 refer Fig 5. Whereas switching MOSFET S2 is fed by a square pulse. Fig 6. shows the simulated result of the output waveforms for the proposed circuit. As soon as the switch S2 is turned on and square wave is applied to S1, the voltage does not reach 400V instantly, it takes some initial time to attain a maximum of 400V this is the setup time for the proposed circuit.

Theoretical Analysis

$$VOUT = N (V_{PP} - V_D) + V_{DC} \quad (3)$$

From equation (3) we can determine the output voltage for the given circuit. The output voltage from the first stage where N = 1 was found to be 45V. Similarly, the output voltage for 26th stage i.e. N = 26 was found to be 420V.

Figure 7: Circuit diagram of 26 stage



The circuit consists of 26 capacitor (C1 – C26) and 26 diodes (D1 – D26) connected in a cascaded form as shown in Fig. 7. Each stage is charged with 30V square wave, where diode acts as a switch. In positive cycle the diode is forward bias hence it charges the capacitor and then passes 2VIN to another stage, where the pulse of another

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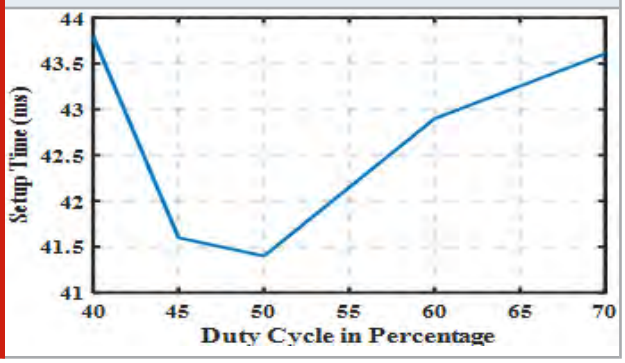
Figure 8: Duty Cycle analysis for 26 stages.



5. Experimental Results: The given designs were tested to obtain parameters like operating frequency, duty cycle, voltage factor and rise time using diverse simulation software and hardware implementation.

a. Duty Cycle Analysis: The input in S1 determines the setup time for the circuit. Frequency and duty cycle are the main parameters which regulate the setup time. The frequency was kept constant to 100KHz and the duty cycle was varied and the setup time reached to 400V. To conclude From Fig 8. it can be observed that as the duty cycle increases, the setup time decreases and then increases gradually with the increase in the duty cycle. Hence, the minimum setup time is 41.4ms which is achieved at 50% duty cycle.

Table 1: Frequency Analysis

Sr. No	Frequency (in Hz)	Setup time
1	100	8.31s
2	500	1.71s
3	1K	876.4ms
4	10K	101.12ms
5	50K	43.89ms
6	100K	41.4ms
7	300K	40.8ms

b. Frequency Analysis: On a similar basis, an experiment is performed by taking multiple input frequencies at S1 with a fixed duty cycle i.e. 50% and setup time is noted until the output reaches 400V refer to Table 1. From Table 1, it can be concluded that as the frequency increases, the setup time decreases and after a particular limit it becomes constant. Therefore, there will be no significant change in setup time after a threshold frequency.

c. Voltage stress Across Capacitor and Diodes: In Table 2, voltage across the capacitor is measured from C1 to C26. Voltage across the capacitor increases as the number of stages increases hence, the capacitor used in the circuit should be rated above VOUT. Whereas the voltage across the diode is constant through the circuit i.e. 15V.

Table 2. Theoretical Analysis

Sr. No	Capacitor	Voltage (V)
1	C2	60
2	C4	90
3	C6	120
4	C8	150
5	C10	180
6	C12	210
7	C14	240
8	C16	270
9	C18	300
10	C20	330
11	C22	360
12	C24	390
13	C26	420

To study the voltage stress across each capacitor and diode, an experiment was conducted in which the voltage across each capacitor was calculated, it was found that as the number of stages increases, the voltage stress on each capacitor increases but the voltage across diode remains almost constant irrespective of the number of stages.

From table. 3 the voltage across diode was found to be ~15V. In order to verify the analytical result, simulations were performed, the difference between the analytical result (table. 2.) and the simulation result (table. 3.) is less than 10%. Hence, the analytical expression is still effective for the CP.

d. Rise time fall time Analysis: The time required for a pulse to rise from 10 % to 90 % of its steady state value is its rise time. In this analysis, the rise time of the circuit is tested for a different number of stages and then for three different input voltages.

Table 4. Rise Time For Different Input Voltages and No. of Stages.

For 10 v I/P		For 20 v I/P		For 30v I/P	
No. of Stages	Rise Time (mS)	No. of Stages	Rise Time (mS)	No. of Stages	Rise Time (mS)
6	1.73	6	1.498	6	1.373
12	6.492	12	5.618	12	4.99
18	13.75	18	11.99	18	11.15
22	22.04	22	17.44	22	16.47
26	27.34	26	24.48	26	22.97

Figure 9: Dependence of rising time on No. of stages and I/P voltages.

