

Issue #14

New Classical Optimizer of VQE for Aqua

[arXiv:1903.12166](https://arxiv.org/abs/1903.12166)

[Ken M. Nakanishi](#) , Yuya  Nakagawa, Youyuan  Zhang



Team members



Ken . Nakanishi

UTokyo
QunaSys

CS

Physics



Yuya . Nakagawa

QunaSys
Chief Engineer

Quantum
Physics



Youyuan . Zhang

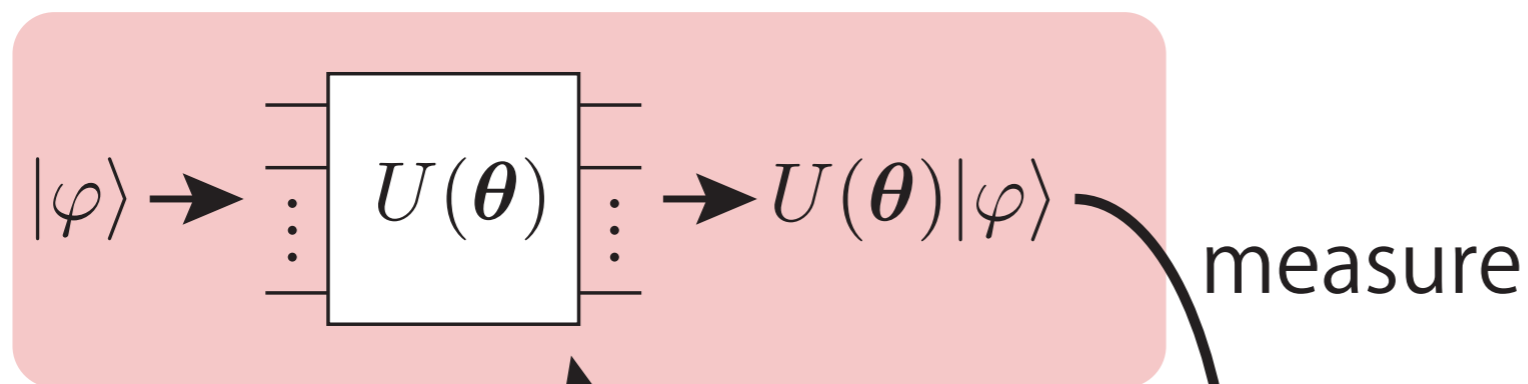
UTokyo
QunaSys

Quantum
Chemistry

VQE:

Given Hamiltonian $\mathcal{H} \Rightarrow$ Find approximate ground state

Quantum computer



minimize $\langle \mathcal{H}(\theta) \rangle$ $\langle \mathcal{H}(\theta) \rangle = \langle \varphi | U(\theta^\dagger) \mathcal{H} U(\theta) | \varphi \rangle$

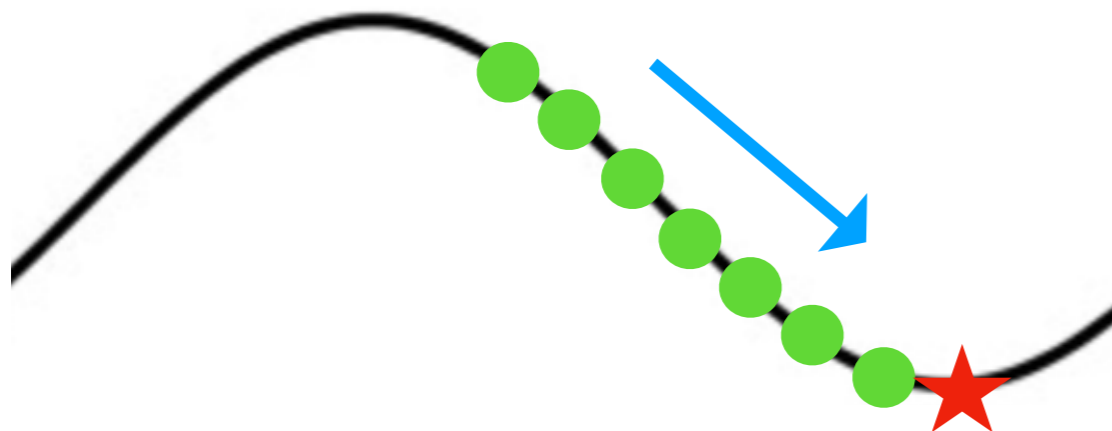
Classical computer

$$\text{Minimize } \langle \mathcal{H}(\theta) \rangle = \langle \varphi(\theta) | \mathcal{H} | \varphi(\theta) \rangle$$

