

External Awards

2014 IEICE Communications Society OCS Young Researchers Award

Winner: Masaki Wada, NTT Access Network Service Systems Laboratories

Date: December 11, 2014

Organization: Institute of Electronics, Information and Communication Engineers (IEICE)-Technical Committee on Optical Communication Systems (OCS)

For “A Study on Mode-dependent Gain Control of 2-LP-mode EDFA within the C- and L-band.”

Published as: M. Wada, T. Sakamoto, T. Mori, T. Yamamoto, N. Hanzawa, and F. Yamamoto, “Modal Gain Controllable 2-LP-mode Fiber Amplifier Using PLC Type Coupler and Long-period Grating,” *The Journal of Lightwave Technology*, Vol. 32, No. 24, pp. 4694–4700, Dec. 2014.

2014 IEICE Communications Society OFT Young Researchers Award

Winner: Takayoshi Mori, NTT Access Network Service Systems Laboratories

Date: February 19, 2015

Organization: IEICE-Technical Committee of Optical Fiber Technologies (OFT)

For “Design of Low DMD Few-mode Fibers Supporting Large Number of Modes for Mode-division-multiplexed Transmission.”

Published as: T. Mori, T. Sakamoto, M. Wada, T. Yamamoto, and F. Yamamoto, “Design of Low DMD Few-mode Fibers Supporting Large Number of Modes for Mode-division-multiplexed Transmission,” *Proc. of OFT 2014*, Kushiro City, Hokkaido, Japan, Aug. 2014.

SIGCHI Best of CHI Honorable Mention Award

Winner: Ge Gao, Naomi Yamashita, Ari Hautasaari, NTT Communication Science Laboratories; Susan Fussell, Cornell University

Date: March 3, 2015

Organization: The Association for Computing Machinery (ACM)-the Special Interest Group on Computer-Human Interaction (SIGCHI)

For “Improving Multilingual Collaboration by Displaying How Non-native Speakers Use Automated Transcripts and Bilingual Dictionaries.”

We examine the value of signaling grounding problems to native speakers by displaying how non-native speakers use automated transcripts and bilingual dictionaries. Our findings suggest ways to improve collaboration systems.

Published as: G. Gao, N. Yamashita, A. Hautasaari, and S. Fussell, “Improving Multilingual Collaboration by Displaying How Non-native Speakers Use Automated Transcripts and Bilingual Dictionaries,” *Proc. of CHI 2015*, Seoul, Korea, Apr. 2015.

SIGCHI Best of CHI Honorable Mention Award

Winner: Paul Luff, King’s College; Naomi Yamashita, NTT Communication Science Laboratories; Hideaki Kuzuoka, University of Tsukuba; Christian Heath, King’s College

Date: March 3, 2015

Organization: ACM-SIGCHI

For “Flexible Ecologies and Incongruent Locations.”

This study contributes to the studies of systems to support real-time collaborative activities by presenting some form of embodiment. It develops the analysis of fractured ecologies and fragmented interaction.

Published as: P. Luff, N. Yamashita, H. Kuzuoka, and C. Heath, “Flexible Ecologies and Incongruent Locations,” *Proc. of CHI 2015*, Seoul, Korea, Apr. 2015.

Interaction 2015 Best Interactive Presentation Award

Winner: Masanori Yokoyama, Motohiro Makiguchi, and Daichi Namikawa, NTT Service Evolution Laboratories; Yuji Takano and Satoshi Nakashima, NTT Communication Science Laboratories; Taiga Yoshida, NTT Media Intelligence Laboratories

Date: March 5, 2015

Organization: Information Processing Society of Japan (IPSJ)

For “Animal Cloud: Crowdsourcing System on the Basis of Animal Cognitions.”

We propose “Animal Cloud,” which is a micro-task crowdsourcing system based on animal cognition. The required conditions of Animal Cloud are as follows: necessity of learning the task, supplement of the task accuracy rate, and securement of the right of choice as to whether the animals do the task or not. As the first step, we implemented an image recognition system based on a rat’s perceptual or cognitive ability as an example of an application that fulfills the required conditions. We conducted the behavioral experiment and simulation to evaluate the feasibility of the system. The results suggested that the system required 50 rats that would learn the micro-task for about 15 days.

