

External Awards

Paper Award

Winners: Tatsuya Iizuka, NTT Space Environment and Energy Laboratories; Takuya Sasatani, University of Tokyo; Naoko Kosaka, NTT Space Environment and Energy Laboratories; Masaki Hisada, NTT Space Environment and Energy Laboratories; Koya Narumi, University of Tokyo; Yoshihiro Kawahara, University of Tokyo

Date: July 15, 2022

Organization: Information Processing Society of Japan

For “Corner-reflector-based Chipless RFID for Wide Range Readout with Low Power Millimeter Wave Radar.”

Published as: T. Iizuka, T. Sasatani, N. Kosaka, M. Hisada, K. Narumi, and Y. Kawahara, “Corner-reflector-based Chipless RFID for Wide Range Readout with Low Power Millimeter Wave Radar,” Proc. of Multimedia, Distributed, Cooperative, and Mobile (DICO-MO) 2022 Symposium, 5H-3, pp. 1085–1091, July 2022.

20th JSAP Photo & Illustration Contest (Science As Art), Excellent Award

Winners: Masato Takiguchi, NTT Basic Research Laboratories; Sylvain Sergent, NTT Basic Research Laboratories; Masaya Notomi, NTT Basic Research Laboratories; Stéphane Vézian, Centre national de la recherche scientifique; Benjamin Damilano, Centre national de la recherche scientifique

Date: October 12, 2022

Organization: The Japan Society of Applied Physics (JSAP)

For “Nano-size Pencil?”

An image of hollow-core nanowire lasers.

Published as: M. Takiguchi, S. Sergent, M. Notomi, S. Vézian, and B. Damilano, “Nano-size Pencil?”, 20th JSAP Photo & Illustration Contest (Science As Art), Oct. 2022.

MIKA Poster Award for Senior Researchers

Winner: Takashi Satake, NTT Network Service Systems Laboratories

Date: October 15, 2022

Organization: Multiple Innovative Kenkyu-kai Association for wireless communications (MIKA), Institute of Electronics, Information and Communication Engineers (IEICE) Communications Society

For “An Effective Location Registration Method in Environments with Large Amount of IoT User Equipment - Use Cases under Large-scale Failures -”.

Published as: T. Satake, Y. Narusue, and H. Morikawa, “An Effective Location Registration Method in Environments with Large Amount of IoT User Equipment - Use Cases under Large-scale Failures -”, MIKA 2022, Oct. 2022 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Composing General Audio Representation by Fusing Multi-layer Features of Pre-trained Model

D. Niizumi, D. Takeuchi, Y. Ohishi, N. Harada, and K. Kashino

Proc. of the 30th European Signal Processing Conference (EUSIPCO 2022), pp. 200–204, Belgrade, Serbia, August/September 2022.

Many application studies rely on audio DNN (deep neural network) models pre-trained on a large-scale dataset as essential feature extractors, and they extract features from the last layers. In this study, we focus on our finding that the middle layer features of existing supervised pre-trained models are more effective than the late layer features for some tasks. We propose a simple approach to compose features effective for general-purpose applications, consisting of two steps: (1) calculating feature vectors along the time frame from middle/late layer outputs, and (2) fusing them. This approach improves the utility of frequency and channel information in downstream processes, and combines the effectiveness of middle and late layer features for different tasks. As a result, the feature vectors

become effective for general purposes. In the experiments using VGGish, PANNs’CNN14, and AST on nine downstream tasks, we first show that each layer output of these models serves different tasks. Then, we demonstrate that the proposed approach significantly improves their performance and brings it to a level comparable to that of the state-of-the-art. In particular, the performance of the non-semantic speech tasks greatly improves, especially on Speech commands V2 with VGGish of +77.1 (14.3% to 91.4%).

Multiple Beat-noise Suppression in Polarization-multiplexed Pump Light for Forward-pumped Raman Amplifier

H. Kawakami, T. Kobayashi, and Y. Kisaka

Proc. of the 48th European Conference on Optical Communication (ECOC 2022), We4D.6, Basel, Switzerland, September 2022.

We show that orthogonally polarized pump light emitted from two

different laser sources in a forward-pumped Raman amplifier system induces beat noise on amplified signal light. Utilizing our proposed noise suppression technique, we improved the signal-to-noise ratio of a 36-QAM (quadrature amplitude modulation) signal after a 1920-km transmission.

Quantifying Fermionic Nonlinearity of Quantum Circuits

S. Hakkaku, Y. Tashima, K. Mitarai, W. Mizukami, and K. Fujii
Physical Review Research, Vol. 4, 043100, November 2022.

Variational quantum algorithms (VQAs) have been proposed as one of the most promising approaches to demonstrate quantum advantage on noisy intermediate-scale quantum (NISQ) devices. However, it has been unclear whether VQAs can maintain quantum advantage under the intrinsic noise of the NISQ devices, which deteriorates the quantumness. Here we propose a measure, called *fermi-*

onic nonlinearity, to quantify the classical simulatability of quantum circuits designed for simulating fermionic Hamiltonians. Specifically, we construct a Monte Carlo type classical algorithm based on the classical simulatability of fermionic linear optics, whose sampling overhead is characterized by the fermionic nonlinearity. As a demonstration of these techniques, we calculate the upper bound of the fermionic nonlinearity of a rotation gate generated by four fermionic modes under the dephasing noise. Moreover, we estimate the sampling costs of the unitary coupled cluster singles and doubles quantum circuits for hydrogen chains subject to the dephasing noise. We find that, depending on the error probability and atomic spacing, there are regions where the fermionic nonlinearity becomes very small or unity, and hence the circuits are classically simulatable. We believe that our method and results help to design quantum circuits for fermionic systems with potential quantum advantages.
