External Awards

TTC Information and Communication Technology Award, TTC Chairman's Prize
Winner: Kenjiro Arai, NTT Network Service Systems Laboratories
Date: June 19, 2018
Organization: The Telecommunication Technology Committee (TTC)

For his contribution to the standardization and actualization of IP interconnections.

DICOMO 2018 Paper Award
Winner: Motohiro Makiguchi and Hideaki Takada, NTT Service Evolution Laboratories
Date: September 4, 2018
Organization: Information Processing Society of Japan (IPSJ), Multimedia, Distributed, Cooperative, and Mobile (DICOMO) 2018 Symposium

For "Tabletop Type Glassless 3D Screen System Using Optical Linear Blending."
Published as: M. Makiguchi and H. Takada, "Tabletop Type Glassless 3D Screen System Using Optical Linear Blending," Proc. of DICOMO 2018, 3C-1, pp. 509–513, Fukui, Japan, July 2018 (in Japanese).

JSAP Poster Award
Winner: Nahoko Kasai, NTT Basic Research Laboratories/Tokyo Metropolitan University; Aya Tanaka and Tetsuhiko Teshima, NTT Basic Research Laboratories; Koji Sumitomo, University of Hyogo; Hiroshi Nakashima, NTT Basic Research Laboratories
Date: September 18, 2018
Organization: The Japan Society of Applied Physics (JSAP)

For "Neuronal Growth Control Using Chemical Modification of Nanopillars."
Published as: N. Kasai, A. Tanaka, T. Teshima, K. Sumitomo, and H. Nakashima, "Neuronal Growth Control Using Chemical Modification of Nanopillars," Proc. of the 79th JSAP Autumn Meeting, 20p-PA3-8, Nagoya, Aichi, Japan, Sept. 2018.

CSS 2018 Incentive Award
Winner: Nariyoshi Chida, Yo Kanemoto, Kazufumi Aoki, and Jun Miyoshi, NTT Secure Platform Laboratories
Date: October 24, 2018
Organization: IPSJ Special Interest Group on Computer Security Group (CSEC), Computer Security Symposium 2018 (CSS 2018)

For "A Formal Grammar-based Approach toward Attack Scenario Reconstruction."
Published as: N. Chida, Y. Kanemoto, K. Aoki, and J. Miyoshi, "A Formal Grammar-based Approach toward Attack Scenario Reconstruction," Proc. of CSS 2018, 2B3-2, Nagano, Japan, Oct. 2018 (in Japanese).

MWS 2018 Outstanding Paper Award
Winner: Toshinori Usui, Yuto Otsuki, Yuhei Kawakoya, Makoto Iwamura, and Jun Miyoshi, NTT Secure Platform Laboratories
Date: October 24, 2018
Organization: IPSJ CSEC, Anti Malware Engineering Workshop 2018 (MWS 2018)

For "Automatic Enhancement of Script Engines by Appending Behavior Analysis Capabilities."
Published as: T. Usui, Y. Otsuki, Y. Kawakoya, M. Iwamura, and J. Miyoshi, "Automatic Enhancement of Script Engines by Appending Behavior Analysis Capabilities," Proc. of MWS 2018, Nagano, Japan, Oct. 2018 (in Japanese).

RIEC Award
Winner: Nobuyuki Matsuda, NTT Basic Research Laboratories
Date: November 29, 2018
Organization: Research Institute of Electrical Communication, Tohoku University

For his achievements in researching advanced control of photonic states for quantum communications.

Papers Published in Technical Journals and Conference Proceedings

Future Nationwide Optical Network Architecture for Higher Availability and Operability Using Transport SDN Technologies
Y. Uematsu, S. Kamamura, H. Date, H. Yamamoto, A. Fukuda, R. Hayashi, and K. Koda
IEICE Transactions on Communications, Vol. E101-B, No. 2, pp. 462–475, February 2018.
An optical transport network is composed of optical transport

systems deployed in thousands of office buildings. As a common infrastructure to accommodate diversified communication services with drastic traffic growth, it is necessary not only to continuously convey the growing traffic but also to achieve high end-to-end communication quality and availability and provide flexible controllability in cooperation with service layer networks. To achieve high-speed and large-capacity transport systems cost-effectively, system configuration, applied devices, and the manufacturing process have recently begun to change, and the cause of failure or performance degradation has become more complex and diversified. The drastic traffic growth and pattern change of service networks increase the frequency and scale of transport-capacity increase and transport-network reconfiguration in cooperation with service networks. Therefore, drastic traffic growth affects both optical-transport-system configuration and its operational cycles. In this paper, we give an overview of the operational problems emerging in current nationwide optical transport networks, and based on trends analysis for system configuration and network-control schemes, we propose a vision of the future nationwide optical-transport-network architecture expressed using five target features.

