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CLASSIFICATION OF ALZHEIMER'S DISEASE USING CONVOLUTIONAL NEURAL NETWORKS

Sumedh Santosh Mahale*1

*1Department Of Information Technology, B.K. Birla College Of Arts, Science & Commerce (Autonomous), Kalyan, 421301, Maharashtra, India.

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ABSTRACT

Due to their sensitivity, the difficulty of executing surgeries, and other factors, disorders related to the brain are among the most difficult diseases to treat and their hefty prices. Contrarily, since the procedure's outcomes are not guaranteed to be successful, it is not necessary for the operation to be successful. One Alzheimer's disease, which affects adults and causes memory loss, is one of the most prevalent conditions that damage the brain and various degrees of information forgetting. based on each patient's condition. For these reasons, it's crucial to identify memory loss, determine the patient's severity of cognitive impairment, and determine the patient's diagnosis of Alzheimer's disease by brain CT scans. In this thesis, we explore methods and techniques for using deep learning classification to categorize Alzheimer's disease. In large studies, this strategy is utilized to improve patient care, save expenses, and allow for speedy and reliable analysis. The model will be created. The Python programming language was utilized to construct the system, which is particularly valuable for clinicians in identifying Alzheimer's disease. Our trained model got a 100% accuracy by using 70% of the image for training and 30% for validation on a stalled test set.

Keywords: Deep Learning, Alzheimer's, Classification, CNN.

I. INTRODUCTION

Every human being has three main memories: first, working memory, which oversees attention and focus while receiving data and information, secondly, short-term memory, which is responsible for storing data for a period of no more than one day, and finally, long-term memory, which is responsible for recording and storing all the events that we experience for a time of no more than one day. Longer than a few days.

Alzheimer's disease is a brain condition that worsens with time and has a devastating impact on memory, reasoning, and even the ability to perform the most fundamental tasks.

To diagnose patients more quickly and accurately, clinicians can use artificial intelligence (AI). It can foresee the possibility of a disease and predict it, allowing for its prevention. Researchers can analyse medical data and treat illnesses using deep learning.

The interpretation of medical images, however, can be a laborious and time-consuming process.

In this project, a deep learning model will be used to identify Alzheimer's disease in its early stages. There are 10 432 JPEG photos and 4 videos. Categories (Mild Demented, Moderate Demented, Non-Demented, Very Mild Demented) (Mild Demented, Moderate Demented, Non-Demented, Very Mild Demented).

Machine learning (ML), a branch of artificial intelligence (AI), is the study of computer algorithms that enable systems to automatically learn from experience and improve without being explicitly programmed. Through experience, one inevitably gets better. Without being expressly taught to do so, machine learning algorithms create a mathematical model using sample data, also referred to as "training data," to make predictions or judgments.

A feature of artificial intelligence called "deep learning" (also known as "deep structured learning" or "hierarchical learning") mimics how the human brain processes information and builds patterns to be used in decision-making. A deep learning method networks that can learn unsupervised from data are a subset of machine learning in artificial intelligence (AI). Unorganized or without labels. It is sometimes referred to as a deep neural network or deep neural learning. Using a hierarchical level of artificial neural networks, the procedure is carried out by the deep learning branch of machine learning. Of machine learning. Like the human brain, artificial neural networks are built with neuron nodes connected in a web-like pattern web.

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In deep learning, each level picks up the ability to express its input data in a composite representation that is a little more abstract. In an image recognition application, the initial input could be a matrix of pixels; the first representational layer could abstract the pixels and encode edges; the second layer could compose and encode arrangements of edges; the third layer could encode a nose and eyes; and the fourth layer could recognize that the image contains a face.

Furthermore, a deep learning process can learn. Which features should be optimally placed in which level on their own? (Of course, hand tuning is still required; for example, adjusting the number of levels and layer sizes might yield variable degrees of abstraction).