Published as: M. Yokoyama, Y. Takano, M. Makiguchi, S. Nakashima, T. Yoshida, and D. Namikawa, “Animal Cloud: Crowdsourcing System on the Basis of Animal Cognitions,” *Proc. of Interaction 2015 (the 19th IPSJ Symposium)*, Tokyo, Japan, Mar. 2015.

Young Scientist Oral Presentation Award

Winner: Takahiro Inagaki, NTT Basic Research Laboratories

Date: March 11, 2015

Organization: The Japan Society of Applied Physics (JSAP)

For “Low-voltage Optical Phase Modulation by Electric-field-induced Phase Transition of KTN Crystal.”

Published as: T. Inagaki, T. Imai, J. Miyazu, H. Takesue, and J. Kobayashi “Low-voltage Optical Phase Modulation by Electric-field-induced Phase Transition of KTN Crystal,” *Proc. of the 75th TSAP Autumn Meeting*, Sapporo, Hokkaido, Japan, Sept. 2014.

2014 IEICE Communications Society OFT Young Researchers Award

Winner: Nobutomo Hanzawa, NTT Access Network Service Systems Laboratories

Date: March 11, 2015

Organization: IEICE-OFT

For “A Study on Mode Dependent Loss of Rayleigh Scattering.”

Published as: N. Hanzawa, K. Tsujikawa, S. Nozoe, L. Ma, and F. Yamamoto, “A Study on Mode Dependent Loss of Rayleigh Scattering,” *Proc. of the 2014 IEICE General Conference*, Niigata City, Niigata, Japan, Mar. 2014.

Specially Selected Paper

Winner: Ryohei Banno, Susumu Takeuchi, Michiharu Takemoto, Tetsuo Kawano, NTT Network Innovation Laboratories; Takashi Kambayashi, NTT Science and Core Laboratory Group; Masato Matsuo, NTT Network Innovation Laboratories

Date: March 15, 2015

Organization: IPSJ

For “Designing Overlay Networks for Handling Exhaust Data in a Distributed Topic-based Pub/Sub Architecture.”

Published as: R. Banno, S. Takeuchi, M. Takemoto, T. Kawano, T. Kambayashi, and M. Matsuo, “Designing Overlay Networks for Handling Exhaust Data in a Distributed Topic-based Pub/Sub Architecture,” *Journal of Information Processing*, Vol. 23, No. 2, pp. 105–116, Mar. 2015.

Papers Published in Technical Journals and Conference Proceedings

Underdetermined Blind Separation and Tracking of Moving Sources Based on DOA-HMM

T. Higuchi, N. Takamune, T. Nakamura, and H. Kameoka

Proc. of 2014 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2014), pp. 3215–3219, Florence, Italy, May 2014.

This paper deals with the problem of the underdetermined blind separation and tracking of moving sources. In practical situations, sound sources such as human speakers can move freely, so blind separation algorithms must be designed to track the temporal changes of the impulse responses. We propose solving this problem through the posterior inference of the parameters in a generative model of an observed multichannel signal, formulated under the assumption of the sparsity of time-frequency components of speech and the continuity of speakers’ movements.

Aging and Availability of Binocular Disparity and Pictorial Depth Cues in 3D-graphics Contents

K. Kihara, H. Fujisaki, S. Ohtsuka, M. Miyao, J. Shimamura, H. Arai, and Y. Taniguchi

Journal of the Society for Information Display, Vol. 22, No. 7, pp. 329–336, July 2014.

Some stereoblind observers do not perceive depth of 3D stimuli that depend on binocular disparity. These individuals, who have no disabilities, comprise over 5% of the general population. In addition, 17.30% of non-stereoblind young (17–24 years old) and young-middle aged (25–39 years old) people do not use disparity information in certain 3D environments, a phenomenon known as pseudo-stereoblindness. This study aimed to investigate the relationship between aging and the proportion of pseudo-stereoblindness in the general population.