Current Optimizers

$$\begin{aligned} & \langle \mathcal{H}(\theta) \rangle > \langle \mathcal{H}(\theta + \Delta\theta) \rangle > \dots \\ & > \langle \mathcal{H}(\theta + n\Delta\theta) \rangle < \langle \mathcal{H}(\theta + (n+1)\Delta\theta) \rangle \end{aligned}$$

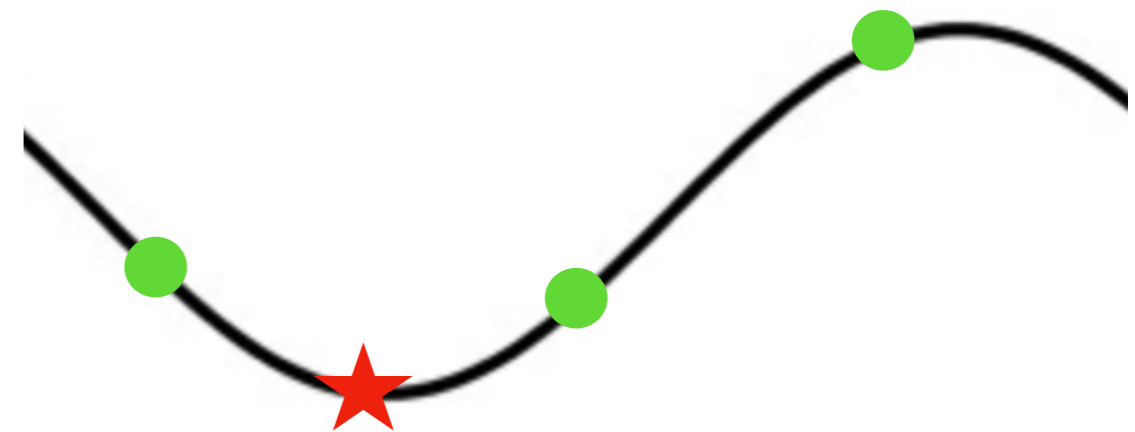
Step by step probing,
highly initial input dependent



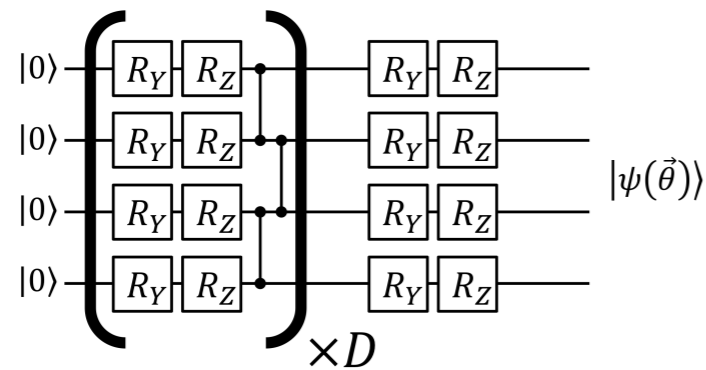
Nakanishi Optimizer

$$\langle \mathcal{H}(\theta) \rangle = \langle \mathcal{H}(\theta + T) \rangle$$

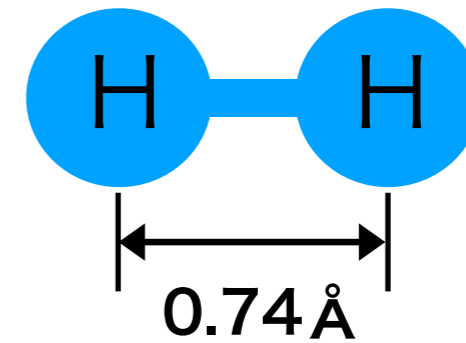
Function determined with 3 points,
exact lowest position found.



