Learning and Overparameterization of Constrained Variational Quantum Circuits

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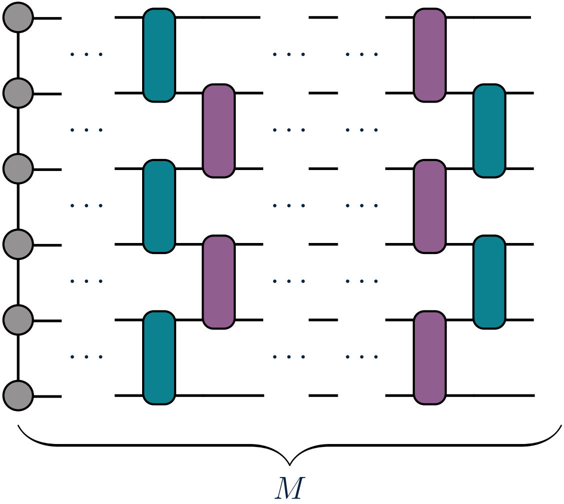
Learning Quantum Circuits



How does the *depth* M of a circuit U_θ affect its optimization and resulting parameters θ?

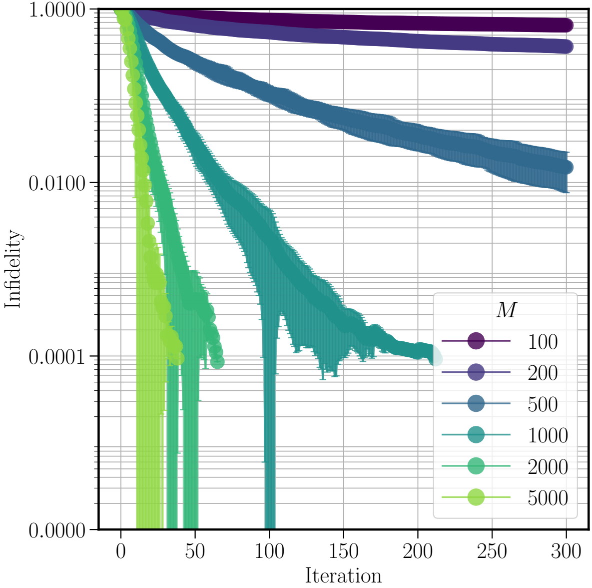
Overparameterization of Quantum Circuits

- The depth at which overparameterization, and exponential convergence to optimality occurs, depends on the *ansatz* of native circuit operators, and the dimensionality D of their span (*dynamical Lie algebra*) (Larocca et al., arXiv:2109.11676, 2021)

- For Haar random target unitaries, and unconstrained parameterizations, *lazy-training* also occurs for sufficient depth $M \sim O(D)$, where parameters *negligibly* change from their random initial values

- For constrained *quantum-control* objectives, *several orders of magnitude* greater depth $M \gg O(D)$ is required to reach the overparameterized regime

Convergence of Quantum Circuits



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Convergence of Quantum Circuits