II. OBJECTIVES

- Implemented was the development of a deep learning model for identifying four stages of Alzheimer's disease (mild, moderate, non-demented, and very mild demented).
- Refrain from manual image analysis errors that can occur during diagnostic analysis.
- By enhancing their capacity to analyse medical images, it enables professionals to diagnose patients more quickly and accurately.

Relevance of the study:

One of the key areas of study in medical imaging is deep learning. Deep learning has been applied to the analysis of CT, MRI, as well as X-ray pictures used in pathology, dermatology, uterus cancer categorization, rare diseases, and mouth cancer detection. Additionally, researchers are using deep learning to teach computers to recognize cancerous tissue at a level equivalent to that of human beings a doctor with training.

III. ANALYSING THE LITERATURE

According to the National Institutes of Science, Design, and Medication's Pharmaceutical Organization, "symptomatic Errors account for approximately 10% of all silent deaths "In addition, 6 to 17 percent of clinic complications are due to. Analysts attribute the reason of symptomatic errors to a variety of various factors other than the doctor's execution, for example, gaps in communication between patients' families and specialists and ineffective engagement in wellbeing data innovations. The goal of this thesis is to help with the speed and precision of the conclusion. Even though artificial intelligence has been around for a long time, in machine learning, a machine may take a dataset, evaluate it, and come to a judgement or forecast based on knowledge gained. A more complicated variation of this involves multiple layers of the learning process, known as deep learning.

Deep learning assists researchers in analysing medical data, such as OCT, MRl, and CT images, to treat disorders. Each layer of the algorithm requires some information from the user. Brain MRI images were used in this work to identify and classify multi-category Alzheimer's disease. An extremely the Open Access Chain of Imaging Studies (OASIS) database was used to show the performance of a deep convolutional network. This model has a 73.75% accuracy rate. This model is a deep learning-based segmentation technique that makes use of SegNet to identify features from the brain areas important to AD. ResNet-101 accurately diagnoses AD and dementia disorders using structural magnetic resonance imaging (sMRI). SegNet characteristics are used to train ResNet-101 with the ADNI dataset. 95% of the time, this model is accurate.

This model uses a convolutional neural network to differentiate the brain of an Alzheimer's patient from a healthy, normal brain. Then The value of categorizing this kind of medical data is that it may be utilized to create a system or forecast model that can discriminate between disease from healthy individuals or determine the disease stage. Functional MRI data of successfully classified by the researchers utilizing Convolutional Neural Networks (CNN) with the well-known architecture LeNet5, distinguishing Alzheimer's patients from healthy controls.

This model is a deep learning-based segmentation technique that makes use of SegNet to identify features from the brain areas important to AD. This model's accuracy rate is 96.85%. To learn different characteristics from, this method offers employing multiple deep 2D convolutional neural networks (2D-CNNs). Local brain images are merged to get the final classification for the AD diagnosis. The entire brain scan was successful. Using a proprietary Convolutional Neural Network, two transfer learning architectures (Inception version 3 and

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Xception), and (CNN). This model's findings demonstrate that transfer learning strategies perform better than non-transfer learning-based strategies for the job for binary AD classification.

SegNet is used in this model's deep learning-based segmentation technique to identify properties of the brain areas related to AD. This model shows how the residual and straightforward 3D convolutional neural network designs can produce equal results. By skipping these feature extraction processes, performance on the three-dimensional (3D) dataset of the Alzheimer's Disease National Initiative (ADNI)

The effectiveness of the proposed method for categorizing Alzheimer's disease is shown using structural MRI brain pictures compared to normal controls and moderate cognitive impairment.

This model created an integrative framework by combining cross-sectional neuroimaging biomarkers at the start of the study and longitudinal cerebrospinal fluid (CSF) and cognitive performance indicators from Alzheimer's disease. Cohort for the Neuroimaging Initiative (ADNI). When integrating multi-domain longitudinal data. A multimodal deep learning approach. The approach offers the ability to identify people at risk of acquiring Alzheimer's disease who would benefit the most from a clinical trial or as a preventive measure. Clinical studies use a stratification method.

