

External Awards

JSAI Incentive Award

Winner: Hiroaki Sugiyama and Toyomi Meguro, NTT Communication Science Laboratories; and Ryuichiro Higashinaka, NTT Communication Science Laboratories/NTT Media Intelligence Laboratories

Date: June 12, 2015

Organization: The Japanese Society of Artificial Intelligence (JSAI)

For “Experimental Analysis for Automatic Evaluation of Open-domain Conversational Systems based on Large-scale Multi-references.”

The evaluation of conversational systems that chat with people remains an open-problem. Some studies have evaluated them by hand with ordinal scales such as the Likert scale. One limitation with this approach is that we cannot use the previously evaluated values since the ordinal scales are not consistent across all of the evaluations. This makes it difficult to compare proposed and previous systems since we have to implement the previous systems and simultaneously evaluate them. We propose an automatic evaluation method for conversational systems that evaluates sentences generated by systems on the basis of similarities that are calculated with many reference sentences and their annotated evaluation values.

Published as: H. Sugiyama, T. Meguro, and R. Higashinaka, “Experimental Analysis for Automatic Evaluation of Open-domain Conversational Systems based on Large-scale Multi-references,” SIGSLUD, Vol. B4, No. 01, pp. 1–6, Sept. 2014.

IEICE ISS Young Researcher's Award in Speech Field

Winner: Ryo Masumura, NTT Media Intelligence Laboratories

Date: August 21, 2015

Organization: Institute of Electronics, Information and Communication Engineers (IEICE) Speech Committee

For “Investigation of Combining Multiple Language Modeling Techniques in Japanese Spontaneous Speech Recognition.”

Recent large vocabulary speech recognition systems consist of two statistical models, the acoustic and language models. In acoustic modeling, deep neural networks have realized a breakthrough, and significant performance improvements have been achieved. On the other hand, in language modeling, there have not been any reports of comparable improvements. Although it is clear that recent practical language models have several problems such as “locality,” “task dependency” and “data sparseness,” we cannot obtain significant performance improvements by solving these problems separately. In this paper, we try to use various language modeling techniques simultaneously to cover the entire problem. Our investigation was conducted by dividing language modeling techniques into three viewpoints, “one pass decoding,” “unsupervised adaptation” and “rescoring.”

Published as: R. Masumura, T. Asami, T. Oba, H. Masataki, and S. Sakauchi, “Investigation of Combining Multiple Language Modeling Techniques in Japanese Spontaneous Speech Recognition,” IEICE Tech. Rep., Vol. 114, No. 151, SP2014-63, pp. 1–6, Jul. 2014.

IEEEJ Excellent Presentation Award

Winner: Takuya Hoshi, NTT Device Technology Laboratories

Date: August 26, 2015

Organization: The Institute of Electrical Engineers of Japan (IEEEJ)

For “Impact of Strained GaAs Spacer between InP Emitter and GaAs_{1-y}Sb_y Base on Structural Properties and Electrical Characteristics of MOCVD-grown InP/GaAs_{1-y}Sb_y/InP DHBTs.”

Novel InP/GaAs_{1-y}Sb_y/InP double-heterojunction bipolar transistors (HBTs) with a GaAs spacer between the InP emitter and GaAs_{1-y}Sb_y base layer were grown by the metalorganic chemical vapor deposition method in order to simplify the switching sequence for forming a high-quality InP-emitter/GaAs_{1-y}Sb_y-base interface. The insertion of the GaAs spacer is a good way to obtain a high-quality E-B interface with a simple precursor-supply sequence and thereby HBTs with both high-current gain and reasonably high RF performance.

Published as: T. Hoshi, N. Kashio, H. Sugiyama, H. Yokoyama, K. Kurishima, M. Ida, H. Matsuzaki, and M. Kohtoku, “Impact of Strained GaAs Spacer between InP Emitter and GaAs_{1-y}Sb_y Base on Structural Properties and Electrical Characteristics of MOCVD-grown InP/GaAs_{1-y}Sb_y/InP DHBTs,” Journal of Crystal Growth, Vol. 395, pp. 31–37, Jun. 2014.

IEICE Fellow

Winner: Takehiro Moriya, NTT Communication Science Laboratories

Date: September 9, 2015

Organization: Institute of Electronics, Information and Communication Engineers (IEICE)

For contributions to research, development and standardization of high-compression coding schemes for speech and audio signals.

IEICE Fellow

Winner: Masahito Tomizawa, NTT Network Innovation Laboratories

Date: September 9, 2015

Organization: Institute of Electronics, Information and Communication Engineers (IEICE)

For contributions to research, development and standardization of technologies for large capacity optical transport networks.

