

Joint Seminar – CQSE, CTP, & CASTS

Special Seminar
Dec. 20, 2019 (Friday)

TIME Dec. 20, 2019, 10:30~11:30am
TITLE The Capabilities and Limits of Quantum Algorithms
SPEAKER Dr. Nai-Hui Chia
The University of Texas at Austin, USA
PLACE Rm716, CCMS & New Physics Building, NTU

Abstract

Quantum computing has notable impacts on computer science in recent years. While quantum computers are about to achieve so-called "quantum supremacy" (i.e., solving some classically-intractable computational tasks), it is the right time to understand the capabilities and limits of near-term and general quantum computers.

In this talk, I will address the following two questions: 1) What is the power of near-term quantum computers? 2) What problems in machine learning and data analysis can have quantum speedups, and what are the limits? We will first see that a general quantum computer is indeed more powerful than a hybrid classical-quantum computer that only has limited quantum circuit depth relative to an oracle. Then, I will show $\text{polylog}(n)$ classical algorithms for problems thought to have had exponential quantum speedups with input/output formats analogous to existing quantum algorithms, including SVM, low-rank linear system, recommendation system, and more. This implies that existing quantum machine learning algorithms have not achieved exponential speedups. Finally, I will discuss polynomial quantum speedups for fundamental problems in data analysis and their limits under plausible assumptions in complexity theory.

