External Awards

Papers Published in Technical Journals and Conference Proceedings

Hierarchical Auto-tagging: Organizing Q&A Knowledge for Everyone

K. Nishida and K. Fujimura

Proc. of CIKM, the 19th ACM International Conference on Information and Knowledge Management, Vol. 2010, No. 10, pp. 1657–1660, Toronto, Canada, 2010.

We propose a hierarchical auto-tagging system, TagHats, to improve users' knowledge sharing. Our system assigns three different levels of tags to Q&A documents: category, theme, and keyword. Multiple category tags can organize a document according to multiple viewpoints, and multiple theme and keyword tags can identify what the document is about clearly. Moreover, these hierarchical tags will be helpful in organizing documents to support everyone because different users have different demands in terms of tag specificity. Our system consists of a hierarchical classification method for assigning category and theme tags, a new keyword extraction method that considers the structure of Q&A documents, and a new method for selecting theme tag candidates from each category. Experiments with documents at Oshiete! goo demonstrate that our system is able to assign hierarchical tags to documents appropriately and is capable of outperforming baseline methods significantly.

Designing Efficient Authenticated Key Exchange Resilient to Leakage of Ephemeral Private Keys

A. Fujioka and K. Suzuki

CT-RSA 2011, Lecture Notes in Computer Science, 2011, Vol. 6558/2011, pp. 121–141, San Francisco, CA, USA, 2011.

We investigate a sufficient condition for constructing authenticated key exchange (AKE) protocols which satisfy security in the extended Canetti-Krawczyk (eCK) model proposed by LaMacchia, Lauter and Mityagin. To the best of our knowledge, this is the first approach for providing secure protocols based on the condition. With this condition, we propose a construction of two-pass AKE protocols, and the resulting two-pass AKE protocols are constructed with a single static key and a single ephemeral. In addition, the security proof does not require the Forking Lemma, which degrades the security of a protocol relative to the security of the underlying problem where it is used in the security proof. Therefore, these imply that the protocols constructed with the condition have an advantage in efficiency such as sizes of storage and communication data. The security of the resulting protocols is proved under the gap Diffie-Hellman assumption in the random oracle model.

Digital Cinema over Optical Network—Status of Super HD Development

T. Fujii, K. Shirakawa, D. Shirai, Y. Tonomura, and M. Kitamura

Proc. of the Optical Fiber Communication Conference and Exposition (OFC/NFOEC 2011) and the National Fiber Optic Engineers Conference, Los Angeles, CA, USA.

Digital Cinema is a promising application that utilizes high-speed optical networks to transfer super-high-definition images. The networks are primarily used for distributing packet data of digital cinema contents and also used to support new services such as the live streaming of musicals and sports games to movie theaters. While current transfer services offer high-definition (HD) quality video, live streaming applications will soon shift to cinema-quality 4K for both business and movie theaters users. The extra-high-quality 4K enables a realistic telepresence and will be combined with special tools such as video editing systems to realize effective remote-collaboration for business workspaces. This paper introduces current research on super-high-definition image transmission and its application, especially in digital cinema and relevant application fields.

An Approximately Universal Set Consisting of Two Observables

Y. Takahashi

Proc. of the 6th Conference on Theory of Quantum Computation, Communication, and Cryptography (TQC 2011), Madrid, Spain.

We show that if we are allowed to use two ancillary qubits, a set consisting of one one-qubit observable and one two-qubit observable is approximately universal for quantum computation. Using the proof, we also show that if we are allowed to use two initialized ancillary qubits, one two-qubit observable is sufficient for graph state preparation. The use of only one two-qubit observable is optimal in terms of the number of observables available and the number of qubits to be measured jointly.

Generation of a Vocal-tract MRI Movie Based on Sparse Sampling

S. Hiroya and T. Kitamura

Proc. of the 9th International Seminar on Speech Production (ISSP'11), pp. 1–8, Montreal, Canada, 2011.

We present a novel technique that can provide a high-quality vocal tract magnetic resonance imaging (MRI) movie during speech production. The method uses MRI vocal-tract images at the central point of each phoneme and interpolation functions between adjacent phonemes obtained from electromagnetic articulographic data. It is based on our finding that articulatory parameters are suitable for a sparse representation. Preliminary results showed that the quality of the obtained vocal-tract MRI movie is high compared with that of the previous technique. The method will be useful for constructing a large database of vocal-tract MRI movies and understanding speech production mechanisms.

Tweet-topic Classification Using Data Compression

K. Nishida, R. Banno, K. Fujimura, and T. Hoshide

Proc. of the 3rd Forum on Data Engineering and Information Management (DEIM Forum 2011), pp. 1–6, Izu, Shizuoka, Japan (in Japanese).

Twitter, a micro-blogging service, has emerged as a new information infrastructure. In this study, we propose a new method that uses data compression for classifying topics of tweets (conversational, short, and real-time messages). Experiments with Japanese tweets assigned hash tags demonstrate that our method using the Deflate data compression method, which gzip uses, achieved higher precision and recall rates than the confidence-weighted linear classification method, which uses the character n-grams or morphemes of a tweet text as input features.

Design and Performance of a Sub-nano-ampere Two-stage Power Management Circuit in 0.35-μm CMOS for Dust-size Sensor Nodes

M. Ugajin, T. Shimamura, S. Muto, and M. Harada

IEICE Trans. on Electronics, Vol. E94.C, No. 7, pp. 1206–1211, 2011.