JCSS Encouragement Paper Prize

Winner: Noriko Shingaki, Seijo University; Miki Kitabata, NTT Network Innovation Laboratories; Hiroto Matsuoka, NTT Device Innovation Center; Toshihiro Takada, NTT Communication Science Laboratories; Akiko Orito, J. F. Oberlin University; Yuko Kato, CDI; Yukie Tsuzuki, Seijo University; and Tatsuo Owada, NTT Resonant Inc.

Date: September 19, 2015

Organization: Japanese Cognitive Science Society (JCSS)

For “Accuracy and Distortions of Personal Memories (“Omoide”) Saved in a Nine-year Time Capsule.”

How should we save our memories? Many people keep diaries and take pictures for that purpose. In this study, we kept things of personal significance in a time capsule for nine years and examined whether personal memories could be saved in a time capsule and how they might possibly change over time. We held a workshop in 2003 when participants contributed something that they possessed which had personal significance at that time of their life. They were interviewed to explain what kind of significance these possessions had for them, and these interview sessions were recorded. Nine years after

the initial workshop, the participants came together again. Before the time capsule was opened, they were asked to recall what they had put in the time capsule and to describe in what ways their possession in the time capsule had been significant to them. By comparing the contents of the participants' responses between 2003 and 2012, it was found that a great deal of the contents had changed from 2003 to 2012. Implications were discussed in regard to the significance of

objects themselves and the narratives that go with the objects in preserving personal memories.

Published as: N. Shingaki, M. Kitabata, H. Matsuoka, T. Takada, A. Orito, Y. Kato, Y. Tsuzuki, and T. Owada, "Accuracy and Distortions of Personal Memories ("Omoide") Saved in a Nine-year Time Capsule," *Cognitive Studies*, Vol. 21, No. 1, pp. 15–28, 2014.

Papers Published in Technical Journals and Conference Proceedings

A Simple Method for Forming Compositionally Graded $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{Sb}_y$ Base of Double-heterojunction Bipolar Transistors Modulating CBr_4 -doping-precursor Flow in Metalorganic Chemical Vapor Deposition

T. Hoshi, N. Kashio, H. Sugiyama, H. Yokoyama, K. Kurishima, M. Ida, H. Matsuzaki, and H. Gotoh

Applied Physics Express, Vol. 7, No. 11, p. 114102, November 2014.

We studied a CBr_4 -flow-modulation method as a way of simplifying the formation of a compositionally graded $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{Sb}_y$ base of InP-based heterojunction bipolar transistors (HBTs) by metalorganic chemical vapor deposition. An investigation of C-doping in $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{Sb}_y$ revealed that the In and Sb content decreases as the supply ratio of CBr_4 to group-III (R_C) increases. We fabricated 0.25- μm -emitter HBTs with a compositionally graded $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{Sb}_y$ base formed by varying R_C at constant group-III, group-V, and V/III ratios. With this method, we obtained a higher current-gain cut-off frequency (504 GHz) and maximum-oscillation frequency (328 GHz) than those of uniform- $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{Sb}_y$ -base HBTs with the same base/collector thicknesses.

Channel Access Acquisition Mechanism Coupled with Cellular Network for Unlicensed Spectrum

R. Kudo, B. A. H. S. Abeysekara, Y. Takatori, T. Ichikawa, M. Mizoguchi, H. Yasuda, A. Yamada, and Y. Okumura

Proc. of VTC2015-Spring (2015 IEEE 81st Vehicular Technology Conference), Glasgow, UK, May 2015.

Interworking among heterogeneous wireless networks across licensed and unlicensed spectra has gained much attention as a way to handle the surge in mobile traffic. The wireless local area network (WLAN) is well known as the dominant wireless network application in the unlicensed spectrum. Unlicensed spectrum access should follow carrier sense multiple access/collision avoidance (CSMA/CA) in order to share wireless resources with existing WLAN nodes. However, the transmission throughput with CSMA/CA can be significantly degraded by the hidden terminal problem in environments where a huge amount of mobile traffic depletes the wireless resource-

es. In this paper, we propose a channel access acquisition mechanism that uses licensed spectrum access. The proposed mechanism significantly reduces the impact of the hidden terminal problem by using both transmission and reception opportunities.

Experimental Verification of Highly-scalable OXC that Consists of Subsystem-modular Express Switch Part and Multicast-switch-based Add/drop Part Enabling Total Throughput of 314 Tbps

S. Takashina, N. Ishida, M. Niwa, Y. Mori, H. Hasegawa, K. Sato, and T. Watanabe

Optics Express, Vol. 23, No. 11, pp. 14796–14805, June 2015.

