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Hybrid Classical-Quantum Architectures for Quantum Machine Learning

Tuesday, 26 March 2024 14:00 (1 hour)

In this talk, I will introduce a hybrid model combining a quantum-inspired tensor network (TN) and a variational quantum circuit (VQC) to perform supervised and reinforcement learning tasks. This architecture allows for the classical and quantum parts of the model to be trained simultaneously, providing an end-to-end training framework. We show that compared to the principal component analysis, a tensor network based on the matrix product state with low bond dimensions performs better as a feature extractor for the input data of the variational quantum circuit in the binary and ternary classification of MNIST and Fashion-MNIST datasets. We also use this architecture to perform quantum reinforcement learning on the MiniGrid environment with 147-dimensional inputs.The hybrid TN-VQC architecture provides a natural way to perform efficient compression of the input dimension, enabling further quantum machine learning applications on noisy intermediate-scale quantum devices. Finally, I will discuss some regularization methods to address the issue of barren plateaus during training for multi-layer VQC.

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