External Awards

Specially Selected Paper
Winners: Takashi Koide, Daiki Chiba, Mitsuaki Akiyama, NTT Secure Platform Laboratories; Katsunari Yoshioka, Tsutomu Matsumoto, Yokohama National University
Date: May 19, 2021
Organization: Information Processing Society of Japan (IPSJ)

For "Understanding the Fake Removal Information Advertisement Sites."
Published as: T. Koide, D. Chiba, M. Akiyama, K. Yoshioka, and T. Matsumoto, "Understanding the Fake Removal Information Advertisement Sites," Journal of Information Processing, Vol. 29, pp. 392–405, May 2021.

PRMU Research Encouragement Award
Winners: Kazuki Adachi and Shin'ya Yamaguchi, NTT Software Innovation Center
Date: May 21, 2021
Organization: The Institute of Electronics, Information and Communication Engineers (IEICE) Technical Committee on Pattern Recognition and Media Understanding (PRMU)

For "Improving Accuracy on Biased Datasets via Explanations of Deep Neural Networks."
Published as: K. Adachi and S. Yamaguchi, "Improving Accuracy on Biased Datasets via Explanations of Deep Neural Networks," IEICE Tech. Rep., Vol. 120, No. 409, PRMU2020-93, pp. 139–144, Mar. 2021.

Best Paper Award
Winners: Yoshihiro Ogiso, Josuke Ozaki, Yuta Ueda, NTT Device Innovation Center; Hitoshi Wakita, NTT Device Technology Laboratories; Shigeru Kanazawa, Mitsuteru Ishikawa, NTT Device Innovation Center
Date: June 3, 2021
Organization: IEICE

For "Ultra-high Bandwidth and Low Drive Voltage InP-based IQ Optical Modulator for 100-GBd Class Optical Transmitter."
Published as: Y. Ogiso, J. Ozaki, Y. Ueda, H. Wakita, S. Kanazawa, and M. Ishikawa, "Ultra-high Bandwidth and Low Drive Voltage InP-based IQ Optical Modulator for 100-GBd Class Optical Transmitter," IEICE Trans. Electron., Vol. J103-C, No. 1, pp. 61–68, Jan. 2020 (in Japanese).

Encouraging Award
Winner: Rintaro Harada, NTT Access Network Service Systems Laboratories
Date: September 10, 2021
Organization: IEICE Technical Committee on Communication Systems

For "A Study on Optical Access Systems for 6G Radio Access Networks."
Published as: R. Harada, H. Ujikawa, N. Shibata, S. Kaneko, and J. Terada, "A Study on Optical Access Systems for 6G Radio Access Networks," IEICE Tech. Rep., Vol. 120, No. 107, CS2020-17, pp. 13–16, 2020.

Papers Published in Technical Journals and Conference Proceedings

Variational Secure Cloud Quantum Computing
Y. Shingu, Y. Takeuchi, S. Endo, S. Kawabata, S. Watabe, T. Nikuni, H. Hakoshima, and Y. Matsuzaki
arXiv:2106.15770, June 2021.

Variational quantum algorithms (VQAs) have been considered to be useful applications of noisy intermediate-scale quantum (NISQ) devices. Typically, in the VQAs, a parametrized ansatz circuit is used to generate a trial wave function, and the parameters are optimized to minimize a cost function. On the other hand, blind quantum computing (BQC) has been studied in order to provide the quantum algorithm with security by using cloud networks. A client with a limited ability to perform quantum operations hopes to have access to a quantum computer of a server, and BQC allows the client to use the server's computer without leakage of the client's information (such as input, running quantum algorithms, and output) to the server. However, BQC is designed for fault-tolerant quantum computing, and this requires many ancillary qubits, which may not be suitable for NISQ devices. Here, we propose an efficient way to implement the NISQ computing with guaranteed security for the client. In our architecture, only $N+1$ qubits are required, under an assumption that the form of ansatzes is known to the server, where N denotes the necessary number of the qubits in the original NISQ algorithms. The client only performs single-qubit measurements on an ancillary qubit sent from the server, and the measurement angles can specify the parameters for the ansatzes of the NISQ algorithms. No-signaling principle guarantees that neither parameters chosen by the client nor the

outputs of the algorithm are leaked to the server. This work paves the way for new applications of NISQ devices.