We propose cost-effective and scalable optical cross connect reconfigurable optical add/drop multiplexing (OXC/ROADM) that consists of a subsystem-modular express switch part and a transponder bank-based add/drop part. The effectiveness of the proposed architecture was verified via a hardware scale evaluation, network performance simulations, and transmission experiments. The architecture enables large throughput and offers significant hardware-scale reductions with marginal fiber-utilization penalty against the conventional architecture. Part of the OXC/ROADM designed to accommodate 35x35 express fiber ports and 2,800 transponders for add/drop was constructed. Its net throughput reaches 314 Tbps using 80 channels of 120-Gbps signals (where 30-Gbaud dual-polarization quadrature phase-shift-keying signals with 7% overhead are assumed).

Resource Allocation Scheme for Heterogeneous Traffic and Received Power in MU-MIMO-OFDMA Transmission

Y. Sakata, T. Murakami, Y. Takatori, M. Mizoguchi, and F. Mae-hara

IEICE Transactions on Communications, Vol. J98-B, No. 7, pp. 707–716, July 2015 (in Japanese).

This paper proposes a resource allocation scheme to cope with heterogeneous traffic and received power for multi-user

multiple-input multiple-output orthogonal frequency division multiple access (MU-MIMO-OFDMA). The feature of the proposed approach is to maximize the frame efficiency by allocating frequency and space resources under different user packet sizes and channel conditions. In allocating frequency and space resources, a large number of allocation patterns have to be considered. Hence, we reduce the number of patterns taking advantage of the fact that broadband channels in OFDMA provide almost the same performance regardless of the frequency band. Computer simulations showed the effectiveness of the proposed scheme in comparisons with MU-MIMO and OFDMA.

Excitation-inhibition Balances of Glx and GABA Predict Individual Differences in Perceptual Organization

H. Kondo, D. Pressnitzer, Y. Shimada, T. Kochiyama, and M. Kashino

Proc. of the 35th Annual Meeting of the Japan Neuroscience Society, Kobe, Japan, July 2015.

An essential function of perceptual systems is to structure the incoming flow of sensory inputs into a coherent scene. This is termed perceptual organization. Perceptual bistability provides us with clues to investigate neural mechanisms of perceptual organization because it produces dissociations between physical information and subjective experience. Here, we showed that the principle of excitation-inhibition balance is shared across auditory and visual bistability and independently implemented in the auditory and motion sensitive areas. We used magnetic resonance spectroscopy to noninvasively measure concentrations of glutamate-glutamine (Glx) and gamma-aminobutyric acid (GABA) in vivo. The time-series data of alternating percepts were obtained while participants listened to auditory streaming or observed visual plaids. Higher Glx concentrations induced shorter durations of alternating percepts, whereas higher GABA concentrations led to longer ones, regardless of sensory inputs. The two forms of neurotransmitter levels accounted for around 30% variance of percept durations for each modality. Our results suggest that the formation and selection of auditory and visual percepts depend on the opponency between excitatory glutamatergic and inhibitory GABAergic systems.

Luminance Profile Control Method Using Gradation Iris for Autostereoscopic 3D Displays

M. Date, T. Kawakami, M. Sasai, and H. Takada

Proc. of CLEO-PR 2015 (the 11th Conference on Lasers and Electro-Optics Pacific Rim), 26B3-6, Busan, Korea, August 2015.

A precise control method of angular luminance distribution of viewing zone using a filter with gradation in transmittance in an iris of a projector is proposed for autostereoscopic 3D (three-dimensional) display with smooth motion parallax.

Lagopus FPGA - A Reprogrammable Data Plane for High-performance Software SDN Switches

K. Yamazaki, Y. Nakajima, T. Hatano, and A. Miyazaki

Proc. of HOT CHIPS 27, pp. 10–19, Cupertino, USA, August 2015.

For cloud service providers and network service operators, software-defined networking (SDN) and network functions virtualization (NFV) are key technologies for automatic provisioning from an upper-management system and for enabling telecom operators to

reduce CAPEX and OPEX. NTT has developed a high-performance SDN software switch called Lagopus, which has been released as open source software since July 2014. In this presentation, we reported on a Lagopus field-programmable gate array (FPGA) as a software-packet-processing-aware 40-Gbps FPGA NIC (network interface card) that was developed to fully utilize the multi-core central processing unit (CPU) power on the SDN/NFV platform with less than 10% x86 CPU power dissipation. We performed a live demonstration of the 40-Gbps wire-speed Lagopus FPGA at HOT CHIPS 27.

A 0.15- μ m CMOS Baseband LSI Employing Sleep Mode with Clock-offset Compensation for M2M Wireless Sensor Networks

K. Suzuki, A. Yamagishi, and M. Harada

IEEJ Transactions on Electrical and Electronic Engineering, Vol. 10, No. 5, pp. 576–584, September 2015.