Demonstration

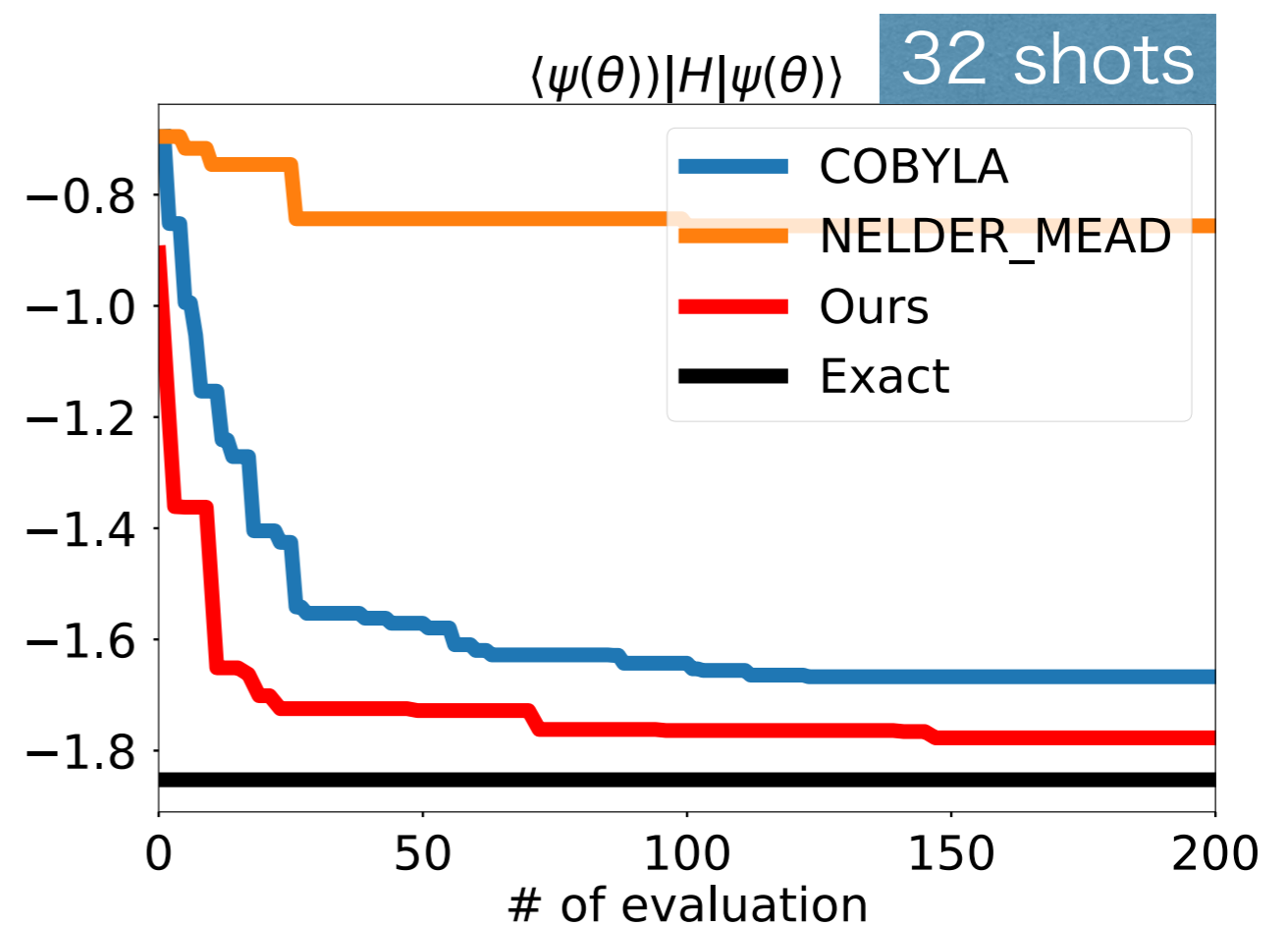
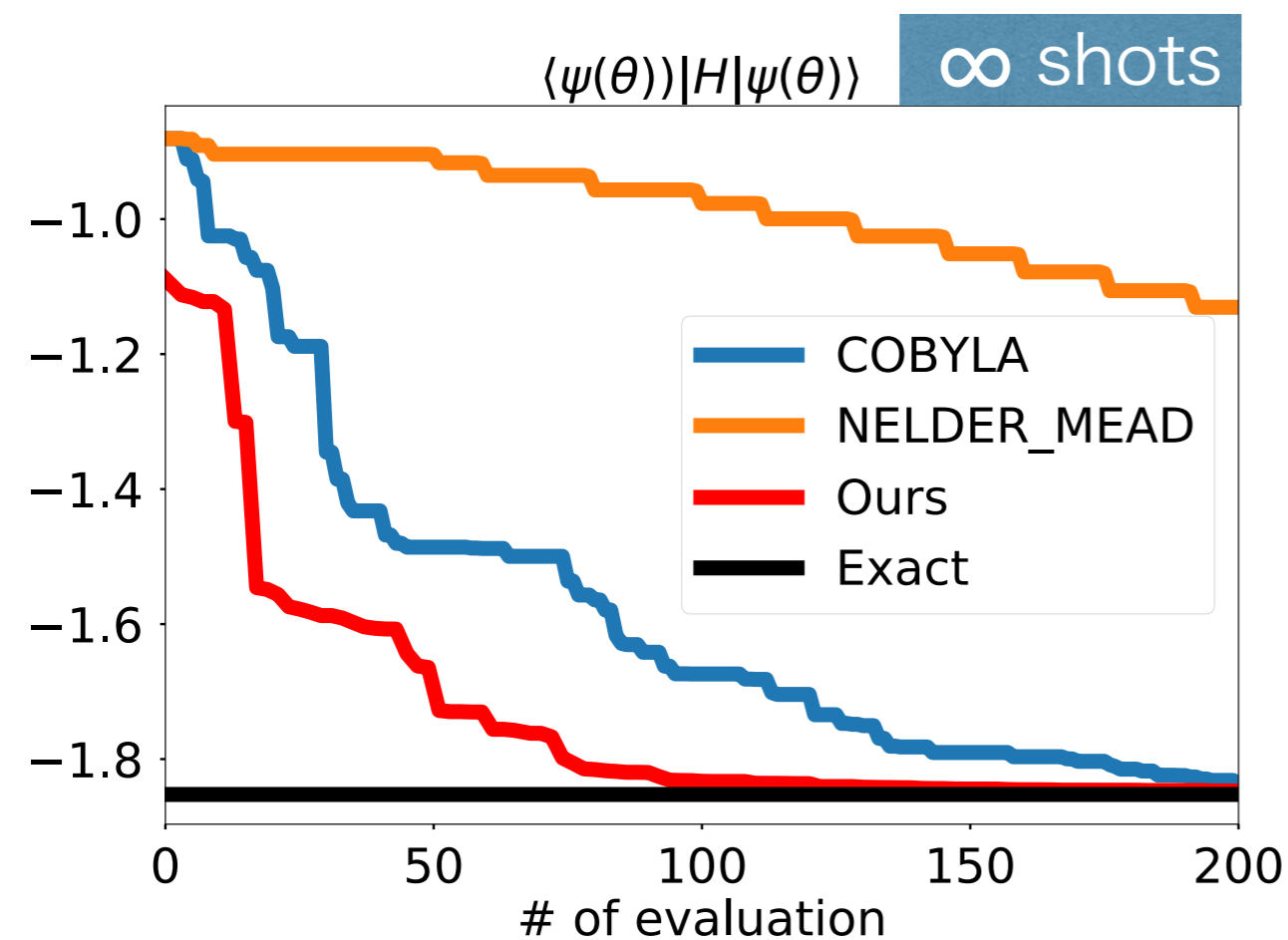


$$\langle \mathcal{H}(\theta) \rangle_{min}$$



Without Noise

With Noise



Results from Simulator

We sent pull-request to Aqua

6

Qiskit / qiskit-aqua

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Code Issues 19 Pull requests 14 Actions Projects 1 Security Insights

Add NFT optimizer #729

Open ken-nakanishi wants to merge 2 commits into Qiskit:master from ken-nakanishi:add_nft

Conversation 2 Commits 2 Checks 1 Files changed 3 +204 -2

ken-nakanishi commented 4 minutes ago

Summary

Added NFT optimizer for quantum-classical hybrid algorithms.

Details and comments

Added NFT optimizer [1, 2] for quantum-classical hybrid algorithms.

- [1] <https://arxiv.org/abs/1903.12166>
- [2] <https://github.com/ken-nakanishi/nftopt>

ken-nakanishi added 2 commits 27 minutes ago

- add NFT optimizer 95d62b5
- update docstring 669c568

Reviewers: No reviews

Assignees: No one assigned

Labels: None yet

Projects: None yet

Milestone: No milestone

Notifications: Customize

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