The Effect of Depth Information on Visual Attention under Monocular and Stereopsis Viewings: An Object Substitution Masking Study

K. Miyaji, K. Kihara, J. Shimamura, Y. Taniguchi, and S. Ohtsuka

Proc. of the 10th Asia-Pacific Conference on Vision (APCV 2014), p. 304, Takamatsu City, Kagawa, Japan, July 2014.

Since augmented reality (AR) is rapidly becoming popular, it is important to determine how visual information appears on different depth planes. Object substitution masking (OSM) is a phenomenon in which a target is masked by surrounding dots that remain after the target is offset, which depends on the division of attention. Our previous OSM study focused on a target and masking dots that were presented on different depth planes. It suggested that OSM was attenuated when participants observed binocularly, where depth cues of vergence, disparity, and accommodation were available simultaneously. However, it is still unclear whether OSM is affected by the depth difference between the target and masking dots if either vergence and disparity or accommodation can be used as depth cue(s). To address this issue, we investigated the visibility of a target in OSM with depth separation between the target and masking dots under monocular and stereopsis viewings.

Load-adaptive Indexing Method for Schema-less Searches

Y. Arakawa, T. Nakamura, M. Nakamura, N. Matsuura, Y. Kawakita, and H. Ichikawa

Proc. of the 2014 IEEE 38th International Computer Software and Applications Conference Workshop (COMPSACW '14), pp. 318–324, Västerås, Sweden, July 2014.

UBI-Tree predicts usage frequencies of each query based on the characteristics of the stored data, and classifies incoming data in the tree so as to improve the search performance of frequently used queries. We propose a new method which improves the search performance of UBI-Tree based on the real load by using a query history. We also experimentally show that the proposed method can improve the average latency and throughput of search processes.

Experimental Evaluation of Chromostereopsis with Varying Center Wavelength and FWHM of Spectral Power Distribution

M. Tsuchida, K. Kashino, and J. Yamato

Proc. of the 16th International Symposium on Multispectral Colour Science (MCS 2014), pp. 133–141, Cherbourg, France, June/July 2014.

This paper experimentally shows how the center wavelength and spectral power distribution (SPD) of displayed color is related to chromostereopsis (CS). CS is a visual illusion whereby the impression of depth is conveyed in two-dimensional color images. CS can be applied to glassless binocular stereopsis by controlling color saturation even when a commercial liquid crystal display (LCD) is used to display a two-dimensional image. We conducted evaluations of stereoscopic visual effects among monochrome images using an LCD panel and three monochrome backlights whose SPD had a single peak. The center wavelength and full width at half maximum (FWHM) of the SPD for the backlight were varied. The experimental results show that CS does not occur strongly when the FWHM of a backlight is larger than 100 nm. We also suggest that the impression of the depth for monochrome images depends on the center wavelength and FWHM of the color, which indicates CS can be expressed by the chromatic aberration.

Asymptotic Local Hypothesis Testing between a Pure Bipartite State and the Completely Mixed State

M. Owari and M. Hayashi

Physical Review, Vol. 90, No. 032327, pp. 1–18, September 2014.

In this paper, we treat asymptotic hypothesis testing between an arbitrary fixed bipartite pure state $|\Psi\rangle$ and the completely mixed state by one-way local operations and classical communication (LOCC), two-way LOCC, and separable positive operator-valued measures (POVMs). As a result, we derive single-letterized formulas for the Stein's lemma type of optimal error exponents under one-way LOCC, two-way LOCC, and separable POVMs, the Chernoff bounds under one-way LOCC POVMs and separable POVMs, and the Hoeffding bounds under one-way LOCC POVMs in the whole region of a parameter and under separable POVMs in a restricted region of a parameter. We also numerically calculate the Chernoff and the Hoeffding bounds under a class of three-step LOCC protocols in low-dimensional systems and show that these bounds not only outperform the bounds for one-way LOCC POVMs but also almost approximate the bounds for separable POVMs in the parameter region where analytical bounds for separable POVMs are derived.

Fast Signal Reconstruction from Magnitude Spectrogram of Continuous Wavelet Transform Based on Spectrogram Consistency

T. Nakamura and H. Kameoka

Proc. of the 17th International Conference on Digital Audio Effects (DAFx-14), pp. 129–135, Erlangen, Germany, September 2014.