This paper describes wireless baseband large-scale integration (LSI) that contains a sleep management circuit. The sleep manager performs the sleep-clock offset compensation and enables a wireless terminal (WT) with a typical crystal oscillator to remain in sleep mode for a long period while maintaining synchronization with the access point. Lab experiments show that the sleep period reaches 512 s and that with intermittent operation the WT maintains synchronization with the access point for ten days. The LSI's average current consumption is as low as 11 μ A for a 128-s sleep period. A wakeup detection circuit is also implemented in the LSI. This circuit performs paging control instead of a microprocessor unit (MPU), and this helps to reduce current consumption in the MPU and the flash ROM (read only memory). The single-chip baseband LSI is fabricated using 0.15- μ m CMOS (complementary metal-oxide-semiconductor) technology. It is 4.6 mm \times 4.2 mm in area and consumes 4.0 μ A for sleep operation.

Viewpoint Image Generation for Head Tracking 3D Display Using Multi Camera and Approximate Depth Information

M. Date, H. Takada, and A. Kojima

Proc. of EuroDisplay 2015, p. 36, Ghent, Belgium, September 2015.

A simple and high image quality method for viewpoint image synthesis is proposed. Smooth motion parallax of wide depth range objects induced by viewpoint movement for left-and-right and front-and-back directions is achieved using multi camera images and approximate depth information. It is suitable for real-time 3D (three-dimensional) display applications.

Inscribed Fitting Method with Asymmetric Evaluation Function for Disaggregating Current Waveforms

F. Ishiyama, T. Watanabe, H. Inoue, and T. Ohyama

Proc. of IEEE 2015 ICCE-Berlin (the 5th IEEE International Conference on Consumer Electronics), pp. 19–23, Berlin, Germany, September 2015.

We propose a method for disaggregating the current waveforms of appliances from a current waveform on a power distribution board. We focus on the case where some appliances have current waveforms that vary continuously and non-proportionally. Our method is a variation of the least squares method with an asymmetric evaluation function. We calculate a standard waveform for each appliance, and

we inscribe the standard waveforms to the current waveform on the power distribution board. We apply our method to the aggregate current waveforms of three appliances and compare the results with the least squares method.

Top of Worlds: Estimating Time Complexity of Calculating Rank Order in Multi-dimensional Hierarchical Sets

T. Hata, H. Kawasaki, H. Kurasawa, H. Sato, M. Nakamura, and A. Tsutsui

Proc. of HASCA2015 (3rd International Workshop on Human Activity Sensing Corpus and its Application), pp. 1405–1412, Osaka, Japan, September 2015.

The increasing number of mobile devices such as smartphones has brought attention to participatory sensing, in which real-world data are collected via personal devices. To collect data via participatory sensing, it is important to motivate participants. Thus, we previously proposed Top of Worlds, a method for encouraging user participation by presenting their rank order. In this paper, we estimate its time complexity in order to understand how often we can present a rank order in the planning phase of services.

Large-scale Optical Switch with Simplified Sub-switch Connections for Datacenter Application

K. Ueda, Y. Mori, H. Hasegawa, K. Sato, and T. Watanabe

Proc. of Photonics in Switching 2015, pp. 366–368, Florence, Italy, September 2015.

We introduce an asymmetric-port-count delivery-and-coupling (DC) switch that can simplify fiber connection arrangement in a large-scale optical switch. A 24x4 DC switch is monolithically implemented with PLC (planar-lightwave-circuit) technologies, and

its good performance is experimentally confirmed.

On the Computational Power of Constant-depth Exact Quantum Circuits

Y. Takahashi

Proc. of CFTM (Computability Theory and Foundations of Mathematics) 2015, Tokyo, Japan, September 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 a constant-depth quantum circuit with gates for the quantum Fourier transform.

Secret-key Distribution Based on Bounded Observability

J. Muramatsu, K. Yoshimura, P. Davis, A. Uchida, and T. Harayama

Proceedings of the IEEE, Vol. 103, No. 10, pp. 1762–1780, October 2015.

This paper reviews an approach to secret-key distribution based on the bounded observability (BO) model. First, the information-theoretic framework of secret-key agreement from a correlated random source is reviewed. Next, the BO model is introduced. In the context of this model, the BO condition is presented as a necessary and sufficient condition for the possibility of secret-key distribution. This condition describes limits on the information obtained by observation of a random object and models the practical difficulty of completely observing random physical phenomena. Finally, an implementation of secret-key distribution based on BO in an optical fiber system is described.