External Awards

Achievement Award
Winner: Masayuki Abe, NTT Secure Platform Laboratories
Date: June 2, 2016
Organization: The Institute of Electronics, Information and Communication Engineers (IEICE)

For his pioneering research on cryptographic protocol and its elemental technology.

Specially Selected Paper
Winner: Junko Takahashi and Yosuke Aragane, NTT Secure Platform Laboratories; Toshiyuki Miyazawa, NTT Technology Planning Department; Hitoshi Fuji, NTT Secure Platform Laboratories; Hirofumi Yamashita, Keita Hayakawa, Shintarou Ukai, and Hiroshi Hayakawa, Denso Corporation
Date: February 15, 2017
Organization: Information Processing Society of Japan (IPSJ)

For "Automotive Attacks and Countermeasures on LIN-Bus."
Published as: J. Takahashi, Y. Aragane, T. Miyazawa, H. Fuji, H. Yamashita, K. Hayakawa, S. Ukai, and H. Hayakawa, "Automotive Attacks and Countermeasures on LIN-Bus," Symposium on Cryptography and Information Security, 4F2-5, Kumamoto, Japan, Jan. 2016.

ICM Research Award
Winner: Akio Watanabe, Yoichi Matsuo, Keishiro Watanabe, Keisuke Ishibashi, and Ryoichi Kawahara, NTT Network Technology Laboratories
Date: March 9, 2017
Organization: IEICE Technical Committee on Information and Communication Management (ICM)

For "Multiple Isolating Actions Extraction from Action Logs for Clarifying Trouble-shooting Process."
Published as: A. Watanabe, Y. Matsuo, K. Watanabe, K. Ishibashi, and R. Kawahara, "Multiple Isolating Actions Extraction from Action Logs for Clarifying Trouble-shooting Process," IEICE Tech. Rep., Vol. 116, No. 124, ICM2016-13, pp. 27–32, July 2016.

EMCJ Young Engineer Award
Winner: Mahmood Farhan, NTT Network Technology Laboratories
Date: March 10, 2017
Organization: IEICE Technical Committee on Electromagnetic Compatibility (EMCJ)

For "Artificial Mains Network for Conducted Disturbance from 2 kHz" and "Voltage Feedback Amplifier with Ferrite-cores for Common-mode Noise Suppression."
Published as: M. Farhan, K. Okamoto, H. Tatemichi, and K. Takaya, "Artificial Mains Network for Conducted Disturbance from 2 kHz," IEICE Tech. Rep., Vol. 115, No. 427, EMCJ2015-121, pp. 99–104, Jan. 2016. M. Farhan, S. Yoshikawa, K. Okamoto, K. Takaya, and A. Nishikata, "Voltage Feedback Amplifier with Ferrite-cores for Common-mode Noise Suppression," IEICE Tech. Rep., Vol. 115, No. 509, EMCJ2015-130, pp. 33–37, Mar. 2016.

Best Paper Award
Winner: Fumihiko Ishiyama, Yuichiro Okugawa, and Kazuhiro Takaya, NTT Network Technology Laboratories
Date: March 12, 2017
Organization: 13th IEEE International Colloquium on Signal Processing & Its Applications (CSPA 2017)

For "Linear Predictive Coding without Yule-Walker Approximation for Transient Signal Analysis - Application to Switching Noise."
Published as: F. Ishiyama, Y. Okugawa, and K. Takaya, "Linear Predictive Coding without Yule-Walker Approximation for Transient Signal Analysis - Application to Switching Noise," Proc. of CSPA 2017, pp. 46–50, Penang, Malaysia, Mar. 2017.

IEICE Fellow in 2016
Winner: Akira Takahashi, NTT Network Technology Laboratories
Date: March 24, 2017
Organization: IEICE Communications Society

For his research and development of QoE (quality of experience) evaluation, design, and management for speech and video communication services and his contribution to international standardization.

