Contribution ID: **294** Contribution code: **S5 Quantum Technology** Type: **Oral Presentation**

Quantum diffusion map for nonlinear dimensionality reduction

Friday 24 June 2022 14:45 (15 minutes)

Inspired by random walks on graphs, the diffusion map (DM) is a class of unsupervised machine learning that offers automatic identification of low-dimensional data structure hidden in a high-dimensional data set. In recent years, among its many applications, the DM has been successfully applied to discover relevant order parameters in many-body systems, enabling automatic classification of quantum phases of matter. However, a classical DM algorithm is computationally prohibitive for a large data set, and any reduction of the time complexity would be desirable. With a quantum computational speedup in mind, we propose a quantum algorithm for the DM, termed the *quantum diffusion map* (qDM). Our qDM takes as an input N classical data vectors, performs an eigendecomposition of the Markov transition matrix in time $O(\log^3 N)$, and classically constructs the diffusion map via the readout (tomography) of the eigenvectors, giving a total expected runtime proportional to N^2polylog N. Finally, quantum subroutines in the qDM for constructing a Markov transition matrix and for analyzing its spectral properties can also be useful for other random-walk-based algorithms.

Authors: SORNSAENG, Apimuk (Chulalongkorn University); Dr DANGNIAM, Ninnat; Dr PALITTAPONGARNPIM, Pantita; CHOTIBUT, thiparat (Chulalongkorn University)

Presenter: SORNSAENG, Apimuk (Chulalongkorn University)

Session Classification: S5 Quantum Technology

Track Classification: Quantum Technology