March 26, 2021

1 Papers

1.1 Cost function dependent barren plateaus in shallow parametrized quantum circuits

- Advantage of VQA are three-fold:
- 1: Allows for easy implementation of task specific algorithms, black box. Tailored quantum algorithms are intuitively hard to construct.
- 2: Makes up for small qubit count by leveraging classical computer power. Many subroutines are outsourced to a classical computer, such as weight update, keeping the number of qubits low.
- 3: For much the same reason, it keeps the circuits shallow as well, so it better handles low decoherence times.
- There are few rigorous scaling results for VQA's. Must use heuristics, numerical experiments.
- Exponentially vanishing gradient for global cost function, that is const functions evaluating operators living in exponentially large Hilbert spaces, for example measuring zero state for $\langle 0|U^\dagger U(\theta)|0\rangle$. Speculation: Parity and last qubit are local and not global operators.

2 Own Notes

2.1 Vanishing Gradient

"Cost function dependent barren plateaus in shallow parametrized quantum circuits" established that VQAs with local cost function(like parity or last qubit) have gradients that only vanish polynomially rather than exponentially with number of qubits n, given that the depth is $\log(n)$