The continuous wavelet transform (CWT) can be seen as a filterbank having logarithmic frequency subband spacing similar to the human auditory system. Thus, to make computers imitate the significant functions of the human auditory system, one promising approach would be to model, analyze, and process magnitude spectrograms given by the CWT. To realize this approach, we must be able to convert a processed or modified magnitude CWT spectrogram, which

contains no information about the phase, into a time domain signal specifically for those applications in which the aim is to generate audio signals. To this end, this paper proposes a fast algorithm for estimating the phase from a given magnitude CWT spectrogram to reconstruct an audio signal.

Joint Audio Source Separation and Dereverberation Based on Multichannel Factorial Hidden Markov Model

T. Higuchi and H. Kameoka

Proc. of the 2014 IEEE International Workshop on Machine Learning for Signal Processing (MLSP 2014), Reims, France, September 2014.

This paper proposes a unified approach for jointly solving underdetermined source separation, audio event detection, and dereverberation of convolutive mixtures. We previously proposed an extension of multichannel NMF (nonnegative matrix factorization), in which the variations over time of the spectral density and the total power of each source are modeled by a hidden Markov model (HMM). This has allowed us to conduct source activity detection and source separation simultaneously through model parameter inference. While this method was based on an anechoic mixing model, the aim of this paper is to further extend the above approach to deal with reverberation by incorporating an echoic mixing model into the generative model of observed signals.

Maximum Reconstruction Probability Training of Restricted Boltzmann Machines with Auxiliary Function Approach

N. Takamune and H. Kameoka

Proc. of MLSP 2014, Reims, France, September 2014.

Restricted Boltzmann machines (RBMs) are stochastic neural networks that can be used to learn features from raw data. They have attracted particular attention recently after being proposed as building blocks for deep belief networks (DBNs) and have been applied with notable success in a range of problems including speech recognition and object recognition. The success of these models raises the issue of how best to train them. At present, the most popular training algorithm for RBMs is the Contrastive Divergence (CD) learning algorithm. We propose deriving a new training algorithm based on an auxiliary function approach for RBMs using the reconstruction probability of observations as the optimization criterion. Through an experiment on parameter training of an RBM, we confirmed that the present algorithm outperformed the CD algorithm in terms of the convergence speed and the reconstruction error when used as an autoencoder.

Training Restricted Boltzmann Machines with Auxiliary Function Approach

H. Kameoka and N. Takamune

Proc. of MLSP 2014, Reims, France, September 2014.

Restricted Boltzmann machines (RBMs) are neural network models for unsupervised learning, but have recently found a wide range of applications as feature extractors for supervised learning algorithms. They have also received a lot of attention recently after being proposed as building blocks for deep belief networks. The success of these models raises the issue of how best to train them. At present, the most popular training algorithm for RBMs is the Contrastive Divergence (CD) learning algorithm. The aim of this paper is to seek a new

optimization algorithm tailored for training RBMs in the hope of obtaining a faster algorithm than the CD algorithm. We propose deriving a new training algorithm for RBMs based on an auxiliary function approach. Through an experiment on parameter training of an RBM, we confirmed that the present algorithm converged faster and to a better solution than the CD algorithm.

A Unified Approach for Underdetermined Blind Signal Separation and Source Activity Detection by Multichannel Factorial Hidden Markov Models

T. Higuchi, H. Takeda, T. Nakamura, and H. Kameoka

Proc. of the 15th Annual Conference of the International Speech Communication Association (Interspeech 2014), Singapore, September 2014.

This paper introduces a new model called the multi-channel factorial hidden Markov model (MFHMM) for underdetermined blind signal separation (BSS). We propose extending the multichannel NMF model by modeling the transition of the set consisting of the spectral densities and the total power of each source using a hidden Markov model (HMM). By letting each HMM contain states corresponding to active and inactive modes, we will show that voice activity detection and source separation can be solved simultaneously through parameter inference of the present model.

Speech Prosody Generation for Text-to-speech Synthesis Based on Generative Model of F_0 Contours

K. Kadowaki, T. Ishihara, N. Hojo, and H. Kameoka

Proc. of Interspeech 2014, Singapore, September 2014.