Simulation of Water Absorption and Desorption Behavior for Anti-corrosion Coatings in Existing and New Accelerated Corrosion Tests

T. Miwa, Y. Takeshita, A. Ishii, and T. Sawada
Progress in Organic Coatings, Vol. 120, pp. 71–78, February 2018.
A cyclic corrosion test (CCT) that ensures compatibility with acceleration of corrosion and approximation of actual outdoor corrosion is in high demand, and many kinds of CCTs have been developed. We have proposed a new CCT for evaluating corrosion resistance of anti-corrosion coatings. In this work, we measured the water diffusion coefficients of three kinds of anti-corrosion urethane/epoxy coatings at 20–60°C and calculated their activation energies. In addition, the water absorption/desorption behaviors of the coatings in several CCTs, including our new CCT, were simulated.

Regulated Transport Network Design Using Geographical Resolution

S. Kamamura, A. Fukuda, R. Hayashi, and Y. Uematsu
IEICE Transactions on Communications, Vol. E101-B, No. 3, pp. 805–815, March 2018.
This paper proposes a regulated transport network design algorithm for IP over a dense wavelength division multiplex (DWDM) network. When designing an IP over DWDM network, the network operator should consider not only cost-effectiveness and physical constraints such as wavelength colors and chromatic dispersion but also operational policies such as resilience, quality, stability, and operability. For considering the above policies, we propose to separate the network design algorithm based on a geographical resolution; the policy-based regulated intra-area is designed based on this resolution, and the cost-optimal inter-area is then designed separately, and finally merged. This approach does not necessarily yield a strict optimal solution, but it covers network design work done by humans, which takes a vast amount of time and requires a high skill level. For efficient geographical resolution, we also present a fast graph mining algorithm, which can solve NP-hard subgraph isomorphism problems within the practical time. We prove the sufficiency of the resulting network design for the above policies by visualizing the topology, and also prove that the penalty of applying the approach is trivial.

Distributed IP Refactoring: Cooperation with Optical Transport Layer and Centralized SDN

S. Kamamura, A. Fukuda, H. Mori, R. Hayashi, and Y. Uematsu
IEICE Transactions on Communications, Vol. E101-B, No. 7, pp. 1661–1674, July 2018.
By focusing on the recent swing to the centralized approach by the software defined network (SDN), this paper presents a novel network architecture for refactoring the current distributed Internet protocol (IP) by not only utilizing the SDN itself but also implementing its cooperation with the optical transport layer. The first IP refactoring is for flexible network topology reconfiguration; the global routing and explicit routing functions are transferred from the distributed routers to the centralized SDN. The second IP refactoring is for cost-efficient maintenance migration; we introduce a resource portable IP router that can behave as a shared backup router by cooperating with the optical transport path switching. Extensive evaluations show that our architecture makes the current IP network easier to configure and more scalable. We also validate the feasibility of our proposal.

End-to-End Redundancy and Maintenance Condition Design for Nationwide Optical Transport Network

Y. Uematsu, S. Kamamura, H. Yamamoto, A. Fukuda, and R. Hayashi
IEICE Transactions on Communications, Vol. E101-B, No. 11, pp. 2267–2276, November 2018.
To achieve high end-to-end availability in nationwide optical transport networks across thousands of office buildings, it is important to properly make each function redundant, and execute protection switching, repair failed functions, and recover redundancy to prevent multiple simultaneous failures. High redundancy leads to high system cost and high power consumption, and tight conditions for recovery lead to high maintenance cost. Therefore, it is important to optimize the balance between redundancy and maintenance conditions based on appropriate availability indicators. We previously proposed a resource-pool control mechanism for a nationwide optical transport network that can optimize the balance. This paper proposes an end-to-end availability evaluation scheme for a nationwide optical transport network with our mechanism, by which network operators can design the pool-resource amount of each function and the maintenance conditions for each network area properly to satisfy the end-to-end availability requirement. Although the maintenance conditions are usually discussed based on failure-recovery times, they should be discussed based on cost- or load-based volumes for this design. This paper proposes a maintenance-operation-load evaluation scheme, which derives the required number of maintenance staff members from failure-recovery times. We also discuss the design of the pool-resource amount and maintenance conditions for each network area of a nationwide network based on the proposed evaluation schemes.

