Quantum Technology Initiative Journal Club

Report of Contributions

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Thursday 27 June 2024 16:00 (40 minutes)

TITLE: Dequantizing quantum machine learning models using tensor networks

Link to the paper: https://arxiv.org/abs/2307.06937

Abstract:
Ascertaining whether a classical model can efficiently replace a given quantum model – dequantization – is crucial in assessing the true potential of quantum algorithms. In this work, we introduced the dequantizability of the function class of variational quantum-machine-learning˜(VQML) models by employing the tensor network formalism, effectively identifying every VQML model as a subclass of matrix product state (MPS) model characterized by constrained coefficient MPS and tensor product-based feature maps. From this formalism, we identify the conditions for which a VQML model's function class is dequantizable or not. Furthermore, we introduce an efficient quantum kernel-induced classical kernel which is as expressive as given any quantum kernel, hinting at a possible way to dequantize quantum kernel methods. This presents a thorough analysis of VQML models and demonstrates the versatility of our tensor-network formalism to properly distinguish VQML models according to their genuine quantum characteristics, thereby unifying classical and quantum machine-learning models within a single framework.

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