This paper deals with the problem of generating the fundamental frequency (F_0) contour of speech from a text input for text-to-speech synthesis. We previously introduced a statistical model describing the generating process of speech F_0 contours, based on the discrete-time version of the Fujisaki model. One remarkable feature of this model is that it has allowed us to derive an efficient algorithm based on powerful statistical methods for estimating the Fujisaki model parameters from raw F_0 contours. To associate a sequence of the Fujisaki model parameters with a text input based on statistical learning, this paper proposes extending this model to a context-dependent one. We further propose a parameter training algorithm for the present model based on decision tree-based context clustering.

Development of Wideband Handset for High Quality IP Telephone Service Trial

M. Okamoto, K. Noguchi, Y. Hiwasaki, and Y. Haneda

Proc. of the 2014 IEEE 3rd Global Conference on Consumer Electronics (GCCE 2014), pp. 523–524, Chiba, Japan, October 2014.

Since 2007, high quality IP telephone service has been provided over a Next Generation Network (NGN) developed by Nippon Telegraph and Telephone Corporation (NTT) Group of Japan. Prior to the commencement of service provision, a wideband telephone handset was developed on an experimental basis and tested in a field trial to verify service validity. The handset demonstrated improved characteristics over those of conventional telephone handsets.

Harmonic-temporal Factor Decomposition Incorporating Music Prior Information for Informed Monaural Source Separation

T. Nakamura, K. Shikata, N. Takamune, and H. Kameoka

Proc. of the 15th International Society for Music Information Retrieval Conference (ISMIR 2014), pp. 623–628, Taipei, Taiwan, October 2014.

For monaural source separation, two main approaches have thus far been adopted. One approach involves applying non-negative matrix factorization (NMF) to an observed magnitude spectrogram, which is interpreted as a non-negative matrix. The other approach is based on the concept of computational auditory scene analysis (CASA). A CASA-based approach called harmonic-temporal clustering (HTC) aims to cluster the time-frequency components of an observed signal based on a constraint designed according to the local time-frequency structure common in many sound sources (such as harmonicity and the continuity of frequency and amplitude modulations). This paper proposes a new approach for monaural source separation called Harmonic-Temporal Factor Decomposition (HTFD) by introducing a spectrogram model that combines the features of the models employed in the NMF and HTC approaches. We further describe some ideas on how to design the prior distributions for the present model to incorporate musically relevant information into the separation scheme.

Efficient POC-based Correspondence Detection Method for Multi-channel Images

M. Tsuchida, S. Sakai, K. Ito, K. Kashino, J. Yamato, and T. Aoki

Proc. of the 22nd Color and Imaging Conference, pp. 113–118, Boston, MA, USA, November 2014.

We propose a new phase-only correlation (POC)-based high-accuracy correspondence detection method for multi-channel images. There is the possibility of improving detection accuracy because conventional POC-based methods do not use color information. In the proposed method, a normalized cross spectrum (or cross-phase spectrum) and weight are calculated for each color channel in the Fourier domain. The weight is determined by the amplitude of the cross spectrum. The weighted normalized cross spectra of all color channels are combined, and inverse Fourier transformation is conducted to obtain a POC function. An experimental evaluation of the matching accuracy between the conventional POC-based method and the proposed method shows that RMSE (root-mean-square error) decreased approximately 25%. This paper also describes an application of the proposed method to stereo image matching. The average detection ratio of correspondences between a stereo-pair image is improved 64% to 95%.

Harmonic/Percussive Sound Separation Based on Anisotropic Smoothness of Spectrograms

H. Tachibana, N. Ono, H. Kameoka, and S. Sagayama

IEEE/ACM Transactions on Audio, Speech, and Language Processing, Vol. 22, No. 12, pp. 2059–2073, December 2014.

This paper describes a method to separate a monaural music signal into harmonic components, e.g., a guitar and percussive components such as a snare drum. Separation of these two components is a useful preprocessing step for many music information retrieval applications, and in addition, it can be used as a new kind of music equalizer in itself, which enables a music listener to freely adjust the ratio of the volume of the guitar and the drum by themselves.

