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【804】Exponential concentration and untrainability in quantum kernel methods

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Kernel methods in Quantum Machine Learning (QML) have attracted significant attention as a potential candidate for quantum advantage in data analysis. In this work, we study the trainability of quantum kernels from the perspective of the resources needed to accurately estimate kernel values. We identify four sources that can lead to exponential concentration and provide associated concentration bounds of quantum kernels. We also show that training a parametrized data embedding with a kernel alignment method is susceptible to exponential concentration. Our results are verified through numerical simulations for several QML tasks, providing guidelines to ensure the efficient evaluation and trainability of quantum kernel methods.

Theoretical Work

Theory

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