External Awards

2014 IEICE Young Researchers' Award
Winner: Shinsuke Nakano, NTT Device Innovation Center
Date: March 11, 2015
Organization: Institute of Electronics, Information and Communication Engineers (IEICE)

For proposing a 6.7-mW 8.8-dB 60-GHz complementary metal oxide semiconductor (CMOS) amplifier and 2.5-mW/Gbps millimeter-wave transmitter using an OOK (on/off keying) pulse modulator based on CMOS inverters.
Published as: S. Nakano, H. Katsurai, and M. Nogawa, "A 6.7-mW 8.8-dB 60-GHz CMOS Amplifier," Proc. of the IEICE General Conference, C-12-22, Mar. 2014 (in Japanese) and S. Nakano, H. Katsurai, M. Togashi, H. Koizumi, and M. Nogawa, "20.1-mW 8-Gbps UWB-IR Millimeter-wave Transmitter Using an OOK Pulse Modulator Based on CMOS Inverters," Proc. of ISCAS 2014 (2014 IEEE International Symposium on Circuits and Systems), pp. 2696–2699, Melbourne, Australia, Jun. 2014.

2014 IEICE Young Researchers' Award
Winner: Yoshihiro Ogiso, NTT Device Innovation Center
Date: March 11, 2015
Organization: Institute of Electronics, Information and Communication Engineers (IEICE)

For proposing an InP(110) athermal IQ (in-phase quadrature) optical modulator with planar waveguide structure.
Published as: Y. Ogiso, Y. Nakanishi, S. Kanazawa, E. Yamada, H. Tanobe, M. Arai, Y. Shibata, and M. Kohtoku, "Planar n-SI-n Heterostructure Athermal InP (110) Optical Modulator," Optics Express, Vol. 22, No. 21, pp. 25776–25781, Oct. 2014.

The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, the Prize for Science and Technology (Research Category)
Winner: Hiroshi Takahashi, Sophia University; Yasuyuki Inoue, NTT Electronics Corporation; and Senichi Suzuki, NTT Device Innovation Center
Date: April 15, 2015
Organization: Ministry of Education, Culture, Sports, Science and Technology

For development of wavelength multi/demultiplexer based on arrayed-waveguide grating.
Published as: H. Takahashi, K. Oda, H. Toba, and Y. Inoue, "Transmission Characteristics of Arrayed Waveguide N×N Wavelength Multiplexer," J. Lightwave Technol., Vol. 13, No. 3, pp. 447–455, Mar. 1995.

Research Encouragement Award
Winner: Yoji Yamato, NTT Software Innovation Center
Date: June 4, 2015
Organization: Steering Committee on Network Software of IEICE Communications Society

For "Automatic Verification Technology of Software Patches for User Virtual Machines on IaaS Cloud."
Published as: Y. Yamato, "Automatic Verification Technology of Software Patches for User Virtual Machines on IaaS Cloud,"

NWS2014-5-02, Tokyo, Japan, Oct. 2014.

TTC Distinguished Service Award
Winner: Satoru Furukawa, NTT Network Service Systems Laboratories
Date: June 22, 2015
Organization: Telecommunication Technology Committee (TTC)

For his contribution to the promotion of standardization of PSTN (Public Switched Telephone Network) migration.

COMPSAC 2015 Honorary Award
Winner: Michiharu Takemoto and Susumu Takeuchi, NTT Network Innovation Laboratories
Date: July 1, 2015
Organization: IEEE COMPSAC 2015 (39th Annual International Computers, Software & Applications Conference)

For Agent-based Service Platform (ASPF).
At the exhibition, NTT proposed modeling elements (a device, process, or concept) both in the real world and cyberspace, and abstracting each element as an agent (independent program). A service is formed as a series of agents.

Technical Committee on Communication Quality Encouragement Award
Winner: Kimiko Kawashima, NTT Network Technology Laboratories; Hiroaki Mori, Kyushu University; Hitoshi Aoki, NTT Network Technology Laboratories; and Takanori Hayashi, NTT Network Technology Laboratories
Date: July 6, 2015
Organization: Technical Committee on Communication Quality of IEICE Communications Society

For "Subjective Quality Assessment Characteristics of Sense of Presence for 4K Coded Video."
Published as: K. Kawashima, H. Mori, H. Aoki, and T. Hayashi, "Subjective Quality Assessment Characteristics of Sense of Presence for 4K Coded Video," IEICE Tech. Rep., Vol. 114, No. 488, CQ2014-112, pp. 1–6, Mar. 2015.