This model suggests a deep convolutional neural network for determining Alzheimer's infection using information from a brain MRI study. Our program can recognize the many phases of Alzheimer's disease and receives widespread execution for early-stage determination, in contrast to most existing algorithms that only conduct binary classification. This exhibit has a 77% exactness rate and was adequately tested to demonstrate that it outperformed baselines on the Open Get to Arrangement of Imaging Considers dataset.

The usefulness of Rs-fMRI for the multi-class classification of AD and its related stages is examined in this study. We investigate ResNet-18 architecture in detail to give a better understanding of deep learning techniques and their applications to AD classification. To consider the training of the network from scratch by using single-channel input as well as performed transfer learning with and without fine-tuning using an extended network architecture. A longitudinal cohort of resting-state fMRI of 138 subjects (25 CN, 25 SMC, 25 EMCI, 25 LMCI, 13 MCI, and 25 AD). To conduct an AD classification job, we experimented with residual neural networks and evaluated the results against prior work in this field.

The models' effectiveness is assessed employing ROC, AUC, f1-measure, precision, recall, and other curves. We discovered that the subjects may be significantly classified using our networks. With our refined model, we were able to get better results for all phases of AD, with accuracy values of 100%, 96.85%, 97.38%, 97.43%, 97.40%, and 98.01% for CN, SMC, EMCI, LMCI, and AD, respectively. However, in terms of overall performance, we attained cutting-edge results with average accuracy of 97.92% and 97.88% for commercially available and customized models, respectively. According to the analysis's findings, neurodegenerative brain illnesses like Alzheimer's disease can be classified and predicted utilizing. Advanced deep learning techniques and functional magnetic resonance imaging are promising for clinical decision making and may help with early diagnosis.

For the classification and identification of AD in this study, two deep neural network techniques—Alex Net and Restnet50—were used. Brain magnetic resonance imaging (MRI) scans gathered from the Kaggle website were among the data utilized in this work to assess and test the proposed model. To effectively classify AD, a convolutional neural network (CNN) technique was used. Using transfer learning models from Alex Net and Restnet50, CNNs were trained beforehand. The results of this experiment demonstrated that the proposed method's detection accuracy is better than that of the current systems. Based on five evaluation parameters for the brain MRI datasets, including accuracy, F1 score, precision, sensitivity, and specificity, the Alex Net model performed exceptionally well. In comparison to Restnet50, Alex Net outperformed it with accuracy, specificity, F1 score, and sensitivity values of 94.53%, 98.21%, and 100%. The suggested approach may enable CAD approaches for AD in medical research be improved.

IV. METHODOLOGY

Implementing deep learning features for Alzheimer's disease classification using a group of patient pictures. There are 10432 JPEG photos and four categories (Mild Demented, Moderate Demented, Non-Demented, and Very Mild Demented). The model is created in Python using the Kera's and TensorFlow frameworks, and the

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system is supported by Graphics. NVIDIA GPUs are being used to accelerate the execution of deep learning algorithms.

