External Awards

Certificate for Special Merit Awards for Outstanding Paper
Winners: Shunichi Seko, Manabu Motegi, Takashi Yagi, and Shinyo Muto, NTT Cyber Solutions Laboratories
Date: Jan. 10, 2011
Organization: The International Conference on Consumer Electronics (ICCE)

For "Video Content Recommendation for Group Based on Viewing History and Viewer Preference".

This paper proposes an algorithm for estimating useful content for known groups. The method enables recommendations for a group such as friends, a couple, and a family. As the first step, we focused on preferences among group members. Our algorithm estimates the preferences using the rating for individuals for video genres and viewing history shared together. Then we judge whether the content is useful for the group on the basis of the preferences. Evaluation tests show that our algorithm is serendipitous.

Published in: 2011 IEEE International Conference on Consumer Electronics (ICCE)
To be published in: IEEE Xplore Digital Library.
http://www.ieeexplore.ieee.org/

NWS Research Award
Winner: Yuusuke Nakano, NTT Network Service Systems Laboratories
Date: Feb. 23, 2011
Organization: Technical Committee on Network Software

For "Method for Using Computational Resources in PCs via Their Web Browsers".

NWS Research Award
Winner: Satoshi Kondoh, NTT Network Service Systems Laboratories
Date: Feb. 23, 2011
Organization: Technical Committee on Network Software

For "Parallel Processing for Sequential Pattern Recognition in HTTP Traffic".

English Session Encouragement Award
Winner: Rie Hayashi, NTT Network Service Systems Laboratories
Date: Mar. 10, 2011
Organization: IEICE Technical Committee on Information and Communication Management

For "Design and Implementation of an Optical Plug and Play Technique (2010 IEICE Society Conference BS-7-27)".

This paper proposes an optical plug and play (PnP) function that enables generalized multiprotocol label switching (GMPLS) networks to be constructed automatically. We establish the architectural requirements for PnP in end-to-end wavelength-division-multiplexing (WDM) networks including routers and optical cross connects (OXCs) and confirm its feasibility through a demonstration using commercial routers and OXCs.

Papers Published in Technical Journals and Conference Proceedings

Approach to Achieving a Carrier-envelope Phase-locked Frequency Comb with Wide Mode Spacing at Telecommunications Wavelengths
T. Nishikawa, A. Ishizawa, A. Mizutori, H. Takara, H. Nakano, A. Takada, and M. Koga
Proc. of the 2nd STAR Symposium on UILS, STAR Cooperation on Ultrafast Intense Laser Science, Amoy, China, 2010.

In this talk, I will present our recent approach to achieving a carrier-envelope phase-locked (CEP-locked) frequency comb with 25-GHz mode spacing at telecommunications wavelengths. First, we tried to reduce the required laser pulse energy to lock the CEP. For this purpose, we used a tellurite photonic crystal fiber and a direct-bonded quasi-phasematched $LiNbO_3$ ridge waveguide for the generation of an octave-bandwidth spectrum and the second harmonic in an f-to-$2f$ self-referencing interferometer, respectively. We succeeded in making a CEP-locked frequency comb at telecommunications wavelengths with a fiber-coupling pulse energy of 230 pJ. Next, we tried to create a high-repetition-rate optical pulse train seeded from a continuous-wave semiconductor laser without using a mode-locking technique. The combination of phase modulation and dispersive fiber is essential for its generation. With our method, a 250-fs optical pulse trained at 25-GHz can be generated.

Convergence-guaranteed Multiplicative Algorithms for

Nonnegative Matrix Factorization with β-divergence

M. Nakano, H. Kameoka, J. L. Roux, Y. Kitano, N. Ono, and S. Sagayama

Proc. of the 2010 IEEE International Workshop on Machine Learning for Signal Processing, Kittilä, Finland, 2010.

