

Provable exponential quantum advantages in learning from physics data

Tuesday 5 November 2024 11:00 (1 hour)

One of the key challenges of the quantum machine learning field is identifying learning problems where quantum learning algorithms can achieve a provable exponential advantage over classical learning algorithms. Previous examples of provable advantages are all arguably contrived, and all rely on cryptographic methods to make learning hard for a classical learner. Further, they are not aligned with the general intuition that the first advantages should come in the learning of quantum systems such as encountered in high energy experiments. In this talk we show that this general intuition is nonetheless correct.

In the first part of this talk I will discuss new observations which allow us to make formal proofs of quantum learning advantages in a broad scope of settings, relying on widely believed conjectures in complexity theory. In the second part of the talk, I will show how this can be applied to meaningful scenarios such as the learning of unknown observables with sampling errors, with a provable advantage. We will also reflect on the possible consequences of these results on learning advantages in high energy scenarios.

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Session Classification: Prospects on Tensor Networks and Machine Learning