V. LIMITATIONS AND SCOPE

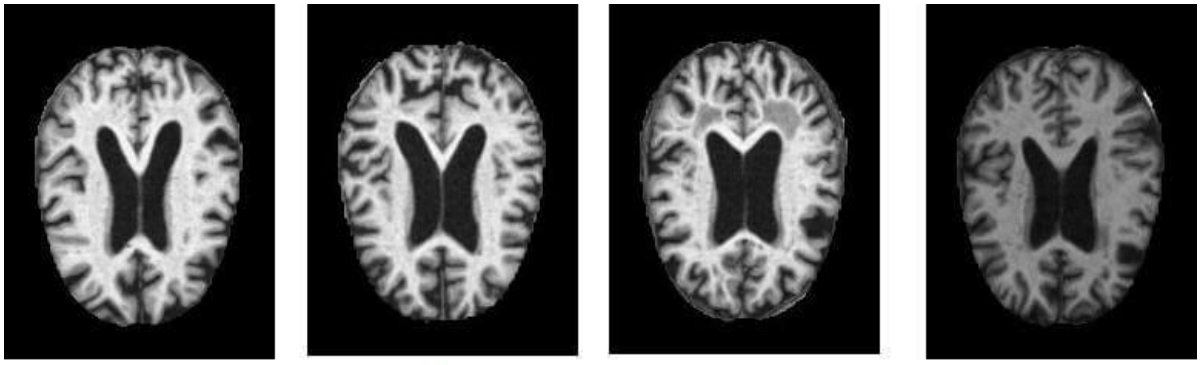
Constraints and difficulties are a part of every project that can be managed and overcome. The system categorizes data. A network research centre was chosen to provide images exclusively (CT, MRI, and X-ray) of Alzheimer's disease. To categorize them, give them various names like "Mild Demented, Moderate Demented, Non-Demented, Very Mild Demented". The training dataset, the mildly demented dataset (2688 images), the moderately demented dataset (2304 images), and the non-demented dataset (3200 images) pictures, along with 2240 photographs of Very Mild Demented.

VI. DATASET

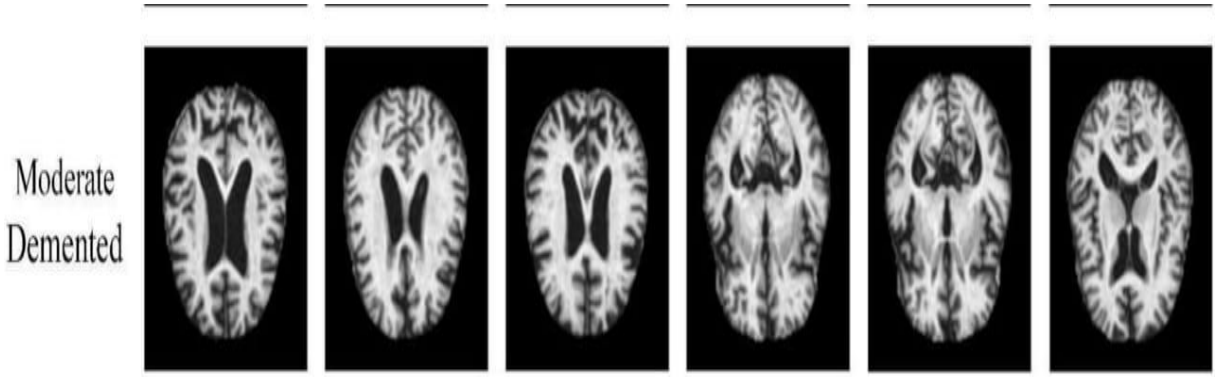
The dataset utilized, provided by Kaggle, provides a set of 10432 photos for testing related to Alzheimer's Disease.

There are four classes of images:

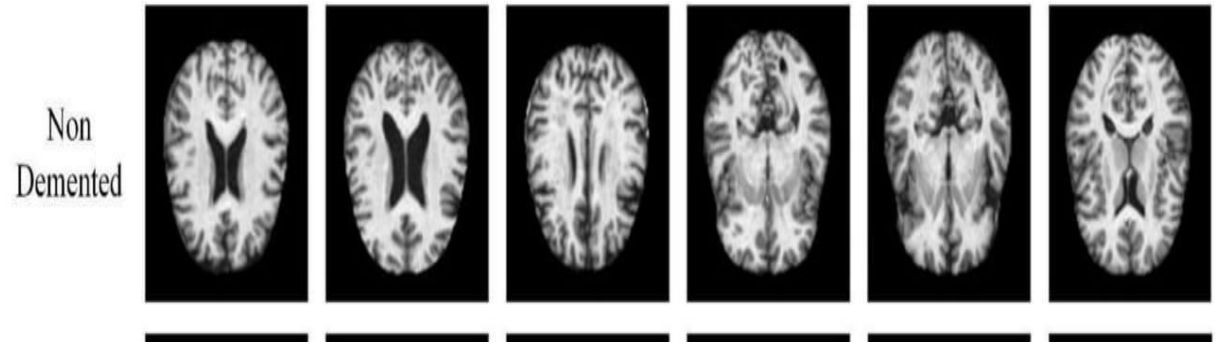
- Class 0 "Mild Demented"