This paper presents a new multiplicative algorithm for nonnegative matrix factorization with β-divergence. The derived update rules have a similar form to those of the conventional multiplicative algorithm, only differing through the presence of an exponent term depending on β. The convergence is theoretically proven for any real-valued β based on the auxiliary function method. The convergence speed is experimentally investigated in comparison with previous work.

Statistical Model of Speech F_0 Contours

H. Kameoka, J. L. Roux, and Y. Ohishi

Proc. of Statistical and Perceptual Audition 2010, ISCA, pp. 43–48, Makuhari, Japan.

This paper proposes a statistical model of speech fundamental frequency (F_0) contours based on the formulation of the discrete-time stochastic process version of the Fujisaki model, which is known as a well-founded mathematical model representing the control mechanism of vocal fold vibration. There are two important motivations for this statistical formulation. One is to derive a general parameter estimation framework for the Fujisaki model that allows the introduction of powerful statistical methods and the other is to introduce a measure of speech naturalness into terms of F_0 contours through a probability distribution assumption, which can be incorporated into many statistical speech processing problems such as speech analysis, synthesis, separation, denoising, and dereverberation.

Fixed Mobile Convergence Application Services Using ID Mapping Database on IMS (IP multimedia subsystem)

A. Kurokawa, I. Inoue, and N. Takaya

Proc. of World Telecommunications Congress 2010, OVE-Austrian Electrotechnical Association, Vol. 2010, No. 1, pp. 31–36, Vienna, Austria.

This paper proposes a new concept of a fixed mobile convergence (FMC) application architecture by using an identity (ID) mapping database for accommodating many kinds of devices on different fixed and mobile networks. We propose two approaches for creating new FMC services. One is linked multiple call sessions over multiple terminals and the other is an approach that focuses on customer ownership of multiple terminals. We also describe a method of implementing linked network services to be used for personal computers on a fixed network and for mobile phones on a mobile network by using a common application accessed by each network and an ID mapping database. Lastly, we describe an implementation approach applied to a prototype system.

Simple Sets of Measurements for Universal Quantum Computation and Graph State Preparation

Y. Takahashi

International Journal of Quantum Information, Vol. 8, No. 6, 2010.

We consider the problem of minimizing resources required for universal quantum computation using only projective measurements. The resources we focus on are observables, which describe projective measurements, and ancillary qubits. We show that the set of observ-ables $\{Z \otimes X, (\cos \theta)X + (\sin \theta)Y$ all $\theta \in [0, 2\pi)\}$ with one ancillary qubit is universal for quantum computation. The set is simpler than a previous one in the sense that one-qubit projective measurements described by the observables in the set are ones only in the (X, Y) plane of the Bloch sphere. The proof of the universality immediately implies a simple set of observables that is approximately universal for quantum computation. Moreover, the proof implies a simple set of observables for preparing graph states efficiently.

Authentication Platform for VPN Services (invited paper)

K. Matsui, K. Ota, and H. Kurita

IEICE Technical Report, Vol. 110, No. 224, pp. 25–30, 2010 (in Japanese).

Virtual private network (VPN) services are widely used especially by corporate users to connect to remote networks. Because VPN services are constructed on public IP (Internet protocol) networks, VPN authentication for user validation is needed. To improve the safety and convenience of VPN services, the following are required: multifactor authentication that combines authentication by password and by other attributes and cooperation with the application service that uses VPN and VPN authentication. Moreover, high availability of VPN authentication is also important because VPN service is becoming the basis of corporate activities. To meet these requirements, we are researching and developing a VPN authentication platform that has functions for multifactor authentication, authentication cooperation, and high availability. This paper outlines VPN authentication and its trend and describes our developed VPN authentication system "AAA".

Anonymity, Privacy, Onymity, and Identity: A Modal Logic Approach

Y. Tsukada, K. Mano, H. Sakurada, and Y. Kawabe

Transactions on Data Privacy, IIIA-CSIC, Vol. 3, No. 3, pp. 177–198, 2010.

