

Performance of QAOA for Portfolio Optimization

Vanessa Dehn

Thomas Wellens

Fraunhofer Institut für angewandte Festkörperphysik IAF, Tullastr. 72, 79108 Freiburg, Germany

vanessa.dehn@iaf.fraunhofer.de

Abstract

For the portfolio optimization problem formulated as a quadratic binary optimization problem, we apply the quantum approximate optimization algorithm (QAOA) and study it using its standard and other versions (different mixers) [1] and, moreover its warm start version (WS-QAOA). Evaluation of the algorithm's performance shows improved performance of WS-QAOA compared to its standard version, but lower performance compared to the tests with the different mixers.

In order to evaluate whether the improved performance of WS-QAOA is due to quantum effects, we analyze to which extent its results can be reproduced by purely classical preprocessing of the original problem followed by standard QAOA.

Finally, we extend the discussion by examining the key effects of the various mixers that yield the best overall performance of all tested versions.

References

- [1] Brandhofer, S., Braun, D., Dehn, V. et al. Benchmarking the performance of portfolio optimization with QAOA. *Quantum Inf Process* 22, 25 (2023). <https://doi.org/10.1007/s11128-022-03766-5>

Figures

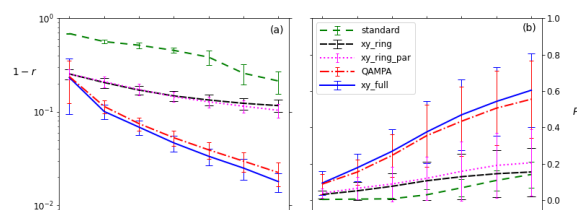


Figure 1: (a) Mean deviation $1 - r$ of the approximation ratio from the optimal solution and (b) mean probability P of obtaining the optimal portfolio, both with standard deviation (error bars) as a function of the QAOA depth p for 20 randomly chosen portfolio optimization instances, using different mixers.
