External Awards

The Surface Science Society of Japan Young Scientist Award
Winner: Manabu Ohtomo, Yoshiaki Sekine, Hiroki Hibino, and Hideki Yamamoto, NTT Basic Research Laboratories
Date: February 8, 2016
Organization: The Surface Science Society of Japan (SSSJ)

For "Etching-free Transfer of Highly-ordered Bottom-up Graphene Nanoribbon."

We report on a novel etching-free transfer method for a highly-aligned bottom-up graphene nanoribbon array grown on a Au(788) surface. This method will pave the way for the device application of ultra-narrow graphene nanoribbons with well-defined edge structures.
Published as: M. Ohtomo, Y. Sekine, H. Hibino, and H. Yamamoto, "Etching-free Transfer of Highly-ordered Bottom-up Graphene Nanoribbon," Abstract of the 2015 Joint Symposium of the Surface Science Society of Japan and the Vacuum Society of Japan (SSSJ's 35th Annual Meeting and VSJ's 56th Annual Symposium), 1Gp07R, Tsukuba, Ibaraki, Japan, Dec. 2015.

IN Research Award
Winner: Ginga Kawaguti, Rie Tagyo, and Fumiya Kobayashi, NTT Network Technology Laboratories
Date: March 3, 2016
Organization: The Institute of Electronics, Information and Communication Engineers (IEICE) Technical Committee on Information Network (IN)

For "Estimation of Web Waiting Time from Network Observation."
Published as: G. Kawaguti, R. Tagyo, and F. Kobayashi, "Estimation of Web Waiting Time from Network Observation," IEICE Tech. Rep., Vol. 115, No. 310, IN-2015-69, pp. 47–50, Nov. 2015.

IN Young Researchers Award
Winner: Tetsuya Hishiki, NTT Network Technology Laboratories
Date: March 3, 2016
Organization: IEICE Technical Committee on Information Network (IN)

For "A Study on Network Architecture based on Architecture Evolution of the Internet."

We focus on the "middle entity," which provides value to applications in the middle of end-to-end communication. We discuss its disposition from the viewpoint of architecture based on the recent evolution of the Internet. The architecture of the Internet has been evolving to adapt to changes in the Internet application usage. Recently, it has tended to use the existing IP protocol stack as a basis of tunnels. This ensures deployment of new protocols or technologies on the tunnels. It may, however, cause side effects such as unoptimized routing. In this paper, we first study the evolution of the Internet from an architecture point of view and then discuss how to improve the architecture empowered by middle entities.
Published as: T. Hishiki, H. Waki, T. Ohba, and A. Koike, "A Study on Network Architecture based on Architecture Evolution of the Internet," IEICE Tech. Rep., Vol. 115, No. 210, IN-2015-52, pp. 69–74, Sept. 2015.

ICM Research Award
Winner: Takafumi Fujita, Nobuhiro Azuma, Takumi Ohba, Masao Aihara, NTT Network Innovation Laboratories; Hiroyuki Morikawa, The University of Tokyo
Date: March 10, 2016
Organization: IEICE Technical Committee on Information and Communication Management (ICM)

For "A Framework for Multiple M2M Service Sharing on M2M Area Networks."

To provide connectivity for machine-to-machine (M2M) devices in an easy and inexpensive way, we propose the concept of "Shared M2M area networks," which enables multiple M2M service providers to share M2M gateways. This paper analyzes characteristics of M2M communications based on a lot of M2M use-cases, and also derives requirements and technical challenges for "Shared M2M area networks." Furthermore, this paper also proposes an access cost evaluation model for "Shared M2M area networks," which can be applied for system design from a cost analysis viewpoint.
Published as: T. Fujita, N. Azuma, T. Ohba, M. Aihara, and H. Morikawa, "A Framework for Multiple M2M Service Sharing on M2M Area Networks," IEICE Tech. Rep., Vol. 115, No. 45, ICM-2015-6, pp. 165–170, May 2015.