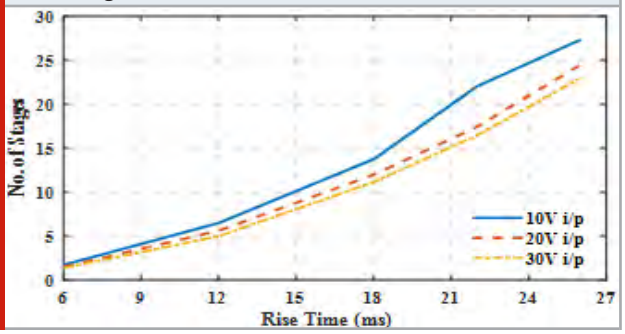


Fig. 9 shows the dependency of rising time on the optimum number of stages and different input voltages. The rise time proportionally increases with the number of stages in case of a large number of stages. On the other hand, from table 4, we observe that the rise time is greater when the input voltage is less i.e. at 10V, the rise time at the 26th stage is 27.34ms, while the rise time at 30V input is 22.67ms.

e. Practical vs Simulation analysis of Output voltage: The proposed design was fabricated as shown in Fig 10. and the measured and simulated results were compared in Fig 11. it can be noted that there exists a goodmatch between the simulated and measured results.

To examine the dependency of the output voltage on the VDC, an experiment was conducted in which the VPP of the square wave was kept equal to the VDC and the obtained results were plotted as shown in Fig11. [a].

Figure 10: Fabricated proposed Dickson charge pump.

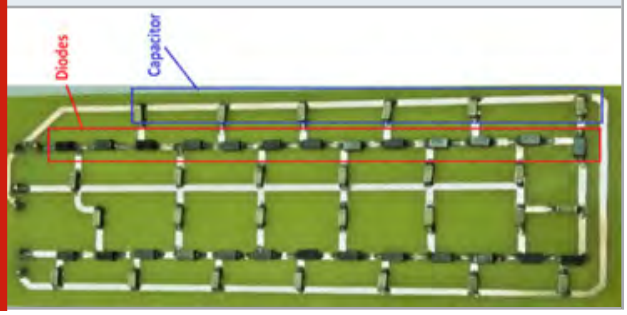
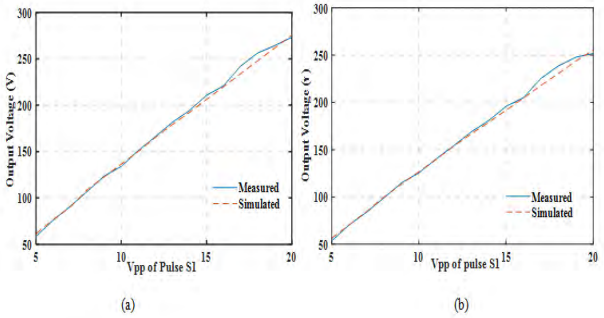


Figure 11: [a] Output voltage when VPP= VDC, [b] Output voltage when VDC= 0V.



From the above experiment, it was found that the VDC is directly added to the output. Therefore,

Output voltage = Boasted voltage + VDC

From Equation (3) we state that

$$V_{OUT} = N (V_{PP} - V_D) + V_{DC}$$

Whereas, the dependency of the output voltage on the VPP of the square wave is given by equation (4), and it was examined in which the VDC was grounded and the results obtained were plotted as shown in Fig. 11. [b]. From the above experiment, it was found that the output voltage is boosted as the VPP increases. Therefore, the

$$V_{OUT} = N (V_{PP} - V_D) \quad (4)$$

CONCLUSION

In this paper, a high-voltage-gain DC-DC converter is introduced that can offer a voltage gain of 14, in order to step up a 30V input to 400 V output which can be given as an input to the pulse generator of GPR. The power circuit consists of a controlling element which will prevent the continuous battery drainage problem caused by pulse generator and will supply power only when required. The minimum setup time of 42ms was achieved at 100KHz with 50% duty cycle and the voltage across the capacitor varies from 30V to 400V, which indicates that it can be used to supply variable voltage. As the number of stages were increased the rise time also increased proportionally. The rise time at 10V input on

the 26th stage is 27.34ms, and the rise time at 30V input is 22.67ms. From the practical analysis, it was found that the VOUT mainly depends on VPP whereas, VDC directly gets added to VOUT. The proposed converter is based on single-phase Dickson CP VM circuit. It can draw power from multiple sources offering continuous input current, making the converter well suited for RADAR application such as GPR and applications requiring high variable voltage.

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