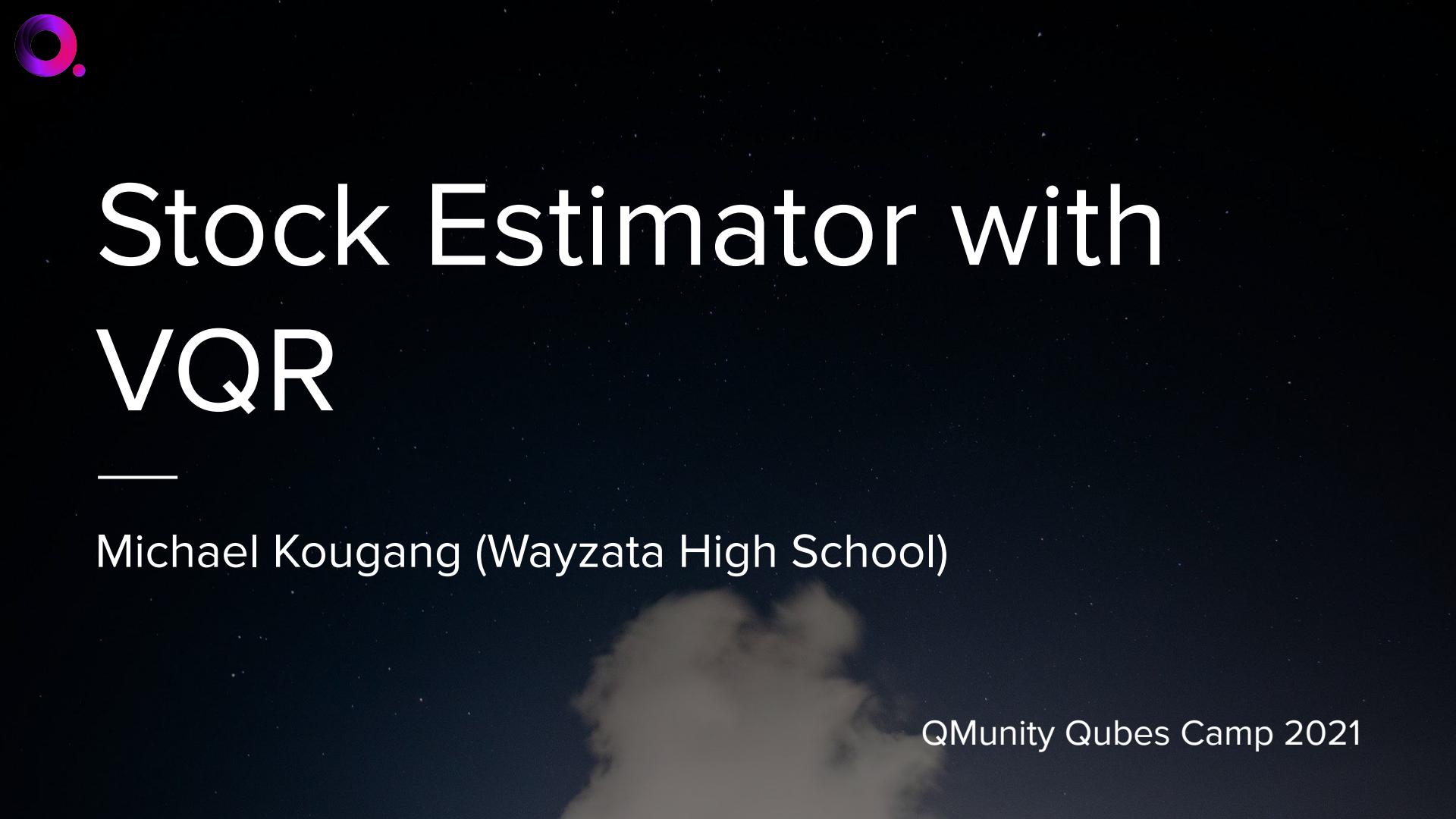


Stock Estimator with VQR

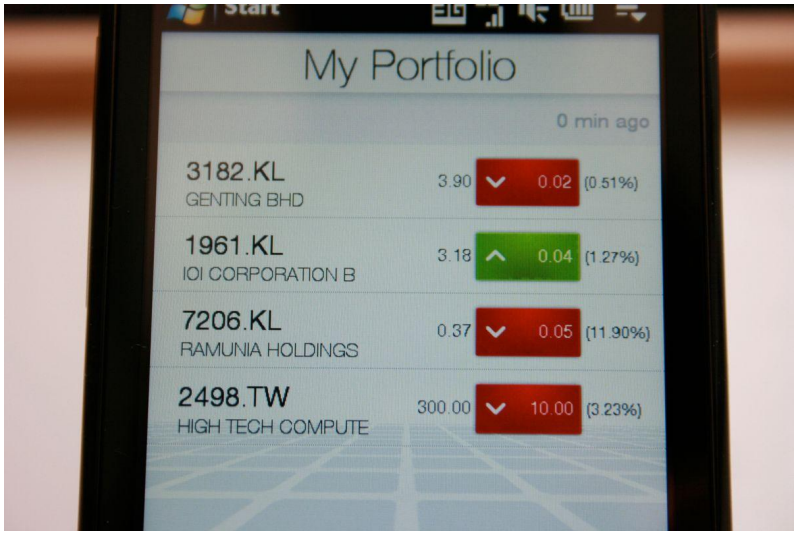
Michael Kougang (Wayzata High School)

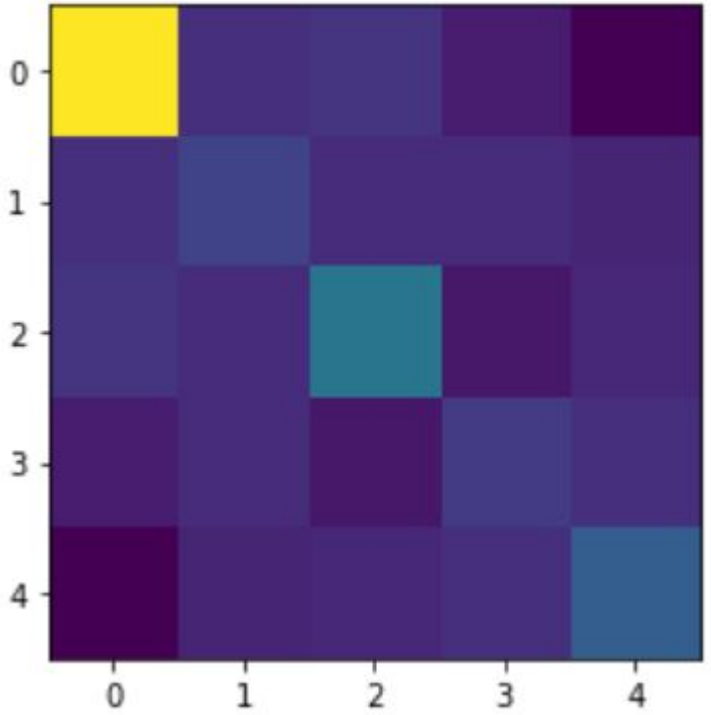
QMunity Qubes Camp 2021

Project Description

- Portfolio Optimization
- Quantum Approximate Optimization Algorithm
- Stock Analysis & Estimator
- Variational Quantum Regression

