



Invited Speaker 4

Quantum-Enhanced Autonomous Agents: Can Quantum Reasoning Better Adapt to Complex Realities?

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Short Abstract:

The world is awash with complex, interacting systems. Predators chasing prey, investors trading stocks, grandmasters playing chess: all share that they process information from their environment and act appropriately in response. As the processes we seek to tackle, automate or adapt to have become ever more complex. Success requires automated agents that adapt to stimuli over ever-greater timescales, creating a key challenge in the dawning era of big data.

Could the quantum mechanical laws that govern fundamental particles come provide a tool to surmount this challenge? Such prospects may first sound surprising. Can a theory designed to model the dynamics at the level of photons and electrons aid in the understanding of systems with no quantum effects?

In this talk, I will survey recent developments exploring such possibilities. We illustrate that quantum-enhanced agents - automated machines capable of processing data quantum mechanically - can better isolate essential data for executing complex strategies. I illustrate how such advantages can be general and may scale without bound in environments where optimal performance necessitates tracking information about events far into the past. Thus, we see how fundamental physics initially motivated to understand unique properties of particles at the quantum scale may have relevance in scientific domains that initially appear unrelated.

Short Bio:

Mile Gu obtained his Ph.D. at the University of Queensland in 2009, spent three years as faculty at Tsinghua under the 1000 talents program starting 2013, and joined Nanyang Technological University as a National Research Foundation Fellow in 2016. He is presently an associate professor at the School of Mathematical and Physical Sciences, Nanyang Technological University. He leads the quantum and complexity science initiative - which seeks to explore how quantum technologies can enhance our capacity to analyse complex systems (www.quantumcomplexity.org). Gu is a member of the Nanyang Quantum Hub and is also affiliated with the Centre for Quantum Technologies at the National University of Singapore.