Contribution ID: **62** Type: **not specified**

Quantum State Preparation for Probability Distributions with Mirror Symmetry Using Matrix Product States

Wednesday, 27 March 2024 18:57 (3 minutes)

Quantum circuits for loading probability distributions into quantum states are essential subroutines in quantum algorithms used in physics, finance engineering, and machine learning. The ability to implement these with high accuracy in shallow quantum circuits is a critical issue. We propose a novel quantum state preparation method for probability distribution with mirror symmetry using matrix product states. By considering mirror symmetry, our method reduces the entanglement of probability distributions and improves the accuracy of approximations by matrix product states. As a result, we improved the accuracy by two orders of magnitude over existing methods using matrix product states. Our approach, characterized by a shallow quantum circuit primarily comprising nearest-neighbor qubit gates and linear scalability with qubit count, is highly advantageous for noisy quantum devices. Also, our experimental findings reveal that the approximation accuracy in tensor networks depends heavily on the bond dimension, with minimal reliance on the number of qubits. We experimentally demonstrated our method for a normal distribution encoded into 10 and 20 qubits on a real quantum processor.

Primary author: SANO, Yuichi (Kyoto University)

Co-author: Dr HAMAMURA, Ikko (IBM Quantum)

Presenter: SANO, Yuichi (Kyoto University)

Session Classification: Poster

Track Classification: Poster presentation