Inferring the Complexity of Efficient Quantum Modelling

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Abstract

Complex, stochastic processes underpin quantitative science. It is therefore of paramount importance to study and understand the behaviour of such processes for the crucial twin purposes of modelling and prediction. These tasks are typically resource-intensive, motivating the need for methods that ameliorate these requirements. A promising recent development to this end [1,2], using a cross-disciplinary blend of tools from quantum and complexity science, has highlighted that quantum simulators can operate with much smaller memories than the minimal possible classical models [3,4], while providing equally accurate predictions.

Presently, these efficient quantum models are designed with prior knowledge of the minimal classical model, necessitating the use of classical inference algorithms when applied to real data. Here, we introduce the Quantum Inference Protocol, an inference algorithm specifically tailored to construct quantum models. It avoids certain drawbacks that the classical models contain [5]. We show that our protocol is robust to statistical noise arising from finite data, and does not require smoothing techniques for imperfect probability distributions. Our results form a key step in the application of this emerging field to real world systems.

References:

Short Biography

Matthew Ho completed an undergraduate degree in Physics in 2017 with a final year project in the area of complexity science under Associate Professor Chew Lock Yue. His PhD journey began with research into automated methods for constructing models of complexity in the quantum regime under Assistant Professor Mile Gu. He is currently working on the quantifying complexity in cellular automata as well as researching into potential complexity-based quantum algorithms that can be implemented on near-term quantum computers.

***Registration will close on 17 Sept, 10am. Attendance is limited to a maximum of 18 people.

Seminar Registration: https://doodle.com/poll/x9a8hwksp4f8n9b

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