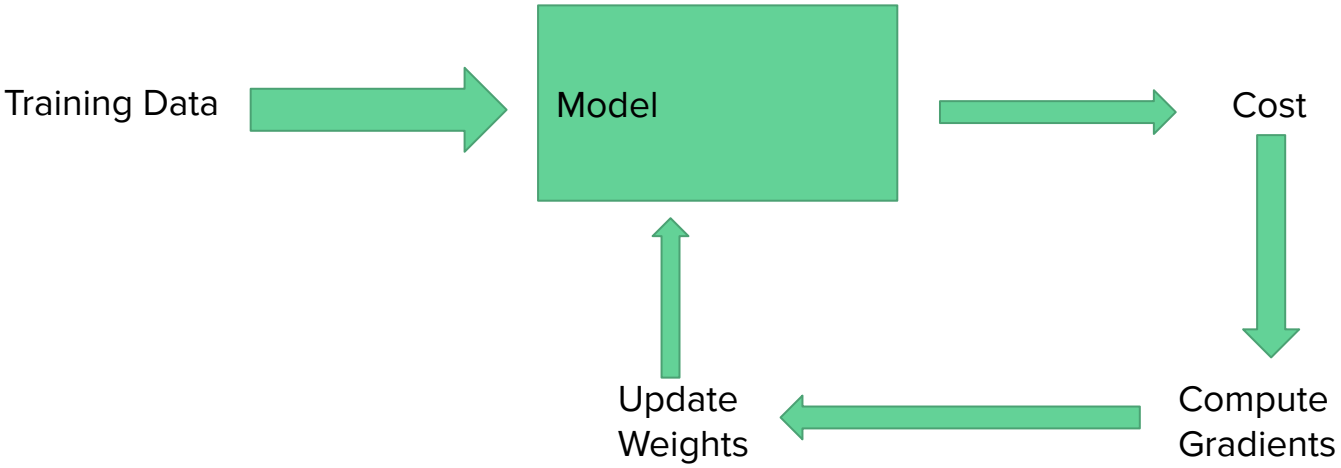
Portfolio Optimization





The process

Quantum Classifier



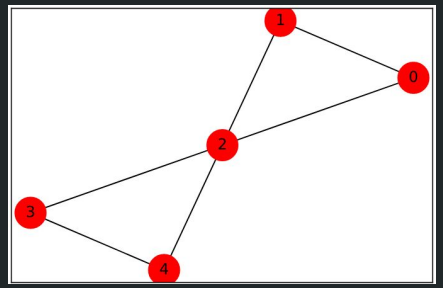
Variational Circuit (Ansatz)

Steps

- Data Encoding & Feature Mapping
- Apply the model / Variational Circuit
- Extract Labels
- Optimize and update model parameters

Quantum Approximate Optimization Algorithm

QAOA is a variational quantum eigensolver that can use MaxCut to optimize weights.



Qiskit Portfolio Optimization Implementation with QAOA

Variational Quantum Regression

Just like in classical regression, the goal of VQR is to predict an output based on a set of inputs.

Qiskit Stock Estimator Implementation with VQR

Research

https://born-2learn.github.io/posts/2020/12/variational-quantum-classifier/

https://qiskit.org/documentation/machine-learning/tutorials/02_neural_network_classifier_and_regressor.html#Regression

https://www.youtube.com/watch?v=N8e5nAk6KBQ&list=PLmRxgFnCIhaMgvot-Xuym_hn69lmzIokg&index=18

https://www.youtube.com/watch?v=AOKM9BkweVU

https://qiskit.org/documentation/finance/tutorials/01_portfolio_optimization.html

https://learn.qiskit.org/course/ch-applications/solving-combinatorial-optimization-problems-using-qaoa

https://medium.com/qiskit/building-a-quantum-variational-classifier-using-real-world-data-809c59eb17c2

https://qiskit.org/events/summer-school/

https://arxiv.org/abs/1411.4028

https://arxiv.org/abs/1304.3061

https://www.kaggle.com/camnugent/sandp500

Team contributions

Show major contributions of each team member

How did you all contribute to the project?

- Michael: researched quantum algorithms, coded Jupyter notebook, etc; (aka everything)

