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Classical Splitting of Parametrized Quantum Circuits

Barren plateaus appear to be a major obstacle to using variational quantum algorithms to simulate large-scale quantum systems or replace traditional machine learning algorithms. They can be caused by multiple factors such as expressivity, entanglement, locality of observables, or even hardware noise. We propose classical splitting of ans\"atze or parametrized quantum circuits to avoid barren plateaus. Classical splitting is realized by splitting an N qubit ansatz to multiple ans\"atze that consists of $\mathcal{O}(\log N)$ qubits. We show that such an ansatz can be used to avoid barren plateaus. We support our results with numerical experiments and perform binary classification on classical and quantum datasets. Then, we propose an extension of the ansatz that is compatible with variational quantum simulations. Finally, we discuss a speed-up for gradient-based optimization and hardware implementation, robustness against noise and parallelization, making classical splitting an ideal tool for noisy intermediate scale quantum (NISQ) applications.

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Short summary of your poster content

We propose to mitigate the Barren Plateau problem with a special type of ansatz. We show that these type of models can significantly improve the trainability of VQAs for classical problems. We provide further analysis on how it can be utilized for quantum problems.

Poster printing

Yes

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