In this paper, we propose a taxonomy of privacy-related information-hiding/disclosure properties in terms of the modal logic of knowledge for multi-agent systems. The properties considered here are anonymity, privacy, onymity, and identity. Intuitively, their meanings are as follows: anonymity hides who performed a certain specific action, privacy hides what was performed by a certain specific agent, onymity discloses who performed a certain specific action, and identity discloses what was performed by a certain specific agent. Building on Halpern and O'Neill's work, we provide formal definitions of these properties and study the logical structure underlying them. In particular, we show that some weak forms of anonymity and privacy are compatible with some weak forms of onymity and identity, respectively. We also discuss relationships between our definitions and existing standard terminology, in particular Pfitzmann and Hansen's consolidated proposal.

Indoor Air Monitoring Using Newly Developed Portable Formaldehyde Monitoring Device

Y. Y. Maruo and J. Nakamura

Indoor Environment, Vol. 13, No. 2, pp. 163–172, 2010 (in Japanese).

We have developed a portable device for monitoring formaldehyde and have carried out indoor air monitoring in several houses. The absorbance difference of the developed sensor element is measured at regular intervals in the monitoring device and converted into

formaldehyde concentration. This is possible because the rutidine derivative formed as a yellow product of the reaction between β-diketone and formaldehyde is stable in the sensor element. The device contains a light-emitting diode as a light source and photodiodes as photodetectors. It is sufficiently small (10 cm × 10 cm × 4 cm) to be installed at a desired location in a house. In addition, the device can monitor a closed area without a convection flow because it does not use a pump for air sampling. The detection limit is 5 ppb·hour, and we estimated that it took about 1 hour to detect a formaldehyde concentration of 94%. The developed sensor device is small and easy to use and we successfully carried out hourly formaldehyde monitoring using our device under several indoor conditions. We found that a high formaldehyde concentration could be measured in a room containing furniture and clothes. We also found that, although the formaldehyde concentration decreased rapidly when ventilation was provided, it recovered rapidly in a few hours when we stopped ventilating the room.

Sound and Vibration Integrated Cues for Presenting Virtual Motions

T. Saito, Y. Ikei, T. Amemiya, and K. Hirota

Proc. of ICAT 2010, VRSJ, pp. 216–217, Adelaide, Australia.

In the present study, we discuss the characteristics of sound and vibration integrated cuing for presenting virtual motions. Three-dimensional sound via 7.1-channel speakers and cutaneous vibration stimuli on the back and thigh are controlled to create the sensation of motion of virtual objects and the self body. The cuing system is designed as part of a multisensory display for an ultra-realistic experience. The system was used to investigate fundamental motion perception regarding onset timing factors for creating the sensation of motion.

High-sensitivity Charge Detection Using Antisymmetric Vibration in Coupled Micromechanical Oscillators

H. Okamoto, N. Kitajima, K. Onomitsu, R. Kometani, S. Warisawa, S. Ishihara, and H. Yamaguchi

Appl. Phys. Lett., Vol. 98, No. 1, p. 014103, 2011.

High-sensitivity charge detection using antisymmetric vibration in two coupled GaAs oscillators is demonstrated. The antisymmetric mode under in-phase simultaneous driving of the two oscillators disappears with perfect frequency tuning. The piezoelectric stress induced by a small gate-voltage modulation breaks the balance of the two oscillators, leading to the re-emergence of the antisymmetric mode. Measurement of the amplitude change enables detection of the applied voltage or, equivalently, added charges. In contrast to frequency-shift detection using a single oscillator, our method allows a large readout up to the strongly driven nonlinear response regime, providing high room-temperature sensitivity of 147 e/Hz$^{0.5}$.

Improving Power Spectra Estimation in 2-Dimensional Areas Using Number of Active Sound Sources

Y. Hioka, K. Furuya, Y. Haneda, and A. Kataoka

IEICE Trans. Fundamentals, Vol. E94-A, No. 1, pp. 273–281, 2011.

