External Awards

The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology—The Young Scientists' Prize—
Winner: Hajime Okamoto, NTT Basic Research Laboratories
Date: April 15, 2014
Organization: Ministry of Education, Culture, Sports, Science and Technology

For "A Study of the Quantum Nanomechanical Sensing Technology".

A new technology that enables highly sensitive mechanical detection has been developed by the integration of superconductor, optical light, and semiconductor low dimensional structures into nanomechanical resonators.

Conference on LED and Its Industrial Application (LEDIA '14) Young Researcher's Paper Award
Winner: Ryan G. Banal, NTT Basic Research Laboratories
Date: April 24, 2014
Organization: Conference on LED and Its Industrial Application (LEDIA '14)

For "Nonpolar M-plane AlGaN Deep-UV LEDs".

We demonstrated stronger deep-UV light emission from nonpolar M-plane AlGaN QW LEDs than conventional polar C-plane ones and explained their emission properties in terms of optical polarization and the quantum-confined Stark effect.

Papers Published in Technical Journals and Conference Proceedings

Resilient Photonic Network Architecture with Plug & play Optical Interconnection Technology
T. Sakano, H. Kubota, T. Komukai, T. Hirooka, and M. Nakazawa
Proc. of the 18th OptoElectronics and Communications Conference (OECC), TuQ3-5, Kyoto, Japan, July 2013.

This paper proposes a resilient photonic network based on digital coherent optical transceivers and movable ICT resource units. We developed a 100-Gbit/s transceiver for the movable unit and experimentally confirmed its plug & play capability.

A Rapidly Restorable Phone Service from Catastrophic Loss of Telecommunications Facilities
T. Sakano, S. Kotabe, K. Sebayashi, T. Komukai, H. Kubota, and A. Takahara
Proc. of Humanitarian Technology Conference (HTC) 2013, IEEE Region 10, TS7, Sendai, Japan, August 2013.

This paper proposes a phone service system which enables us to rapidly restore telephone service even under the situation where the facilities for ICT services are catastrophically damaged due to a large scale disaster. In the proposed system, a movable ICT unit which accommodates an IP-PBX function is deployed to a damaged area, and it promptly launches a telephone service based on Voice over IP (VoIP) and WiFi technologies. Users are able to access the telephone service using their own smartphones and telephone numbers; thus, it is convenient to use. The authors developed a prototype system and performed subjective evaluation experiments by expected users such as the employees of telecom companies, local governments, and the Japanese government. Through the experimental results, we confirmed the effectiveness of the proposed system.

Multi-document Summarization Model Based on Redundancy-constrained Knapsack Problem
H. Nishikawa, T. Hirao, T. Makino, Y. Matsuo, and Y. Matsumoto
Journal of Natural Language Processing, Vol. 20, No. 4, pp. 585–612, September 2013.

In this study, we regard multi-document summarization as a redundancy-constrained knapsack problem. The summarization model based on this formulation is obtained by adding a constraint that curbs redundancy in the summary to a summarization model based on the knapsack problem. As the redundancy-constrained knapsack problem is an NP-hard problem and its computational cost is high, we propose a fast decoding method based on the Lagrange heuristic to quickly locate an approximate solution. Experiments based on ROUGE evaluation show that our proposed model outperforms the state-of-the-art text summarization model known as the maximum coverage model in finding the optimal solution. We also show that our decoding method finds a good approximate solution, which is comparable to the optimal solution of the maximum coverage model, more than 100 times faster than an integer linear programming solver.

Nonlinear Modeling and Analysis on Concurrent Amplification of Dual-band Gaussian Signals

I. Ando, G. Tran, K. Araki, T. Yamada, T. Kaho, Y. Yamaguchi, and K. Uehara

IEICE Trans. on Electronics, Vol. E96-C, No. 10, pp. 1254–1262, October 2013.

In a flexible wireless system, nonlinear distortion is increased in its wideband power amplifier (PA) because the PA needs to concurrently amplify multi-band signals. By taking higher harmonics as well as inter- and cross-modulation distortion into consideration, we have developed a method to analytically evaluate the adjacent channel leakage power ratio (ACPR) and error vector magnitude (EVM) on the basis of the PA's nonlinear characteristics. We devised a novel method for modeling the PA amplifying dual-band signals. The method makes it possible to model it merely by performing a one-tone test, making use of the Volterra series expansion and the general Wiener model. We then use the Mehler formula to derive the closed-form expressions of the PA's output power spectral density (PSD), ACPR, and EVM. The derivations are based on the assumption that the transmitted signals are complex Gaussian distributed in orthogonal frequency division multiplexing transmission systems.