Papers Published in Technical Journals and Conference Proceedings

A Citizen-centric Approach towards Global-scale Smart City Platform

T. Yonezawa, J. A. Galache, L. Gurgen, I. Matranga, H. Maeomichi, and T. Shibuya

Proc. of the 2015 International Conference on Recent Advances in Internet of Things, Singapore, April 2015.

In order to help smart cities provide responsive services to improve the quality of life of their citizens, a global-scale platform relying on cloud computing as an enabler to bridge the Internet of Things with Internet of People via Internet of Services, is presented in this paper. This platform will focus on a citizen-centric approach, offering end-users the possibility of creating their own cloud services and sharing them with other citizens, as well as involving other city stakeholders ranging from municipalities to service developers and application integrators. The definition, design, and development of the aforementioned platform has been carried out within the ClouT project (ongoing), framed into a joint European-Japanese initiative, where different field trials developed on top of the developed platform have been deployed in the four cities taking part in the project: Mitaka and Fujisawa in Japan, and Santander and Genova in Europe.

Pupillometric Evidence for the Locus Coeruleus-noradrenaline System Facilitating Attentional Processing of Action-triggered Visual Stimuli

K. Kihara, T. Takeuchi, S. Yoshimoto, H. M. Kondo, and J. I. Kawahara

Frontiers in Psychology, Vol. 6, Article 827, June 2015.

The present study investigated whether the locus coeruleus-noradrenaline (LC-NA) system is involved in the attentional facilitation effect. A rapid serial visual presentation paradigm was used to assess the dynamics of transient attention in humans. Participants were instructed to change a digit stream to a letter stream by pressing a button and specifying successive targets of four letters. Pupil dilation was measured as an index of LC-NA function. These results indicate that target identification in the visual task is closely linked to pupil dilation. We conclude that the LC-NA system plays an important role in the facilitation of transient attention driven by voluntary action.

First Experimental Demonstration of Signal Performance Improvement by Walsh-Hadamard Transform for Super-channel Transmission

A. Masuda, K. Shibahara, S. Kawai, and M. Fukutoku

Proc. of 2015 Opto-Electronics and Communications Conference (OECC), Shanghai, China, June/July 2015.

We show application schemes of the Walsh-Hadamard transform method to mitigate optical filtering and polarization-dependent loss effects. The conducted experiments demonstrate for the first time that the method effectively improves overall performance of super-channel transmission.

Sensory-perceptual Transformations for Auditory Scene Analysis

H. M. Kondo

Proc. of CME 2015 (the 9th International Conference on Complex Medical Engineering), Okayama, Japan, June 2015.

An essential function of perceptual systems is to structure the incoming flow of sensory inputs into a coherent scene. Multistability in perception provides us with clues to investigate sensory-perceptual transformations because it produces dissociations between physical information and subjective experience. For instance, spontaneous switching between different percepts is caused by prolonged listening to a sequence of triplet tones and a word, which are called auditory streaming and verbal transformations, respectively.

Transferring Positioning Model for Device-free Passive Indoor Localization

K. Ohara, T. Maekawa, Y. Kishino, Y. Shirai, and F. Naya

Proc. of UbiComp2015 (the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing), pp. 885–896, Osaka, Japan, September 2015.

This paper proposes a method that transfers a signal strength model used for locating a person obtained in another environment (source environment) to the end user environment. With the transferred models, we can construct a positioning model for the end user environment inexpensively. Our evaluation showed that our method achieved almost the same positioning performance as a supervised method that requires labeled training data obtained in an end user's environment.

Multicore Space Division Multiplexed Unrepeatered Transmission beyond 100-Tb/s Capacity

H. Takara, T. Mizuno, A. Sano, and Y. Miyamoto

Proc. of Frontiers in Optics 2015, FM1E.1, San Jose, CA, USA, October 2015.

The paper describes high capacity unrepeatered transmission using a multicore-fiber based remote optically pumped amplifier. Recent development on transmission technologies based on multicore space-division-multiplexing is also reviewed.

Evaluation of Importance of Treating Free-style Information in Disaster Information System, and Proposal for Effective Utilization Method

F. Ichinose, H. Hayashi, T. Yamamoto, T. Kokogawa, M. Sugiyama, and Y. Maeda

Journal of Institute of Social Safety Science, No. 27, pp. 179–188, November 2015 (in Japanese).