- Class 1 " Moderate Demented"



- Class 2 " Nondemented"



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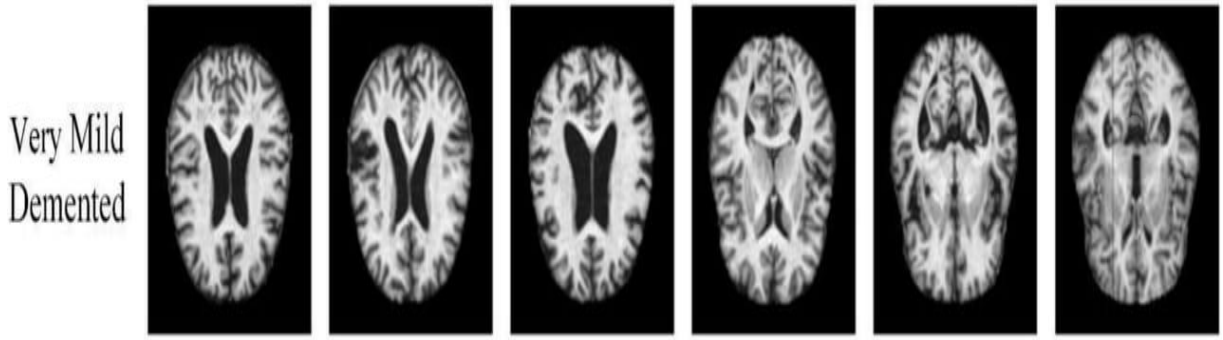
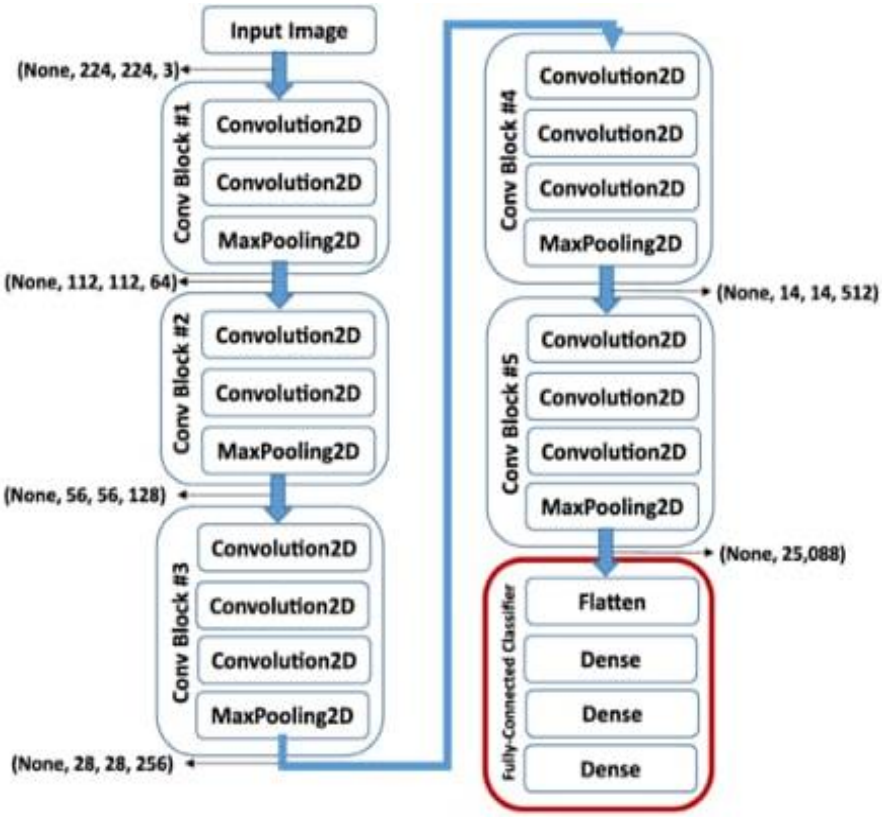
- Class 3 " Very Mild Demented"