Wideband Injection Locked CMOS Quadrature Ring Oscillator with Small Phase Errors

N. Jahan, A. Anand, T. Kaho, K. Yousef, and R. K. Pokharel

Proc. of the 2014 Korea-Japan Microwave Workshop (KJMW2014), Suwon, Korea, December 2014.

This paper presents a wideband low phase noise complementary metal-oxide-semiconductor (CMOS) quadrature ring oscillator. It employs a novel technique to improve phase errors by single pulse injection with three dummy transistors. The analysis was verified by models in a 0.18- μm CMOS process. The simulation results show that the phase errors can be minimized within ± 1 degree. It has a wide tuning range from 0.3 GHz to 5.8 GHz at free-run oscillation, and low phase noise with -136.8dBc/Hz @ 1MHz offset at 5.25-GHz oscillation with injection locking.

Unified Approach for Underdetermined BSS, Source Activity Detection, Dereverberation and DOA Estimation with Multichannel Factorial HMM

T. Higuchi and H. Kameoka

Proc. of the 2014 IEEE Global Conference on Signal and Information Processing (GlobalSIP), Atlanta, GA, USA, December 2014.

This paper proposes a novel method for simultaneously solving the problems of underdetermined blind source separation (BSS), source activity detection, dereverberation, and direction-of-arrival (DOA) estimation by introducing an extension of the multichannel factorial hidden Markov model (MFHMM).

Full Information Maximum Likelihood Estimation in Factor Analysis with a Large Number of Missing Values

K. Hirose, S. Kim, Y. Kano, M. Imada, M. Yoshida, and M. Matsuo

Journal of Statistical Computation and Simulation, January 2015.

We consider the problem of full information maximum likelihood (FIML) estimation in factor analysis when a majority of the data values are missing. The expectation-maximization (EM) algorithm is often used to find the FIML estimates, in which the missing values on manifest variables are included in the complete data. However, the ordinary EM algorithm has an extremely high computational cost. In this paper, we propose a new algorithm that is based on the EM algorithm but that efficiently computes the FIML estimates. A significant improvement in the computational speed is realized by not treating the missing values on manifest variables as a part of the complete data. When there are many missing data values, it is not clear if the FIML procedure can achieve good estimation accuracy. In order to investigate this, we conduct Monte Carlo simulations under a wide variety of sample sizes.

Quantum Algorithms for Finding Constant-sized Sub-hypergraphs

F. L. Gall, H. Nishimura, and S. Tani

Proc. of the 18th Conference on Quantum Information Processing (QIP 2015), Sydney, Australia, January 2015.

We develop a general framework to construct quantum algorithms that detect if a 3-uniform hypergraph given as input contains a sub-hypergraph isomorphic to a prespecified constant-sized hypergraph. This framework is based on the concept of nested quantum walks recently proposed by Jeffery, Kothari, and Magniez [SODA'13], and extends the methodology designed by Lee, Magniez, and Santha

[SODA'13] for similar problems over graphs. As applications, we obtain a quantum algorithm for finding a 4-clique in a 3-uniform hypergraph on n vertices with query complexity $O(n^{1.883})$, and a quantum algorithm for determining if a ternary operator over a set of size n is associative with query complexity $O(n^{2.113})$.

Estimating Spectral Reflectance of Fabrics from High-resolution Multi-band HDR Images

S. Tanaka, A. Takayanagi, M. Tsuchida, Y. Sakaguchi, and H. T. Tanaka

Proc. of the 21st Korea-Japan joint Workshop on Frontiers of Computer Vision (FCV 2015), Mokpo, Korea, January 2015.

We present a spectral reflectance estimation method of high reflectance targets such as fabrics compared with training samples. We show the efficacy from the results of comparing the proposed method and the conventional method. In addition, the spectral reflectance of polyester satin fabric was estimated from high-resolution multi-band high dynamic range (HDR) images. The spectral reflectance including object color was observed strongly in the weft central region.

Probabilistic Modeling of Pitch Contours towards Prosody Synthesis and Conversion

H. Kameoka

Speech Prosody in Speech Synthesis, pp. 49–69, February 2015.

