External Awards

Certificate of Appreciation
Winner: Seishi Takamura, NTT Computer and Data Science Laboratories
Date: December 17, 2021
Organization: Asia-Pacific Signal and Information Processing Association (APSIPA)

For his leadership and dedication to the activities of industrial relations and development of APSIPA as Vice President - Industrial Relations and Development from 2020 to 2021.

Certificate of Appreciation
Winner: Seishi Takamura, NTT Computer and Data Science Laboratories
Date: December 17, 2021
Organization: APSIPA

For serving as an Industrial Forum Co-Chair at the APSIPA Annual Summit and Conference 2021.

Specially Selected Paper
Winners: Sorachi Kato, Osaka University; Tomoki Murakami, NTT Access Network Service Systems Laboratories; Takuya Fujihashi, Takashi Watanabe, Shunsuke Saruwatari, Osaka University
Date: January 15, 2022
Organization: Information Processing Society of Japan

For “CBR-ACE: Counting Human Exercise Using Wi-Fi Beamforming Reports.”
Published as: S. Kato, T. Murakami, T. Fujihashi, T. Watanabe, and S. Saruwatari, “CBR-ACE: Counting Human Exercise Using Wi-Fi Beamforming Reports,” Journal of Information Processing, Vol. 30, No. 1, pp. 66–74, 2022.

Top Reviewer Award (Top 10%)
Winner: Yoichi Chikahara, NTT Communication Science Laboratories
Date: February 11, 2022
Organization: The 25th International Conference on Artificial Intelligence and Statistics (AISTATS 2022)

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

Physical Review A, Vol. 105, 022603, Feb. 2022.

Variational quantum algorithms (VQAs) have been considered to be useful applications of noisy intermediate-scale quantum (NISQ) devices. Typically, in 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 a 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 ansätze 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 ansätze of the NISQ algorithms. The 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.

Passive Verification Protocol for Thermal Graph States
K. Akimoto, S. Tsuchiya, R. Yoshii, and Y. Takeuchi

arXiv:2202.10624, Feb. 2022.

Graph states are entangled resource states for universal measurement-based quantum computation. Although matter qubits such as superconducting circuits and trapped ions are promising candidates to generate graph states, it is technologically hard to entangle a large number of them due to several types of noise. Since they must be sufficiently cooled to maintain their quantum properties, thermal noise is one of major ones. In this paper, we show that for any temperature T, the fidelity $\langle G|\rho_T|G\rangle$ between an ideal graph state $|G\rangle$ at zero temperature and a thermal graph state ρ_T, which is a graph state at temperature T, can be efficiently estimated by using only one measurement setting. A remarkable property of our protocol is that it is passive, while existing protocols are active, namely they switch between at least two measurement settings. Since thermal noise is equivalent to an independent phase-flip error, our estimation protocol also works for that error. By generalizing our protocol to hypergraph states, we apply our protocol to the quantum-computational-supremacy demonstration with instantaneous quantum polynomial time circuits. Our results should make the characterization of entangled matter qubits extremely feasible under thermal noise.