Model:

Convolutional Neural Networks - VGG16 application, Adam optimizers, and SoftMax activation Here are several examples:



VII. RESULTS

After reducing the photos to 128x128 pixels, we used the original Alzheimer's disease dataset of 10432 images. We split the data into two categories: training (70%), and validation (30%). Following training, the results were as follows: 100% training accuracy, 0.0012 training loss, 97% validating accuracy, and 0.0832 validating loss.

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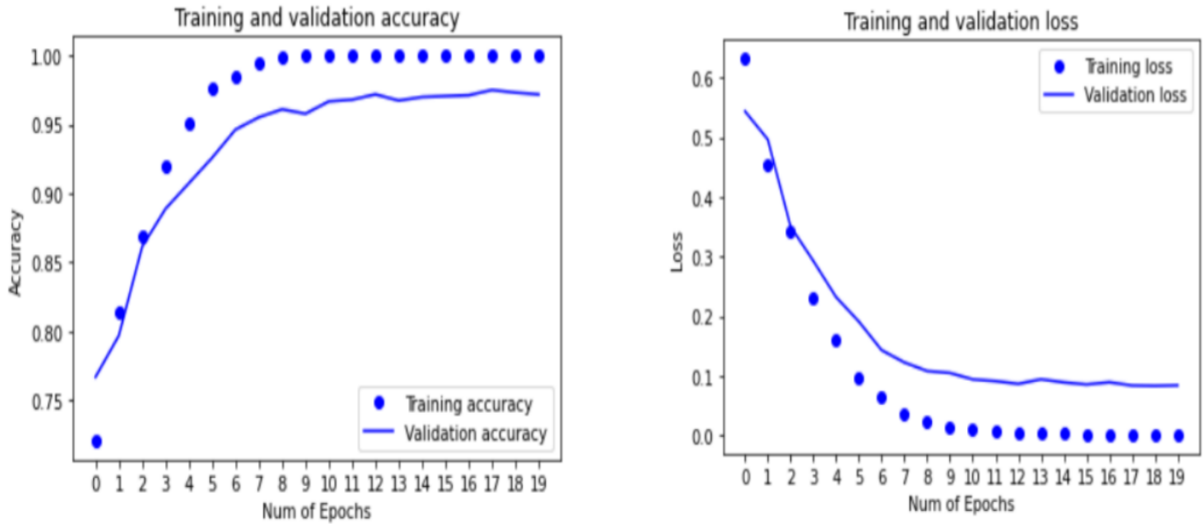

VIII. CONCLUSION

Brain-related diseases are among the most difficult diseases to cure due to their sensitivity, the difficulty of conducting procedures, and the intensity of their symptoms. In contrast, the treatment is not essential for success because the results of the operation may be unsuccessful. Alzheimer's disease is one of the most frequent brain disorders affecting people, causing memory loss and knowledge loss to varying degrees. The state of each patient. For these reasons, using CT scans of the brain to detect memory loss and establish the patient's level of Alzheimer's disease is crucial. In this study, we examine various strategies and methodology for categorizing Alzheimer's disease using deep learning classification.

The proposed method is used in large-scale research to improve patient care, save costs, and allow for quick and reliable analysis. The model was constructed in Python and was used to design a system that helped clinicians classify Alzheimer's disease. After using 70% of the image for training and 30% of the image for validation, our trained model achieved a testing accuracy of 100% on a held-out test set.

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