Young Researcher Award
Winner: Shunsuke Kurumatani, NTT Software Innovation Center
Date: July 10, 2015
Organization: Executive Committee of DICOMO (Multimedia, Distributed, Cooperative, and Mobile) 2015 Symposium

For "Evaluation of Application Performance on a Software-based Fault Tolerance."
Published as: S. Kurumatani, Y. Kasae, Y. Tsuruoka, S. Morishita, H. Akama, and H. Takahashi, "Evaluation of Application Performance on a Software-based Fault Tolerance," Proc. of DICOMO 2015, 7D-4, pp. 1502–1508, Tokyo, Japan, Jul. 2015 (in Japanese).

EMS Award
Winner: Ryo Nakao, NTT Nanophotonics Center, NTT Device Technology Laboratories
Date: July 17, 2015
Organization: Electronic Materials Symposium (EMS) Steering Committee

For "Dislocation Reduction in MOVPE-grown InGaAs/GaAs MQWs with GaAs/Ge Buffer Layers on Si Substrates by Thermal Cycle Annealing."

Published as: R. Nakao, M. Arai, T. Yamamoto, and S. Matsuo, "Dislocation Reduction in MOVPE-grown InGaAs/GaAs MQWs with GaAs/Ge Buffer Layers on Si Substrates by Thermal Cycle Annealing," Proc. of the 34th Electronic Materials Symposium, Th2-3, Shiga, Japan, Jul. 2015 (in Japanese).

NETs2015 Distinguished Paper Award
Winner: Yoji Yamato, NTT Software Innovation Center
Date: July 18, 2015
Organization: International Conference on Internet Studies 2015 (NETs2015)

For "Server Structure Proposal and Automatic Verification Technology on IaaS Cloud of Plural Type Servers."

We propose a server proposal and automatic performance verification technology on IaaS (Infrastructure as a Service) cloud with bare metals, containers and virtual machines. Firstly we measured the performance of each type of server. Based on the performance results, our systems propose the appropriate type of server to satisfy user requirements.

Published as: Y. Yamato, "Server Structure Proposal and Automatic Verification Technology on IaaS Cloud of Plural Type Servers," Proc. of NETs2015, Tokyo, Japan, Jul. 2015.

Papers Published in Technical Journals and Conference Proceedings

What Happens in a Small Transistor with Single-electron Resolution?

K. Nishiguchi

Proc. of EM-NANO 2015 (the 5th International Symposium on Organic and Inorganic Electronic Materials and Related Nanotechnologies), p. 36, Niigata, Japan, June 2015.

Downscaling of silicon transistors using state-of-the-art technology has already reached the 20–16-nm generation and enabled massive production of high-performance electrical circuits for various applications. Such downscaling also provides transistors with new functionalities: single-electron transfer and room-temperature detection. These two functions allow new applications utilizing single electrons.

Second-order Configuration of Local Features for Geometrically Stable Image Matching and Retrieval

X. Wu and K. Kashino

IEEE Transactions on Circuits and Systems for Video Technology, Vol. 25, No. 8, pp. 1395–1408, August 2015.

Local features offer high repeatability, which supports efficient matching between images, but they do not provide sufficient discriminative power. Imposing a geometric coherence constraint on local features improves the discriminative power but makes the matching sensitive to anisotropic transformations. We propose a novel feature representation approach to solve the latter problem. Each image is abstracted by a set of tuples of local features. We revisit affine shape adaptation and extend its conclusion to characterize the geometrically stable feature of each tuple. The representation thus provides higher repeatability with anisotropic scaling and shearing than found in previous research. We develop a simple matching model by voting in the geometrically stable feature space, where votes arise from tuple correspondences. To make the required index space linear as regards the number of features, we propose a second approach called a centrality-sensitive pyramid to select potentially meaningful tuples of local features on the basis of their spatial neighborhood information. It achieves faster neighborhood association and has greater robustness to errors in interest point detection and description. We comprehensively evaluated our approach using Flickr Logos 32, Holiday, Oxford Buildings, and Flickr 100 K benchmarks. The results of extensive experiments and comparisons with advanced approaches demonstrate the superiority of our approach in image retrieval tasks.

Effect of Load-balancing against Disaster Congestion with Actual Subscriber Extension Telephone Numbers

D. Satoh, H. Kawano, and Y. Chiba

IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E98-A, No. 8, pp. 1637–1646, August 2015.