Young Researcher's Award
Winner: Yuki Minami, NTT Network Innovation Laboratories
Date: March 24, 2017
Organization: IEICE

For "An Infrastructure for Application Customization based on SDN/NFV."
Published as: Y. Minami, Y. Mochida, and J. Ichikawa, "An Infrastructure for Application Customization based on SDN/NFV," Proc. of the IEICE General Conference, B-6-72, Fukuoka, Japan, Mar. 2016.

Young Researcher's Award
Winner: Masaki Wada, NTT Access Network Service Systems Laboratories
Date: March 24, 2017
Organization: IEICE

For "Characteristic Evaluation of Spectral-hole Burning of 2-LP Mode Erbium Doped Fiber."
Published as: M. Wada, T. Sakamoto, S. Aozasa, T. Mori, T. Yamamoto, and K. Nakajima, "Characteristic Evaluation of Spectral-hole Burning of 2-LP Mode Erbium Doped Fiber," Proc. of the IEICE General Conference, B-13-19, Fukuoka, Japan, Mar. 2016.

Young Researcher's Award
Winner: Rie Tagyo, NTT Network Technology Laboratories
Date: March 24, 2017
Organization: IEICE

For "Communication Quality Estimation with Degradation for Specific Attribute Combination."
Published as: R. Tagyo, D. Ikegami, G. Kawaguchi, and A. Takahashi, "Communication Quality Estimation with Degradation for Specific Attribute Combination," Proc. of the IEICE General Conference, B-11-8, Fukuoka, Japan, Mar. 2016.

Young Researcher's Award
Winner: Haruka Suzuki, NTT Secure Platform Laboratories
Date: March 24, 2017
Organization: IEICE

For "A Study of Attribute Assurance of Data Generated by Individuals."

Published as: H. Suzuki, G. Takahashi, K.Fujimura, T. Nakamura, and K. Hayakawa, "A Study of Attribute Assurance of Data Generated by Individuals," Proc. of the IEICE General Conference, D-9-18, Fukuoka, Japan, Mar. 2016.

Achievement Award
Winner: Tatsuaki Okamoto, NTT Secure Platform Laboratories
Date: June 30, 2017 (award ceremony date)
Organization: The Japan Society for Industrial and Applied Mathematics

For his research on basic theory and applied technology of public key cryptography.

Papers Published in Technical Journals and Conference Proceedings

Anomaly Detection in a Telephone System by Using Traffic Balance Analysis

T. Moriya, N. Tanji, and S. Seto

IEICE Transactions on Communications (JPN edition), Vol. J99–B, No. 9, pp. 799–805, September 2016.

This paper proposes an anomaly detection method for telephone systems by monitoring the change of vector of nodes' traffic. To improve the detection performance in a telephone system's traffic, a function that reduces fluctuation of the vector was applied and evaluated in an actual telephone system.

Design of Homogeneous Trench-assisted Multi-core Fibers Based on Analytical Model

F. Ye, J. Tu, K. Saitoh, K. Takenaga, S. Matsuo, H. Takara, and T. Morioka

Journal of Lightwave Technology, Vol. 34, No. 18, pp. 4406–4416, September 2016.

We present a design method of homogeneous trench-assisted multicore fibers (TA-MCFs) based on an analytical model utilizing an analytical expression for the mode coupling coefficient between two adjacent cores. The analytical model can also be used for crosstalk (XT) properties analysis, such as XT reduction amount versus trench width, trench depth, and other fiber structural parameters as compared with normal step-index MCFs. Furthermore, the model can be used to search for core positions for further XT reduction in non-close-packed structures. For instance, we show that a dual-ring structure is the quasi-optimum core layout starting from a one-ring structured 12-core fiber. Based on the analytical model, a square-lattice structured 24-core fiber and a 32-core fiber are designed both for propagation-direction interleaving (PDI) and non-PDI transmission schemes. The proposed model provides a powerful tool for designing high-count homogeneous TA-MCFs.