Since the voice fundamental frequency (F_0) contour is an important acoustic correlate of many prosodic constructs, modeling and analyzing F_0 contours can be potentially useful for many speech applications such as speech synthesis, speaker identification, speech conversion, and dialogue systems, in which prosodic information plays a significant role. In this chapter, we formulate a statistical model of F_0 contours by translating the “Fujisaki model,” a well-founded mathematical model representing the control mechanism of vocal fold vibration, into a probabilistic model described as a discrete-time stochastic process.

Highly Realistic 3D Display System for Space Composition Telecommunication

M. Date, H. Takada, Y. Honda, S. Ozawa, S. Mieda, and A. Kojima

Journal of Display Technology, Vol. 11, No. 2, pp. 121–128, February 2015.

In this paper, we describe a highly realistic 3D display system that generates composites of current and remote places for telecommunication purposes. It uses a 3D projector and head tracking to display a person in a remote place as a life-size stereoscopic image against background scenery. Since it generates displayed images that correspond to the observer's viewing position, it reproduces well the fidelity of existence and the feel of materials. We also describe a simple, fast, and high quality background scenery generation method, the development of which was inspired by the visual effects of depth-fused 3D (DFD) displays, and applied it to a single direction conceptual demonstration system. Our system is a promising means of achieving real-time communication between two different places in cases where a sense of reality is required.

Impossibility of Classically Simulating One-clean-qubit Computation

K. Fujii, H. Kobayashi, T. Morimae, H. Nishimura, S. Tamate, and S. Tani

arXiv:1409.6777v2 [quant-ph], February 2015.

Deterministic quantum computation with one quantum bit (DQC1) is a restricted model of quantum computing where the input state is a completely mixed state except for a single clean qubit, and only a single output qubit is measured at the end of the computing. It is proved that the restriction of quantum computation to the DQC1 model does not change the complexity classes NQP (Nondeterministic Quantum Polynomial-Time) and SBQP (Small Bounded-Error Quantum Polynomial-Time). As the main consequence, it follows that the DQC1 model cannot be efficiently simulated by classical computers unless the polynomial-time hierarchy collapses to the second level (more precisely, to AM), which answers the long-standing open problem posed by Knill and Laflamme under the very plausible complexity assumption. The argument developed in this paper also weakens the complexity assumption necessary for the existing impossibility results on classical simulation of various sub-universal quantum computing models, such as the IQP (intuitive quantum physics) model and Boson sampling.

Wavelength-tunable Filter Utilizing Non-cyclic Arrayed Waveguide Grating to Create Colorless/Directionless/Contentionless ROADMs

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

Proc. of SPIE Photonics West, 938807, San Francisco, CA, USA, February 2015.

We propose here novel tunable-filter architecture that sandwiches a single-stage non-cyclic athermal AWG (arrayed waveguide grating) having flatter-topped passbands between small-scale switches. With this configuration, the optical tunable filter attains low insertion loss, large passband bandwidths, low power consumption, compactness, and high cost-effectiveness. A prototype was monolithically fabricated with PLC (planar-lightwave-circuit) technologies, and its excellent performance was experimentally confirmed utilizing 80-channel 30-GBaud dual-polarization QPSK (quadrature phase-shift-keying) signals.

Real-time Viewpoint Image Synthesis Using Strips of Multi-camera Images

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

Proc. of SPIE Photonics West, 939109, San Francisco, CA, USA, February 2015.

A real-time viewpoint image generation method is achieved. Video communications with a high sense of reality are needed to make natural connections between users in different places. In this paper, we propose a real-time viewpoint image generation method using simple blending of multiple camera images taken at equal horizontal intervals and convergence obtained by using approximate information of an object's depth.

Consideration of Tunable Components for Next-generation Passive Optical Network Stage 2

K. Asaka

Journal of Lightwave Technology, Vol. 33, No. 5, pp. 1072–1076,

March 2015.

Possible configurations of tunable components for the next-generation passive optical network stage 2 (NG-PON2) are reviewed on the basis of system requirements. Expected network functions in NG-PON2 systems along with the concept of in-service tuning in colorless ONUs are also reviewed.

Designing Overlay Networks for Handling Exhaust Data in a Distributed Topic-based Pub/Sub Architecture

R. Banno, S. Takeuchi, M. Takemoto, T. Kawano, T. Kambayashi, and M. Matsuo

Journal of Information Processing, Vol. 23, No. 2, pp. 105–116, March 2015.