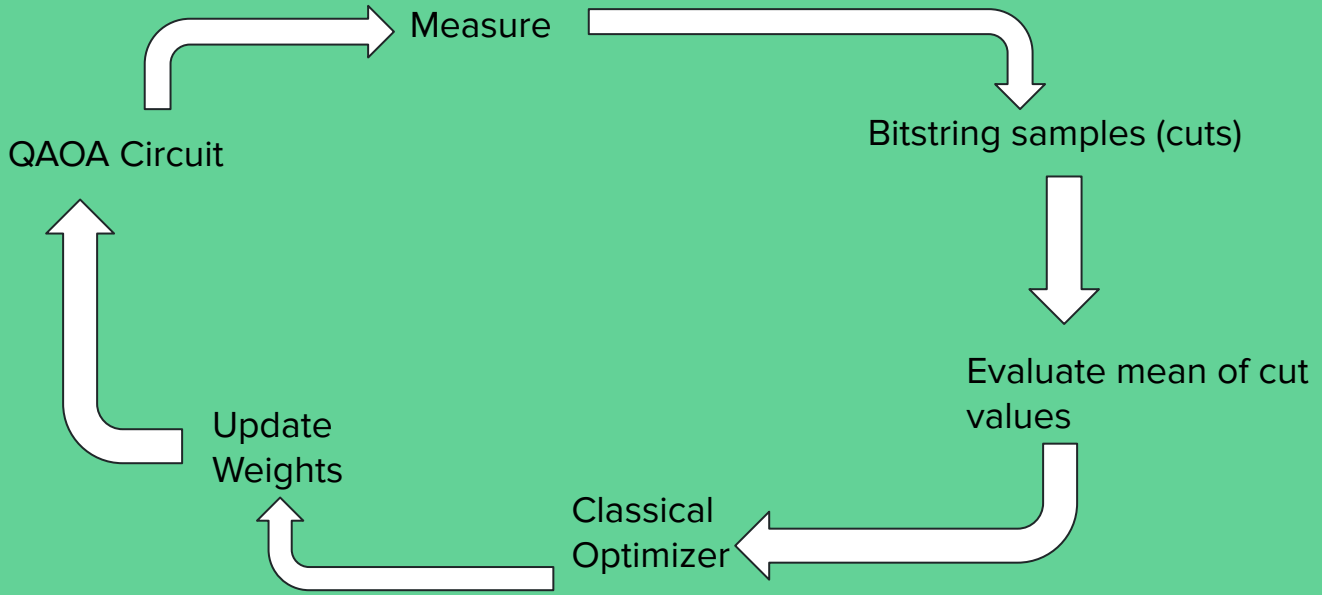
Aha!

Share some pictures

What did you want to highlight?

1. Really nice code?
2. Cool project results?
3. Impressive quantum circuit?

QAOA Overview

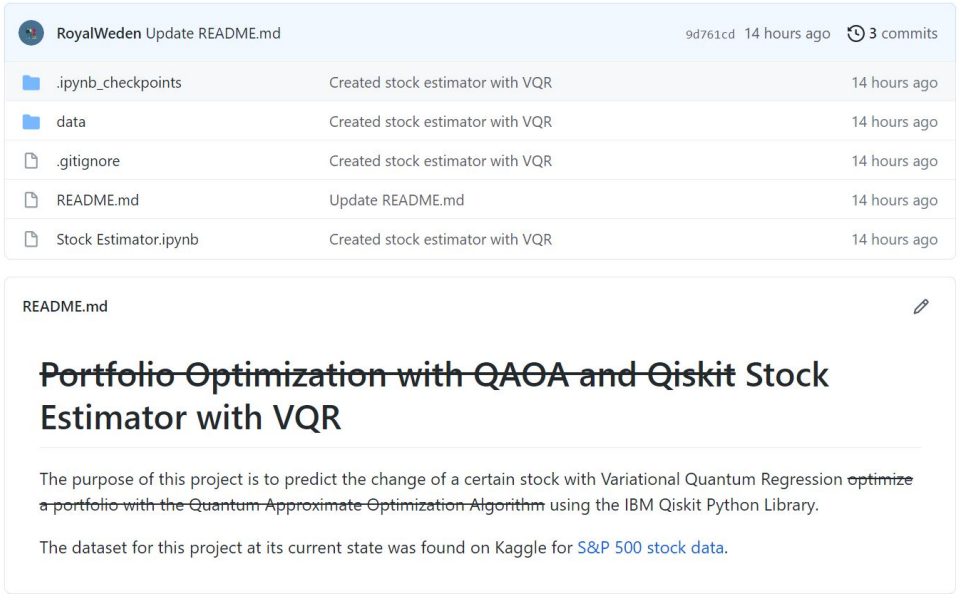


Conclusion

Variational Quantum Circuits have a lot of use for classification and regression. While we don’t have complete certainty that algorithms like QAOA will provide benefit from Quantum Computing, most signs show that this will be the case.

What will you do next?

- Gain a greater background in QML
- Create an easy-to-use web application for people to optimize their portfolios using QAOA or another VQC algorithm.
- Quantum Machine Learning Applications
- Other Finance Applications



https://github.com/RoyalWeden/qml-portfolio-optimization

Thank You!

Mentors and Instructors

Special Thanks to
Syed