The design and performance of a sub-nanoampere two-stage power management circuit that uses off-chip capacitors for energy accumulation are presented. Focusing on the leakage current and the transition time of the power switch transistor, we estimated the minimum current for accumulation. On the basis of the results, we devised a two-stage power management architecture for sub-nanoampere operation. The simulation and experimental results for the power management circuit reveal the accumulation operation with a 1-nA current source.

Electrical Characterization of Terphenyl-based Molecular Devices

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Japanese Journal of Applied Physics, Vol. 50, No. 7, pp. 071603–071603-6, 2011.

The electrical characteristics of phenylene-based molecular devices were assessed. A device consisted of nanogap electrodes and phenylene-based conjugated molecules. Two different types of nanogap electrode were tested. One was obtained by electromigration of a Au nanowire modified with a self-assembled monolayer (SAM) of 4,4-p-terphenyldithiol and the other was fabricated by the shadow evaporation of metals and subsequent deposition of a SAM. Some of the devices with electrodes of the first type exhibited activation energy for electrical conduction of up to 0.26 eV. This high activation energy coincides with the intramolecular barrier estimated by ab $initio$ molecular orbital calculations. On the other hand, all of the devices with electrodes of the second type exhibited a comparatively low activation energy. Neither device type showed a clear gate effect with an electrical field of up to 3 MV/cm. These results indicate that the electrical characteristics of molecular devices are affected by the fabrication process and the resultant molecule-electrode configuration.

Localized Corrosion of Lead in Water Containing High Concentration of Chloride Ions

M. Watanabe, E. Yoneta, S. Yanagi, M. Matsumoto, M. Kama, H. Saito, T. Handa, and T. Sawada

Journal of Material Testing Research Association of Japan, Vol. 56, No. 3, pp. 139–146, 2011.

We investigated the reproduction of crevice corrosion in lead and observed the corroded samples. Electrochemical tests revealed the pitting corrosion mechanism of passive film on lead surface. The crevice corrosion progressed with exposure time. First, a passive film was formed after exposure to the atmosphere. Next, pit corrosion occurred at the film/metal interface. Roughly speaking, the pit corrosion rate was reduced because of the formation of a new passive film. However, the corrosion rate of lead was accelerated when the pH became lower at the crevice.

A System for Creating the Content for a Multi-sensory Theater

K. Hirota, S. Ebisawa, T. Amemiya, and Y. Ikei

Virtual and Mixed Reality—Systems and Applications, Lecture Notes in Computer Science, 2011, Vol. 6774, pp. 151–157, 2011.

This paper reports on the current progress of a project to develop a multi-sensory theater. The project targets not only the development of hardware devices for multi-sensory presentations but also an investigation into the framework and method of expression for creating the content. Olfactory, wind, and pneumatic devices that present the sensation of odor, wind, and gusts, respectively, were developed and integrated into an audio-visual theater environment. All the devices, including the video device, are controlled through a MIDI interface. A framework for creating multi-sensory content by programming the sequence of device operations was also implemented.

Concave-convex Surface Perception by Visuo-vestibular Stimuli for Five-senses Theater

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

Virtual and Mixed Reality—New Trends, Lecture Notes in Computer Science, Vol. 6773, pp. 225–233, 2011.

The paper describes a pilot study of perceptual interactions among visual, vestibular, and tactile stimulations for enhancing the sense of presence and naturalness for ultra-realistic sensations. In this study, we focused on understanding the temporally and spatially optimized combination of visuo-tactile-vestibular stimuli that create concave-convex surface sensations. We developed an experimental system to present synchronized visuo-vestibular stimulation and evaluated the influence of various combinations of visual and vestibular stimuli on the shape perception by body motion. The experimental results motivate us to add a tactile sensation to facilitate ultra-realistic communication by changing the contact area between the human body and motion chair.

Sparse Source Separation Based on Simultaneous Clustering of Source Locational and Spectral Features

S. Araki, T. Nakatani, and H. Sawada

Acoustical Science and Technology, Vol. 32, No. 4, pp. 161–164, 2011.

This paper proposes blind source separation methods for sparse sources that have an inherent ability to align the permutation of frequency components, and the approach can be applied even if the number of sources is unknown. The proposed method simultaneously classifies both the source locational feature (phase difference between microphones) and the spectral feature (spectral temporal envelope). In this method, source separation in each frequency bin is performed by clustering the source locational features while synchronizing the spectral envelop. Thanks to the common amplitude modulation characteristics, this method inherently aligns the permutation of the frequency components.

Carrier-mediated optomechanical coupling in GaAs cantilevers

Phys. Rev. Vol. B 84, p. 014305, 2011.

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

We have investigated optomechanical coupling in n-GaAs/i-GaAs bilayer cantilevers induced by optical band-gap excitation. The strain-assisted optopiezoelectric effect, which is associated with the separation of electron-hole pairs due to the built-in electric field, causes a time-delayed backaction force and influences the thermal vibration of the cantilevers. Vibration of the [110]-oriented cantilever is amplified by this optopiezoelectric backaction, and self-oscillation is induced for strong excitation. In contrast, for the [1 10]-oriented cantilever, the optopiezoelectric backaction dampens the vibration because the direction of the piezoelectric stress is reversed. We have experimentally extracted the response time of this optopiezoelectric backaction, where the delay is on the order of the nonradiative recombination lifetime in GaAs. This optopiezoelectric backaction is maximized when the laser wavelength matches the optical absorption edge. This is because the strain-induced change in the optical absorption is maximized at the absorption edge, so a large force gradient results.