

EVolutionary algorithms toolbox for VAriational Quantum circuits (EVOVAQ)

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Abstract—Evolutionary algorithms are increasingly attracting attention in the burgeoning research field of Quantum Computing. Indeed, the versatility of these methods, each with its own peculiarities, is encouraging their exploration across various quantum domains, especially in variational quantum algorithms. In detail, these quantum algorithms are promising candidates for achieving quantum advantage in key application scenarios like optimization and machine learning. However, substantial effort is being directed towards enhancing their performance, which is still limited by critical challenges related to trainability, efficiency, and resulting accuracy. Starting from these considerations, the aim of this work is twofold: firstly, we show that evolutionary techniques possess trainability-friendly characteristics for the practical implementation of these quantum algorithms; secondly, we introduce a user-friendly Python package that enables the use of these algorithms for training variational quantum algorithms in a simple interface with existing quantum libraries, e.g. Qiskit.

Index Terms—Evolutionary Algorithms, Python package, Quantum Computing, Variational Quantum Algorithms