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An optimal quantum sampling regression algorithm for variational eigensolving in the low qubit number regime[1] PEDRO RIVERO, Argonne National Laboratory, Illinois Institute of Technology, IAN C. CLOET, Argonne National Laboratory, ZACK SULLIVAN, Illinois Institute of Technology — The VQE algorithm, with all its merits, has turned out to be quite expensive to run given the way we currently access quantum processors (i.e. over the cloud). In order to alleviate this issue, in this paper we introduce an alternative hybrid quantum-classical algorithm, and analyze some of its use cases based on time complexity in the low qubit number regime. In exchange for some extra classical resources, this novel strategy is proved to be optimal in terms of the number of samples it requires from the quantum processor. We develop a simple —yet general— analytical model to evaluate when this algorithm is more efficient than VQE, and, from the same theoretical considerations, establish a threshold above which quantum advantage can occur. Finally, we demonstrate the efficacy of our algorithm for a benchmark problem.

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