In most cases, activity logs are not recorded properly. In a conventional disaster information system, we record certain kinds of digital information such as the damage situation in order to prepare documents for meetings at the headquarters, but the activity log that affects the management is not recorded. The disaster information system (WebEOC®) can record the activity logs of the disaster

control headquarters. At the Kashihara city office, it has been used for training from the year H23 (2011). We clarify the actual information processing situation in a disaster control headquarters by analyzing its activity log, and we point out the importance of the free-style information and suggest a policy for carrying out activities effectively.

Dispersion Insensitive Demodulation Using Spectral Symmetry of Real-valued Signals

M. Yoshida, K. Yonenaga, and A. Hirano

Electronics Letters, Vol. 51, No. 24, pp. 2024–2026, November 2015.

A chromatic dispersion insensitive demodulation for real-valued signals (e.g. binary shift keying and 4 amplitude shift keying) is proposed. This method utilizes the symmetric spectrum of signals and can be implemented simply in a feed-forward manner. Its feasibility is confirmed through simulations and experiments.

On the White Turbidity Phenomena in the Drying Process of Nanoporous Vycor Glass

S. Ogawa and J. Nakamura

Journal of the Spectroscopical Research of Japan, Vol. 64, No. 6, pp. 549–558, December 2015 (in Japanese).

The transient white turbidity phenomena observed in drying transparent nanoporous composites are reviewed with reference to experimental results, including their transmission spectrum changes, wavelength dependence, and correlation with the amount of an imbibed wetting fluid. These results are analyzed from both the particle-scattering and Einstein's fluctuation viewpoint. The former permits us to interpret the observed λ-4 dependence as random Rayleigh scatterers embedded in a homogeneous matrix. The scatterers have a variable effective radius, which is a measure of optical imhomogeneities that cause the strong scattering. The latter permits us to directly extract the spatial correlations in the pore space of the composites from the transmission spectrum of forward-scattered light. The agreement between the radius and the correlation length that characterizes optical inhomogeneites implies that the phenomena can be explained by a fractal-like percolation of a wetting fluid.

Estimating Human Visual Attention Based on Visual Saliency

A. Kimura

Japanese Journal of Optics, Vol. 45, No. 1, pp. 22–28, January 2016 (in Japanese).

We humans are easily able to instantaneously detect the regions in a visual scene that are most likely to obtain something of interest. Exploiting this pre-selection mechanism called visual attention for image and video processing systems would make them more sophisticated and thus more useful. This paper briefly describes various computational models of human visual attention and their development. In particular, this paper introduces visual attention models based on visual saliency that can be regarded as a measure of visual attractiveness.

Bringing Movable and Deployable Networks to Disaster Areas: Development and Field Test of MDRU

T. Sakano, S. Kotabe, T. Komukai, T. Kumagai, Y. Shimizu, A. Takahara, T. Ngo, Z. M. Fadlullah, H. Nishiyama, and N. Kato

IEEE Network, Vol. 30, No. 1, pp. 86–91, January 2016.

Communication demand is paramount for disaster-affected people to confirm safety, seek help, and gather evacuation information. However, the communication infrastructure is likely to be crippled due to a natural disaster, which makes disaster response excruciatingly difficult. Although traditional approaches can partially fulfill the most important requirements from the user perspective, including prompt deployment, high capacity, large coverage, useful disaster-time application, and carrier-free usability, a complete solution that provides all those features is still required. Our collaborative research and development group has developed the Movable and Deployable Resource Unit, which is referred to as the MDRU and has been proven to have all those required features. Via extensive field tests using a compact version of an MDRU (i.e., the van-type MDRU), we verify the effectiveness of the MDRU-based disaster recovery network. Moreover, we demonstrate the further improvement of the MDRU's performance when it is complemented by other technologies such as relay-by-smartphone or satellites.

Dense Space-division Multiplexed Transmission Systems Using Multi-core and Multi-mode Fiber

T. Mizuno, H. Takara, A. Sano, and Y. Miyamoto

Journal of Lightwave Technology, Vol. 34, No. 2, pp. 582–592, January 2016.