The Unicellular Red Alga *Cyanidioschyzon merolae*, an Excellent Model Organism for Elucidating Fundamental Molecular Mechanisms and Their Applications in Biofuel Production

I. Pancha, K. Takaya, K. Tanaka, and S. Imamura

Plants, Vol. 10, No. 6, 1218, June 2021.

Microalgae are considered one of the best resources for the production of biofuels and industrially important compounds. Various models have been developed to understand the fundamental mechanism underlying the accumulation of triacylglycerols (TAGs)/starch and to enhance its content in cells. Among various algae, the red alga *Cyanidioschyzon merolae* has been considered an excellent model system to understand the fundamental mechanisms behind the accumulation of TAG/starch in the microalga, as it has a smaller genome size and various biotechnological methods are available for it. Furthermore, *C. merolae* can grow and survive under high temperature (40°C) and low pH (2–3) conditions, where most other organisms would die, thus making it a choice alga for large-scale production. Investigations using this alga has revealed that the target of rapamycin (TOR) kinase is involved in the accumulation of carbon-reserved molecules, TAGs, and starch. Furthermore, detailed molecular mechanisms of the role of TOR in controlling the accumulation of TAGs and starch were uncovered via omics analyses. Based on these findings, genetic engineering of the key gene and proteins resulted in a drastic increment of the amount of TAGs and starch. In addition to these studies, other trials that attempted to achieve the TAG increment in *C. merolae* have been summarized in this article.

Articulatory Compensation for Low-pass Filtered Formant-altered Auditory Feedback

Y. Uezu, S. Hiroya, and T. Mochida

The Journal of the Acoustical Society of America, Vol. 150, No. 1, pp. 64–73, July 2021.

Auditory feedback while speaking plays an important role in stably controlling speech articulation. Its importance has been verified in formant-altered auditory feedback (AAF) experiments where speakers utter while listening to speech with perturbed first (F1) and second (F2) formant frequencies. However, the contribution of the frequency components higher than F2 to the articulatory control under the perturbations of F1 and F2 has not yet been investigated. In this study, a formant-AAF experiment was conducted in which a low-pass filter was applied to speech. The experimental results showed that the deviation in the compensatory response was significantly larger when a low-pass filter with a cutoff frequency of 3 kHz was used compared to that when cutoff frequencies of 4 and 8 kHz were used. It was also found that the deviation in the 3-kHz condition correlated with the fundamental frequency and spectral tilt of the produced speech. Additional simulation results using a neurocomputational model of speech production (SimpleDIVA model) and the experimental data showed that the feedforward learning rate increased as the cutoff frequency decreased. These results suggest that high-frequency components of the auditory feedback would be involved in the determination of corrective motor commands from auditory errors.

Effects of Vibrotactile Stimuli on Perception of Voiced and Unvoiced Bilabial Stop Consonants in Noise

A. Ono, M. Nakatani, A. Nakane, J. Watanabe, and S. Hiroya

Proc. of the 12th International Seminar on Speech Production (ISSP2020), pp. 194–197, July 2021.

Vibrotactile stimulation replicating laryngeal vibration has been reported to improve discrimination between degraded voiced and unvoiced consonants in consonant-vowel syllables. In this study, we investigated (1) whether or not vibrotactile stimulation in the consonant region biases the perception of unvoiced consonants toward voiced ones and (2) the relationship between the effect and auditory efficacy. Our results indicated that vibrotactile stimulation across the unvoiced consonant and vowel region, not just in the unvoiced consonant region, biased the consonant perception toward voiced consonants. Also, we found a non-linear effect of vibrotactile stimulation across the consonant-vowel region on auditory efficacy. Our findings will likely contribute to understanding how to improve intelligibility under noisy conditions and will likely help people with hearing impairments.