Implementation and Evaluation of Real-time Distributed Zero-forcing Beamforming for Downlink Multi-user MIMO Systems

T. Murakami, K. Ishihara, R. Kudo, Y. Asai, T. Ichikawa, and M. Mizoguchi

IEICE Trans. on Communication, Vol. E96-B, No. 10, pp. 2521–2529, October 2013.

The implementation and experimental evaluations of distributed zero-forcing beamforming (DZFBF) for downlink multi-user multiple-input multiple-output (DL MU-MIMO) systems are presented. In DZFBF, multiple access points (APs) transmit to desired stations (STAs) at the same time using the same frequency channel while mitigating inter-cell interference. To clarify the performance and feasibility of DZFBF, we developed a real-time transmission testbed that includes two APs and four STAs; all are implemented using a field programmable gate array. For real-time transmission, we also implemented a simple weight generation process based on ZF weight using channel state information which is fed back from STAs; it is an extension of the weight generation approach used in DL MU-MIMO systems. By using our testbed, we demonstrate the real-time transmission performance in actual indoor multi-cell environments. These results indicate that DL DZFBF is more effective than DL MU-MIMO with time division multiple access.

Estimating Illuminant Colors by a Gray-world-assumption-based Method Using High and Low Chroma Gamuts and Opponent Color Properties

H. Kawamura, S. Yonemura, J. Ohya, and A. Kojima

IEICE Trans. on Information and Systems (Japanese Edition), Vol. J96-D, No. 12, pp. 3079–3089, December 2013.

We propose an illuminant color estimation method based on gray world assumption using opponent color properties and color gamuts. It estimates illuminant colors more correctly than the conventional method in cases where there are few colors in an image or when image colors are distributed unevenly in local areas in the color space. The method uses high-chroma gamuts for adding appropriate colors to the original image and low-chroma ones for narrowing down illuminant color possibilities. Experimental results show that the average estimation error derived by our method is statistically smaller than that derived by the conventional method.

Deriving the "Salience Level" of a Target Sound Using a Tapping Technique

S. Kidani, H. Liao, M. Yoneya, M. Kashino, and S. Furukawa

Abstracts of Proc. of the 37th Annual Midwinter Meeting of the Association for Research in Otolaryngology (ARO), Vol. 37, p. 385, San Diego, USA, February 2014.

The salience level obtained by the tapping method reflects the subjective salience of target sounds. The salience level is somewhat independent of the subjective loudness of a sound, as indicated by the lack of correlation between the salience level and the loudness value.

A Method of Estimating Scene Illuminant Colors from Color Images under Varying Illumination Taken by Fixed Camera

H. Kawamura, Y. Yao, S. Yonemura, J. Ohya, and A. Kojima

The Journal of the Institute of Image Electronics Engineers of Japan, Vol. 43, No. 2, pp. 164–174, 2014.

This paper proposes a method for estimating scene illuminant colors from two color images taken by a fixed camera under two different illuminations. Our method obtains two sets of surface reflectances of a scene area common to the two images, and estimates the colors of the two illuminations based on the property that the intersection of the sets could correspond to the common area. To obtain the sets of surface reflectance from the colors in the images, the relationship between surface reflectance and the colors in the image, which are calculated using surface reflectance called a "typical set" from the ISO/TR 16066 object color spectra database for color reproduction evaluation and possible illuminants, is used. Experiments using numerical simulation and actual images show that our method derives smaller estimation errors than conventional methods, and that it provides stable estimations for several kinds of illuminants and reflectances.

Improvement of 200-kHz KTN Optical Scanner Performance with Multiple Internal Reflection

S. Toyoda, Y. Sasaki, and J. Kobayashi

The Journal of Engineering, pp. 1–2, 2014.