In this paper, we describe recent progress in space-division multiplexed (SDM) transmission, and our proposal and demonstration of dense space-division multiplexing (DSDM), which offers the possibility of ultra-high capacity SDM transmission systems with high spatial density and spatial channel count of over 30 per fiber. We introduce the SDM transmission matrix, which cross-indexes the various types of multi-core multi-mode transmissions according to the type of light propagation in optical fibers, and discuss how the spatial channels are handled in the network. For each category in the matrix, we present the latest advances in transmission studies and evaluate their transmission performance by spectral and spatial efficiencies. We also expound on technologies for multi-core and/or multi-mode transmission including optical fiber, signal processing, spatial multi/demultiplexer, and amplifier, which will play key roles in configuring DSDM transmission systems, and we review the first DSDM transmission experiment over a 12 core × 3 mode fiber.

Optimized Canonical Labeling Algorithm for Graph Rewriting Systems

K. Miyahara and K. Ueda

Computer Software, Vol. 33, No. 1, pp. 126–149, February 2016 (in Japanese).

In graph-base model checking, systems are modeled with graph structures which are highly expressive and feature a symmetry reduction mechanism. However, it involves frequent isomorphism checking of graphs generated in the course of model checking. Canonical labeling of graphs, which gives a unique representation to isomorphic graphs, is expected to be an effective method to check isomorphism among many graphs efficiently. It is therefore important to efficiently compute canonical forms of graphs in graph rewriting systems. For this purpose, we propose an optimization technique for McKay's canonical labeling algorithm that reuses information of graph

structures that does not change by rewriting. To enable reuse, we reformulated McKay's algorithm to clarify what substructures of graphs are utilized in its execution, and designed an algorithm for successive graph canonicalization that organizes graph information in such a way that recomputation may be minimized. We evaluated the performance of the proposed algorithm and found that it achieved sublinear time complexity with respect to the number of vertices for many cases of re-canonicalization.

Integrated Photonic Devices and Applications for 100GbE-and-beyond Datacom

Y. Doi, T. Ohyama, T. Yoshimatsu, T. Ohno, Y. Nakanishi, S. Soma, H. Yamazaki, M. Oguma, T. Hashimoto, and H. Sanjoh

We review recent progress in integrated photonics devices and their applications for data communications. In addition to current technology used in 100-Gigabit Ethernet (100GbE) with compact form-factor of a transceiver, the next-generation technology for 400GbE seeks a larger number of wavelengths with a more sophisticated modulation format and higher bit rate per wavelength. For wavelength scalability and functionality, planar lightwave circuits (PLCs) such as arrayed waveguide gratings (AWGs) will be important, as well higher-order-modulation to ramp up the total bit rate per wavelength. We introduce integration technology for a 100GbE optical sub-assembly that has a 4λ x 25-Gb/s non-return-to-zero (NRZ) modulation format. For beyond 100GbE, we also discuss applications of 100GbE sub-assemblies that provide a 400-Gb/s throughput with 16λ x 25-Gb/s NRZ and bidirectional 8λ x 50-Gb/s four-level pulse amplitude modulation (PAM4) using PLC cyclic AWGs.

Transferring Positioning Model for Device-free Passive Positioning based on Wi-Fi Signals

K. Ohara, T Maekawa, Y. Kishino, Y. Shirai, and F. Naya

The widespread use of smartphones equipped with Wi-Fi modules has led to studies of Wi-Fi based indoor positioning techniques. However, many Wi-Fi indoor positioning methods assume that an end user to be tracked always possesses a signal receiver such as a smartphone, and this assumption places a large burden on end users. Recently, to alleviate the burden, device-free indoor positioning techniques have been studied, which enable us to locate an end user who does not possess a smartphone based on RSSI attenuation caused by the human body. However, device-free indoor positioning techniques require a lot of training data in a target environment. In this study, we propose a device-free positioning method that transfers training data collected in other environments to a target environment in order to reduce the training cost of positioning systems.