To provide event-driven services in IoT, scalable methods of topic-based pub/sub messaging are indispensable. Methods using structured overlay networks are promising candidates. However, existing methods have the problem of wasting network resources, because they lack adaptivity to “exhaust data,” which have low or no value most of the time. This problem has two aspects. One is that each publisher node continues to forward data to a relay node even if there are no subscribers. The other is that excessively large multicast trees are constructed for low value data, which will be received by only a small number of subscribers. In this paper, we formulate the desirable design of overlay networks by defining a property called “strong relay-free” as an expansion of the relay-free property. The property involves publishers and subscribers composing connected subgraphs to enable detection of the absence of subscribers and autonomous adjustment of the tree size. We also propose a practical method satisfying the property by using Skip Graph, which we valuated through simulation experiments. We confirmed that the proposed method can suspend publishing adaptively and shorten the path length on multicast trees by more than 75% under an experimental condition with 100,000 nodes.

Non-linear Matrix Factorization for Group Recommendation

Y. Yoshikawa, T. Iwata, and H. Sawada

Transactions of the Japanese Society for Artificial Intelligence, Vol. 30, No. 2, pp. 485–490, March 2015.

Group recommendation is a task to recommend items to groups such as households and communities. In this paper, we propose a nonlinear matrix factorization method for group recommendation. The proposed method assumes that each member in a group has its own latent vector, and the behavior of each group is determined by the probability distribution of the members' latent vectors. Recommendations of items are performed by using nonlinear functions that map the distributions of the groups into scores for items. The nonlinear functions are generated from Gaussian processes, which are defined by the similarities between distributions of the groups. We can efficiently calculate the similarities by embedding each distribution as an element in a reproducing kernel Hilbert space. We demonstrate the effectiveness of the method using two synthetic datasets and two real datasets in two prediction tasks.

Dense Space Division Multiplexed Transmission over Multi-core and Multi-mode Fiber

T. Mizuno, H. Takara, A. Sano, and Y. Miyamoto

Proc. of the Optical Fiber Communication Conference and Exposi-

tion (OFC) 2015, Th1D.2, San Francisco, CA, USA, March 2015.

We review recent progress in space division multiplexed (SDM) transmission and examine our experimental demonstration of dense SDM (DSDM) using both multi-core and multimode, which provide a key advance to ultra-high capacity transmission.

Large-scale Optical-switch Prototype Compactly Implemented with Novel Functional Configuration

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

Proc. of OFC 2015, W3D.1, San Francisco, CA, USA, March 2015.

We propose a novel optical-switch architecture that can be compactly implemented with a novel functional configuration. A highly integrated 180×180 optical switch prototype was fabricated using planar-lightwave-circuit technologies, and its good performance was experimentally confirmed.

Demonstration of Large-port-count and Compact ROADM that Exhibits Virtual-C/D/C Performance

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We demonstrate novel large-scale and cost-effective reconfigurable optical add-drop multiplexer (ROADM) architecture that

exploits the subsystem-modular express switches and tailored transponder banks for add/drop functionality. Simulations show that the proposed ROADM offers virtual-C/D/C performance. Good transmission characteristics are experimentally confirmed.

Photospectroscopically Observed Pore-space Correlations of a Wetting Fluid during the Drying Process in Nanoporous Vycor Glass

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We use light scattering to study spatial correlations in the pore space of Vycor glass upon draining a wetting fluid. We analyze the transmission spectrum of forward-scattered light on the basis of the theory of dielectric constant fluctuation, whereas conventional light scattering analyzes the scattered light at small angles of monochromatic incident light. Assuming that the drained pores, which are surrounded by filled pores, exhibit long-range correlations of a fractal dimension of 2.5, we analytically derive the corresponding turbidity. The slight deviation from the λ^{-4} Rayleigh wavelength dependence directly provides the correlation length of the interconnected network of drained pores. The estimated length, ranging from 0.5 nm to 18 nm at most, is almost the same order as that indirectly estimated from our previous simple but effective Rayleigh scattering model.