We demonstrated that load balancing using actual subscriber extension numbers was practical and effective against traffic congestion after a disaster based on actual data. We investigated the ratios of the same subscriber extension numbers in each prefecture and found that most of them were located almost evenly all over the country without being concentrated in a particular area. The ratio of every number except for the fourth-last digit in the last group of four numbers in a telephone number was used almost equally and located almost evenly all over the country. Tolerance against overload in the last, second-, and third-last single digits stays close to that in the ideal situation if we assume that each session initiation protocol server has a capacity in accordance with the ratio of each number on every single digit in the last group of four numbers in Japan.

Observing the Semiconducting Band-gap Alignment of MoS$_2$ Layers of Different Atomic Thicknesses Using a MoS$_2$/SiO$_2$/Si Heterojunction Tunnel Diode

K. Nishiguchi, A. Castellanos-Gomez, H. Yamaguchi, A. Fujiwara, H. S. J. van der Zant, and G. A. Steele

Applied Physics Letters, Vol. 107, p. 053101, August 2015.

We demonstrate a tunnel diode composed of a vertical MoS$_2$/SiO$_2$/Si heterostructure. A MoS$_2$ flake consisting of four areas of different thicknesses functions as a gate terminal of a silicon field-effect transistor. A thin gate oxide allows tunneling current to flow between the n-type MoS$_2$ layers and p-type Si channel. The tunneling-current characteristics show multiple negative differential resistance features, which we interpret as an indication of different conduction-band alignments of the MoS$_2$ layers of different thicknesses. The presented tunnel device can also be used as a hybrid-heterostructure device combining the advantages of two-dimensional materials with those of silicon transistors.

Maintenance of Communication Carrier Networks against Large-scale Earthquakes

Y. Takahashi and D. Satoh

IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E98-A, No. 8, pp. 1602–1609, August 2015.

The network operations center of a communication carrier plays an important and critical role in the early stage of disaster response because its function is to maintain communication services, which includes traffic control and restoration of services. This paper describes traffic control and restoration of services affected by the Great East Japan Earthquake and discusses challenges on traffic congestion and restoration for future large-scale disasters.

Topological Graph Layouts into a Triangular Prism

M. Miyauchi

Proc. of the 28th Workshop on Circuits and Systems, pp. 49–54, Awaji, Hyogo, Japan, August 2015.

This paper newly defines a (topological) graph layout into a triangular prism. A *graph layout into a triangular prism* is a graph layout into a triangular prism that carries the vertices along the three crests between two triangles of the prism and the edges in the three rectangular surfaces such that no two edges cross in the interior of the surfaces. Also, a *topological* graph layout into a triangular prism is defined as edges that are allowed to cross the crests. This paper constructs topological complete bipartite graph layouts into a triangular prism with fewer crest-crossings than previous results.

On the Computational Power of Constant-depth Exact Quantum Circuits

Y. Takahashi

Proc. of ICIAM 2015 (the 8th International Congress on Industrial and Applied Mathematics), Beijing, China, August 2015.

We show that there exists a constant-depth polynomial-size quantum circuit for the quantum OR operation. We also show that under a plausible assumption, there exists a classically hard problem that is solvable by using a constant-depth quantum circuit with gates for the quantum Fourier transform.

Experience Simulator for the Digital Museum

Y. Ikei, S. Shimabukuro, S. Kato, K. Komase, K. Hirota, T. Amemiya, and M. Kitazaki

Proc. of HCI International 2015 (the 17th International Conference on Human-Computer Interaction), pp. 436–446, Los Angeles, USA, August 2015.

An experience transfer method is discussed to introduce a physical reliving of the previous person's body motion. The evaluation showed that the vestibular stimulation markedly enhanced the sensation of walking, and that the self-body with a first person view produced the highest rating.

Interest Point Selection by Topology Coherence for Multi-query Image Retrieval

X. Wu and K. Kashino

Multimedia Tools and Applications, Vol. 74, No. 17, pp. 7147–7180, September 2015.

Although the bag-of-visual-words model in computer vision has been demonstrated successfully for the retrieval of particular objects, it suffers from limited accuracy when images of the same object are very different in terms of viewpoint or scale. Naively leveraging multiple views of the same object to query the database naturally alleviates this problem to some extent. However, the bottleneck appears to be the presence of background clutter, which causes significant confusion with images of different objects. To address this issue, we explore the structural organization of interest points within multiple query images and select those that derive from the tentative region of interest to significantly reduce the negative contributions of confusing images. The approach is discriminative in distinguishing clutter from interest points, and at the same time, is highly robust as regards variation in viewpoint and scale as well as errors in interest point detection and description.