Accelerating a Lloyd-type k-Means Clustering Algorithm with Summable Lower Bounds in a Lower-dimensional Space

K. Aoyama, K. Saito, and T. Ikeda
IEICE Transactions on Information and Systems, Vol. E101-D, No. 11, pp. 2773–2783, November 2018.
This paper presents an efficient acceleration algorithm for Lloyd-type k-means clustering, which is suitable to a large-scale and high-dimensional data set with potentially numerous classes. The algorithm employs a novel projection-based filter (*PRJ*) to avoid unnecessary

distance calculations, resulting in high-speed performance keeping the same results as a standard Lloyd's algorithm. The *PRJ* exploits a summable lower bound on a squared distance defined in a lower-dimensional space to which data points are projected. The summable lower bound can make the bound tighter dynamically by incremental addition of components in the lower-dimensional space within each iteration although the existing lower bounds used in other acceleration algorithms work only once as a fixed filter. Experimental results on large-scale and high-dimensional real image data sets demonstrate that the proposed algorithm works at high speed and with low memory consumption when large k values are given, compared with the state-of-the-art algorithms.

Automatic Driving Support Scheme Considering Signal and Traffic Conditions

K. Mizutani, M. Yoshida, T. Hata, and I. Shake

Transactions of the Society of Instrument and Control Engineers, Vol. 54, No. 11, pp. 793–801, November 2018 (in Japanese).

Currently, vehicle communication infrastructures are conducted in several locations, and they provide some traffic and signal information for vehicles. With this information, automatic driving technologies are widely studied, and they focus on the avoidance of stopping by red light signals and car crashes. They have deep insight for all research fields; however, there are no proposals for realizing both types of avoidance at the same time. In this paper, we propose an action determination learning scheme for realizing driving support considering both types of avoidance. Our scheme is based on Deep Reinforcement Learning, which is similar to the latest crash avoidance scheme. A simulation evaluation revealed that the numbers of both crashes and stopping by red light signals becomes lower as time goes on, and effective parameter tuning is revealed at the same time.

Quantum Remote Sensing with Asymmetric Information Gain

Y. Takeuchi, Y. Matsuzaki, K. Miyanishi, T. Sugiyama, and W. J. Munro

arXiv:1811.05586 [quant-ph], November 2018.

Typically, the aim of quantum metrology is to sense target fields with high precision utilizing quantum properties. Unlike the typical aim, in this paper, we use quantum properties for adding a new functionality to quantum sensors. More concretely, we propose a delegated quantum sensor (a client-server model) with security inbuilt. Suppose that a client wants to measure some target fields with high precision, but he/she does not have a high-precision sensor. This leads the client to delegate the sensing to a remote server who possesses a high-precision sensor. The client gives the server instructions on how to control the sensor. The server lets the sensor interact with the target fields in accordance with the instructions, and then sends the sensing measurement results to the client. In this case, since the server knows the control process and readout results of the sensor, the information of the target fields is available not only to the client but also to the server. We show that by using an entanglement between the client and the server, an asymmetric information gain is possible so that only the client can obtain the sufficient information of the target fields. In our scheme, the server generates the entanglement between a solid state system (that can interact with the target fields) and a photon, and sends the photon to the client. On the other hand, the client is required to possess linear optics elements only including wave plates, polarizing beam splitters, and single-photon detectors. Our scheme is feasible with the current technology, and our results pave the way for a novel application of quantum metrology.

Analysis of Communicative Phrase Prosody Based on Linguistic Modalities of Constituent Words

K. Takada, H. Nakajima, and Y. Sagisaka

Proc. of the 13th International Conference on Knowledge, Information and Creativity Support Systems, Pattaya, Thailand, pp. 217–221, November 2018.

In this paper, phrase prosody is analyzed based on linguistic modalities of constituent words for communicative speech synthesis. Since Japanese final particles and auxiliaries play crucial roles to indicate speaker's intention and attitudes as modality differences, Japanese phrase sets showing different degrees of the speaker's judgment were employed. Communicative/reading speech data were compared over 5 kinds of modality of epistemic judgment (uncertainty of what the speaker said) and 8 kinds of modality of evaluative judgment (what the speaker wishes listeners to be). These modality differences were quantified in 6-point Semantic Differential (SD) scales. The corresponding phrase communicative/reading prosody differences were measured by the F_0 rising in the phrase final mora. Statistical analysis showed a negative correlation value between the F_0 rising in the phrase final mora and the SD about judgment only in communicative prosody but not in reading prosody. These results support the communicative prosody control possibilities from the modality information embedded in constituent words.