Speech Sound Naturalness Alters Compensation in Response to Transformed Auditory Feedback

S. Hiroya and T. Mochida

5th Joint Meeting of the Acoustical Society of America and Acoustical Society of Japan, 3pSC84, Honolulu, HI, USA, November/December 2016.

Articulatory compensations in response to real-time formant perturbation have revealed that auditory feedback plays an important role in speech production. However, these compensatory responses were at most 40% for formant shifts and varied depending on vowel type and subjects. Although previous formant perturbation studies have been done using linear predictive coding (LPC), it is known that the estimation accuracy for low vowels and female speech would be degraded due to a glottal source-vocal tract interaction. To improve the accuracy, we have developed a real-time robust formant tracking system using the phase equalization-based autoregressive exogenous (PEAR) model which utilizes the glottal source signals measured by electroglottography. In this study, we compared compensatory responses to real-time formant perturbation using PEAR and LPC. Eleven Japanese subjects (seven females) read Japanese mora (/hi/ or /he/) with headphones. The first two formant frequencies were altered. Results showed that compensatory responses using PEAR were significantly larger than those using LPC. Moreover, the naturalness of altered speech sounds was improved by PEAR. This indicates that improving speech sound naturalness by PEAR led to larger compensatory responses. Therefore, our system would be useful to understand the auditory feedback mechanisms in more detail.

A Study on Reduction of Violation Behavior of Security Rules

Y. Okano and H. Okuyama

IPSJ Journal, Vol. 58, No. 1, pp. 258–268, January 2017.

Information leakage incidents in organizations are often caused by insiders. In particular, it is a common issue that employees violate security rules such as giving priority to work. In this study, we focus on behaviors involving the taking of business related information out

of the workspace without permission, which is often seen in violation behaviors. We consider situations of takeout behaviors and the psychology of the concerned parties, and we find factors of those behaviors and consider deterrents. We carried out hearings with people in charge of security management and group interviews with people who have taken information out illegally. We also hypothesized factors and deterrents and implemented a questionnaire to verify the hypotheses. We found that pressure from outside is the underlying cause of takeout behaviors. We show that it may not be possible to prevent those behaviors through employee training alone and consider that it is also necessary for the employees to recognize the information leakage risk the organization faces and also the risk they face, and we facilitate the employees' execution of normal procedures when they take information outside or work overtime. Additionally, a help desk regarding takeout of business related information is established.

Visualizing Video Sounds with Sound Word Animation to Enrich User Experience

F. Wang, H. Nagano, K. Kashino, and T. Igarashi
IEEE Transactions on Multimedia, Vol. 19, No. 2, pp. 418–429, February 2017.

Sound information in videos plays an important role in shaping the user experience. When sound is not accessible in videos, text captions can provide sound information. However, conventional text captions are not very expressive for nonverbal sounds because they are designed to visualize speech sounds. Here, we present a framework to automatically transform nonverbal video sounds into animated sound words and position them near the sound source objects in the video for visualization. This provides natural visual representation of nonverbal sounds with rich information about the sound category and dynamics. To evaluate how the animated sound words generated by our framework affect the user experience, we implemented an experimental system and conducted a user study involving over 300 participants from an online crowdsourcing service. The results of the user study show that the animated sound words can effectively and naturally visualize the dynamics of sound while clarifying the position of the sound source as well as contribute to making video-watching more enjoyable and increasing the visual impact of videos.

High-capacity Dense Space Division Multiplexing Transmission

T. Mizuno and Y. Miyamoto
Optical Fiber Technology, Vol. 35, pp. 108–117, February 2017.

In this paper, we review space division multiplexing (SDM) transmission experimental demonstrations and associated technologies. In past years, SDM achieved high capacity transmission through increased spatial multiplicity, and long-haul transmission through improved transmission performance. More recently, dense SDM (DSDM) with a large spatial multiplicity exceeding 30 was demonstrated with multicore technology. Various types of multicore and multimode SDM fibers, amplification, and spatial multi/demultiplexers have helped achieve high-capacity DSDM transmission.

