

External Awards

IPSJ Yamashita SIG Research Award

Winner: Takeshi Mishima, NTT Software Innovation Center

Date: March 13, 2018

Organization: Information Processing Society of Japan (IPSJ)

For “Database Live Migration Middleware in Cloud Environment.”

Database-as-a-service has been gaining popularity in cloud computing because multitenant databases can reduce costs by sharing off-the-shelf resources. However, due to heavy workloads, resource sharing often causes a hot spot. Unfortunately, a hot spot can lead to violation of service level agreements and destroy customer satisfaction. To efficiently address the hot spot problem, we propose a middleware approach called Madeus that conducts database live migration. To make efficient database live migration possible, we also

introduce the lazy snapshot isolation rule (LSIR) that enables concurrently propagating syncsets, which are the datasets needed to synchronize slave with master databases. Unlike current approaches, Madeus is pure middleware that is transparent to the database management system and is based on commodity hardware and software. To demonstrate the superiority of our approach over current approaches, we experimentally evaluated Madeus by using PostgreSQL with the TPC-W benchmark. The results indicate that Madeus achieves more efficient live migration than three other types of middleware approaches, especially under heavy workloads; therefore, it can effectively resolve hot spots.

Published as: T. Mishima and Y. Fujiwara, “Database Live Migration Middleware in Cloud Environment,” WebDB Forum 2016, Kanagawa, Japan, Sept. 2016 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Shape Parameter Estimation for Generalized-Gaussian-distributed Frequency Spectra of Audio Signals

R. Sugiura, Y. Kamamoto, and T. Moriya

Proc. of the 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 736–740, New Orleans, LA, USA, March 2017.

We have devised a method for estimating, from a single frame of audio frequency spectra, a shape parameter of multivariate generalized Gaussian distribution which has variance represented by an all-pole model and no covariance. Based on powered all-pole spectrum estimation (PAPSE), which is an extension of linear prediction, the proposed method simultaneously estimates the shape parameter and the maximum-likelihood variance, allowing more accurate representation of the probability density functions of the spectra. This paper shows an integration of the estimation into an audio codec for an example of its application, which resulted in the enhancement of the objective and subjective reconstruction quality. Since this estimation method provides us with simple parameters which reflect some acoustic features of signals, the method may also be useful in other audio signal processing problems.

Overlapping of Back Vowels /o/ and /u/ by Young Seoul Korean Speakers: Focusing on the Effect of Preceding Consonantal Type and Utterance Unit on Overlap in Formant Distribution

T. Igeta, S. Hiroya, and T. Arai

Journal of the Phonetic Society of Japan, Vol. 21, No. 2, pp. 53–60, August 2017 (in Japanese).

This study investigated overlapping of /o/ and /u/ in young Seoul Korean speakers’ lenis/aspirated CV (consonant-vowel) syllables and discusses its results with previous studies’ observations of overlapping in speech units of different length. Male speakers showed no overlapping in the lenis CV context, but did in the aspirated CV context. Females showed overlapping in both contexts, with greater overlapping in the aspirated. By comparing with previous V and read speech studies, it suggests that overlapping may be related to coarticulation and clarity reduction for males. For females, there is a possibility that the presence of C reduces overlapping in V.

CLEAR: Conditionally Lossless Encoding under Allowed Rates for Low-delay Sound Data Transmission

R. Sugiura, Y. Kamamoto, N. Harada, T. Kawanishi, and T. Moriya

The 143rd Audio Engineering Society International Convention, 9899, New York, NY, USA, October 2017.

We present in this paper a near-lossless full-band stereo compression scheme called Conditionally Lossless Encoding under Allowed Rates (CLEAR), aiming at its use in real-time transmission of sound data and sounds to be mixed or processed after being transmitted. Using a uniform quantizer with MPEG-4 Audio Lossless Coding (ALS) and adaptive pre- and post-processing, CLEAR controls the encoding bit rate with maximum fidelity of reconstructed signals. Objective experiments show an enhancement in signal to noise ratio (SNR) and from conventional low-delay codecs with compatible perceptual quality. Additionally, companding-based perceptual weighting designed for CLEAR is shown to make an improvement in Perceptual Evaluation of Audio Quality (PEAQ).

Impact of Articulator Velocity-controlled Rhythm in Perceiving Speech

S. Hiroya, N. Lavan, S. Chen, and S. K. Scott

Neuroscience 2017, Washington, D.C., USA, November 2017.

In this study, we developed a method that can convert temporal patterns of speech based on articulator velocity. The velocity was calculated from articulatory data, which were collected using the electromagnetic articulography (EMA) system. The bell-shaped velocity profile of natural speech was converted to an emphasized, uniform, and reversed velocity profile, without altering sentence duration. The result of speech intelligibility (percent keywords correct) showed natural = emphasized > uniform > reversed. Also, results showed natural > emphasized > uniform > reversed. These results indicate that speech intelligibility is affected by the non-biological articulator velocity profile such as uniform and reversed, but naturalness of speech rhythm is affected by any manipulation of velocity profiles.

Display Technologies of Sensory-motor Information Utilizing Touch and Somatic Illusions

T. Amemiya

The Japanese Journal of Psychonomic Science, Vol. 36, No. 1, pp. 135–141, December 2017 (in Japanese).

Touch, the sensation processed by the somatosensory system, is closely related to the body state. Due to the spatiotemporal characteristics of the somatosensory receptors and the structural constraints of the body, we have sometimes experienced sensory illusions in touch as well as in vision. In this paper, I introduce several techniques to generate illusory sensations which can be exploited to develop information displays. I review the previous findings of our experiments of the changes in haptic perception or body image using the techniques.

Multi-access Edge Computing: A Survey

H. Tanaka, M. Yoshida, K. Mori, and N. Takahashi

Journal of Information Processing, Vol. 26, pp. 87–97, February 2018.

Multi-access Edge Computing (MEC) can be defined as a model for enabling a business oriented, cloud computing platform within multiple types of access networks (e.g., LTE, 5G, Wi-Fi, FTTH, etc.) at the close proximity of subscribers to serve delay sensitive, context aware applications. To extract the most potential, MEC has to be designed as infrastructure to support many kinds of IoT applications and their ecosystems, in addition to having a sufficient management mechanism. In this context, various research and standardization efforts are ongoing. This paper provides a comprehensive survey of the state-of-the-art research efforts on the MEC domain, with a focus on the architectural proposals as infrastructure, the issue of the partitioning of processing among user devices, edge servers, and a cloud, and the issue of resource management.