Variationally Learning Grover's Quantum Search Algorithm

Speaker: Mauro Morales, Skolkovo Institute of Science and Technology
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(Broadcasting Room 375, Geography Building, ECNU Zhongbei Campus)
Host: Tim Byrnes, NYU Shanghai

Abstract
Given a parameterized quantum circuit such that a certain setting of these real-valued parameters corresponds to Grover's celebrated search algorithm, can a variational algorithm recover these settings and hence learn Grover's algorithm? We tried several constrained variations of this problem and answered this question in the affirmative, with some caveats. Grover’s quantum search algorithm is optimal up to a constant. The success probability of Grover’s algorithm goes from unity for two-qubits, decreases for three- and four-qubits and returns near unity for five-qubits then oscillates ever-so-close to unity, reaching unity in the infinite qubit limit. The variationally approach employed here found an experimentally discernible improvement for three- and four-qubits respectively. Our findings are interesting as an extreme example of variational search, and illustrate the promise of using hybrid quantum classical approaches to improve quantum algorithms.