Embodiment Bridging over Cyber Spaces and Physical Spaces: Comments on Kitazaki's Article

T. Amemiya
Japanese Psychological Review, Vol. 59, No. 3, pp. 324–329, March 2017.

The possibility of implementing 'we-mode' among users in cyber spaces, which is proposed by Kitazaki, is discussed by reviewing the studies on body ownership and the sense of agency, both of which are strongly involved in self-body perception and recognition. The movement of a body in cyber space should strongly correlate with that in the physical space, but not necessary be rendered as realistic. Furthermore, the interaction and relationship between the spaces from the point of view of both a sense of realistic self-body in a cyber space and behavior changes after an experience in a cyber space are discussed to consider the possibility of creating 'we-mode' bridging of the physical and cyber spaces.

Chaotic Laser Based Physical Random Bit Streaming System with a Computer Application Interface

S. Shinohara, K. Arai, P. Davis, S. Sunada, and T. Harayama
Optics Express, Vol. 25, No. 6, pp. 324–329, March 2017.

We demonstrate a random bit streaming system that uses a chaotic laser as its physical entropy source. By performing real-time bit manipulation for bias reduction, we were able to provide the memory of a personal computer with a constant supply of ready-to-use physical random bits at a throughput of up to 4 Gbps. We pay special attention to the end-to-end entropy source model describing how the entropy from physical sources is converted into bit entropy. We confirmed the statistical quality of the generated random bits by revealing the pass rate of the NIST SP800-22 test suite to be 65% to 75%, which is commonly considered acceptable for a reliable random bit generator. We also confirmed the stable operation of our random bit steaming system with long-term bias monitoring.

Modular Representation of Layered Neural Networks

C. Watanabe, K. Hiramatsu, and K. Kashino
arXiv:1703.00168 [stat.ML], March 2017.

Deep neural networks have greatly improved the performance of various applications including image processing, speech recognition, natural language processing, and bioinformatics. However, it is still difficult to discover or interpret knowledge from the inference provided by a deep neural network, since its internal representation has many nonlinear and complex parameters embedded in hierarchical layers. Therefore, it becomes important to establish a new methodology by which deep neural networks can be understood.

In this paper, we propose a new method for extracting a global and simplified structure from a layered neural network. Based on network analysis, the proposed method detects communities or clusters of units with similar connection patterns. We show its effectiveness by applying it to three use cases. (1) Network decomposition: it can decompose a trained neural network into multiple small independent networks, thus dividing the problem and reducing the computation time. (2) Training assessment: the appropriateness of a trained result with a given hyperparameter or randomly chosen initial parameters can be evaluated by using a modularity index. And (3) data analysis: in practical data it reveals the community structure in the input, hidden, and output layers, which serves as a clue for discovering knowledge from a trained neural network.

Fractal and Spinodal-decomposed Turbidities of Nanoporous Glass: Fluctuation Picture in Turbid and Transparent Vycor

S. Ogawa and J. Nakamura

The light propagation and scattering in monolithic transparent nanoporous materials such as Vycor glasses exhibit two optical turbidities, both of which are slightly deviated from the λ^{-4} Rayleigh wavelength dependence in the visible region: one is a transient white turbidity τ_f, characterized by the convex-upward dependence on the inverse fourth power of wavelength, and the other is turbidity τ_{sp} inherent to the structural inhomogeneity, characterized by the convex-downward dependence. The former is attributed to a fractal-like percolation network of imbibed or drained pores as a consequence of transient imbibition or drainage of wetting fluid into or from the pore space. The latter is attributed to the structural inhomogeneities inherent to the original dry porous glass, which are produced by spinodal decomposition. In this paper, we develop a general scheme to estimate the transmittance spectra of Vycor through the turbidities τ_f and τ_{sp} in the visible region on the basis of the theory of dielectric constant fluctuations. We show the applicability and its limitation of the turbidity analysis of the photospectroscopically measured data as a method to study the correlation functions that characterize the pore space and the structural features of isotropic transparent nanoporous media, on the presupposition that there exists no light attenuation other than the scattering.