The authors have realized a $KTa_xNb_{1-x}O_3$-based optical beam scanner that has three- and five-pass configurations with internal reflection whose scanning angle is exactly proportional to the optical path length. They successfully increased the scanning angle to about 140 mrad with a 200-kHz modulation using a five-pass configuration. This beam scanner will provide an optical coherence tomography (OCT) system with a spatial resolution of 7 μm and advantages over other OCT systems.

Missing Sensor Value Estimation Method for Participatory Sensing Environment

H. Kurasawa, H. Sato, A. Yamamoto, H. Kawasaki, M. Nakamura, Y. Fujii, and H. Matsumura

Proc. of 2014 IEEE International Conference on Pervasive

Computing and Communications (PerCom), pp. 103–111, Budapest, Hungary, March 2014.

Participatory sensing produces incomplete sensor data. Thus, we have to fill in the gaps of any missing values in the sensor data in order to provide sensor-based services. We propose a method to estimate a missing value of incomplete sensor data. It accurately estimates a missing value by repeating two processes: selecting sensors locally correlated with the sensor that includes the missing value and then updating the training sensor dataset that consists of data from the selected sensors available for multiple regression. This procedure effectively helps to find more suitable neighbor records of a query record from the training sensor dataset and to refine the regression model using the records. We confirmed through a field trial and a life-log enrichment trial that our method was effective for estimating missing sensor values in a participatory sensing environment.

Large-scale Cross-media Analysis and Mining from Socially Curated Contents

A. Kimura

Progress in Informatics, No. 11, pp. 19–30, 2014.

This paper focuses on another emerging trend called *social curation*, a human-in-the-loop alternative to automatic algorithms for social media analysis. Social curation can be defined as a spontaneous human process of remixing social media content for the purpose of further consumption. What characterizes social curation is definitely the manual effort involved in organizing a collection of social media content, which indicates that socially curated content has potential as a promising information source against automatic summaries generated by algorithms. Curated content would also provide latent perspectives and contexts that are not explicitly presented in the original resources. Following this trend, this paper presents recent developments and the growth of social curation services, and reviews several research trials for cross-media analysis and mining from socially curated content.

Channel Coding and Lossy Source Coding Using a Generator of Constrained Random Numbers

J. Muramatsu

IEEE Trans. on Information Theory, Vol. 60, No. 5, pp. 2667–2686, May 2014.

Stochastic encoders for channel coding and lossy source coding are introduced with a rate close to the fundamental limits, where the only restriction is that the channel input alphabet and the reproduc-tion alphabet of the lossy source code are finite. Random numbers, which satisfy a condition specified by a function and its value, are used to construct stochastic encoders. The proof of the theorems is based on the hash property of an ensemble of functions, where the results are extended to general channels/sources, and alternative formulas are introduced for channel capacity and the rate-distortion region. Since an ensemble of sparse matrices has a hash property, we can construct a code by using sparse matrices.

Eye-hand Coordination in On-line Visuomotor Adjustments

N. Abekawa, T. Inui, and H. Gomi

NeuroReport, Vol. 25, No. 7, pp. 441–445, 2014.

We examine the relationship between on-line hand adjustment and eye movements. In contrast to the well-known temporal order of eye and hand initiations where the hand follows the eyes, we found that on-line hand adjustment was initiated before the saccade onset. Despite this order reversal, a correlation between hand and saccade latencies was observed, suggesting that the on-line hand motor system is not independent of eye control. Moreover, the latency of the hand adjustment with saccadic eye movement was significantly shorter than that with eye fixation. This hand latency modulation cannot be ascribed to any changes of visual or oculomotor reafferent information since the saccade was not yet initiated when the hand adjustment started. Taken together, the hand motor system would receive preparation signals rather than reafference signals of saccadic eye movements to provide quick manual adjustments of the goal-directed eye-hand movements.

Reliable Data Transmission of 8K Video over Multi-domain Networks

T. Fujii, H. Uose, M. Stanton, and L. Ciuffo

Proc. of 15th Workshop RNP, Vol. WRNP15, pp. 1–40, Florianópolis, Brazil, May 2014.

We explained the technology to transmit 8K new generation video for a public-viewing event from Brazil to Tokyo. Shared networks are used to transmit 8K video to reduce the network cost and setup-time, but we need to take special care to ensure reliability against packet losses. Therefore, we developed an improved LDGM-FEC algorithm and implemented it in a system to enable robust IP transmission over long-distance shared networks.