An improvement of estimating sound power spectra located in a particular two-dimensional area is proposed. We previously proposed a conventional method that estimates sound power spectra using multiple fixed beamformings in order to emphasize speech located in a particular two-dimensional area. However, the method has one drawback that the number of areas where the active sound sources are located must be restricted. This restriction makes the method less effective when many noise source located in different areas are simultaneously active. In this paper, we reveal the cause of this restriction and determine the maximum number of areas for which the method is able to simultaneously estimate sound power spectra. Then we also introduce a procedure for investigating areas that include active sound sources to reduce the number of unknown power spectra to be estimated. The effectiveness of the proposed method is examined by experimental evaluation applied to sounds recorded in a practical environment.

Vibration Amplification, Damping, and Self-Oscillations in Micromechanical Resonators Induced by Optomechanical Coupling through Carrier Excitation

H. Okamoto, D. Ito, K. Onomitsu, H. Sanada, H. Gotoh, T. Sogawa, and H. Yamaguchi

Phys. Rev. Lett., Vol. 106, p. 036801, 2011.

Carrier-induced dynamic backaction in micromechanical resonators is demonstrated. Thermal vibration of an n-GaAs/i-GaAs bilayer cantilever is amplified by optical band-gap excitation, and for the excitation power above a critical value, self-oscillations are induced. These phenomena are found in the [110]-oriented cantilever, whereas the damping (deamplification) is observed in the [$\bar{1}$10] orientation. This optomechanical coupling does not require any optical cavities but is instead based on the piezoelectric effect that is generated by photoinduced carriers.

End-User QoE Estimation for Video Communication Services by Packet-layer Model

M. Kasuda, K. Ushiki, T. Tominaga, T. Hayashi, A. Takahashi, and K. Kawashima

IEICE, Vol. J94-B, No. 1, pp. 24–35, 2011 (in Japanese).

In IP (Internet protocol) video communication services, not only bearer quality on the IP network but also the implementation of end-terminals strongly affects end-users' quality of experience (QoE). We propose a packet-layer model for estimating the video quality of IP video communication services from information in packet headers. Our model is an end-users' QoE estimation method using invalid frames, which are quality-degraded video frames, whose duration depends on the type of picture with invalid packets and on the structure of a group of pictures. The invalid packets are the sum of data loss in the IP network and end-terminals. Experimental results show that the proposed model performs well, achieving sufficient accuracy for use in quality monitoring of IP videophone and IPTV services.

Multimedia Quality Estimation Model for Video Streaming Services

T. Tominaga, K. Yamagishi, T. Hayashi, and A. Takahashi

IEICE, Vol. J94-B, No. 1, pp. 49–60, 2011 (in Japanese).

This paper proposes a multimedia quality estimation model for high-definition television (HDTV) video streaming services. The model is expressed by audio quality, video quality, and the quality of their multiplicative interaction term. First, we performed tests using two subjective assessment methods to clarify an adequate method based on the model's structure. We found that the method of evaluating the individual quality separately was adequate for measuring audio and video quality. Then we performed multiple regression analysis and constructed the multimedia quality estimation model.

Finally, we showed the model's accuracies for a real system's degradation pattern and for unknown content.

LEAVES: Legend Enhanced Application Virtual Environment System

S. Hashimoto, Y. Seki, and H. Suwa

Organizations that have a rapid turnover of staff face difficulties in passing on the knowledge possessed by experienced people to the next generation. Our goal was to build a system for smoothly passing on notes gained from experience and to make notes containing important information more "visible". Our system, Legend Enhanced Application Virtual Environment System (LEAVES), was built on the basis of a related study of an input format for formalizing notes, a system for sharing information, an algorithm for automating information organization, and an expression method that is easily understood by an inexperienced person. We tested how well the system could be used to handle notes related to two logistical challenges: moving a laboratory and setting up an exhibition. We found that LEAVES could be used to effectively create and pass on notes.