RICE QUANTUM GROUP MEETING SEMINAR SERIES

Date: January 28, 2022, Friday

Time: 3PM - 4PM

Venue: SST 300

Research Group: Prof. Anastasios Kyrillidis's Group

Presenter: J. Lyle Kim

Title: Fast quantum state reconstruction via accelerated non-convex programming

Abstract: We propose a new quantum state reconstruction method that combines ideas from compressed sensing, non-convex optimization, and acceleration methods. The algorithm, called Momentum-Inspired Factored Gradient Descent (MiFGD), extends the applicability of quantum tomography for larger systems. Despite being a non-convex method, MiFGD converges provably to the true density matrix at an "accelerated" linear rate, in the absence of experimental and statistical noise, and under common assumptions. With this manuscript, we present the method, prove its convergence property and provide Frobenius norm bound guarantees with respect to the true density matrix. From a practical point of view, we benchmark the algorithm performance with respect to other existing methods, in both synthetic and real experiments performed on an IBM's quantum processing unit. We find that the proposed algorithm performs orders of magnitude faster than state of the art approaches, with the same or better accuracy. In both synthetic and real experiments, we observed accurate and robust reconstruction, despite experimental and statistical noise in the tomographic data. Finally, we provide a ready-to-use code for state tomography of multi-qubit systems.

Short Bio: J. Lyle Kim is a 3rd year PhD student in Computer Science Department at Rice University, working with Prof. Tasos Kyrillidis. His research interests are optimization, statistical machine learning, and quantum computing. Before joining Rice, he was a research professional at UChicago Booth School of Business, working with Prof. Panos Toulis. He obtained BA in Mathematics and Statistics from UChicago in 2017.

Note: Snacks and Coffee will be served during the event.