Digital-Analog Variational Quantum Eigensolver

Salada Bowl

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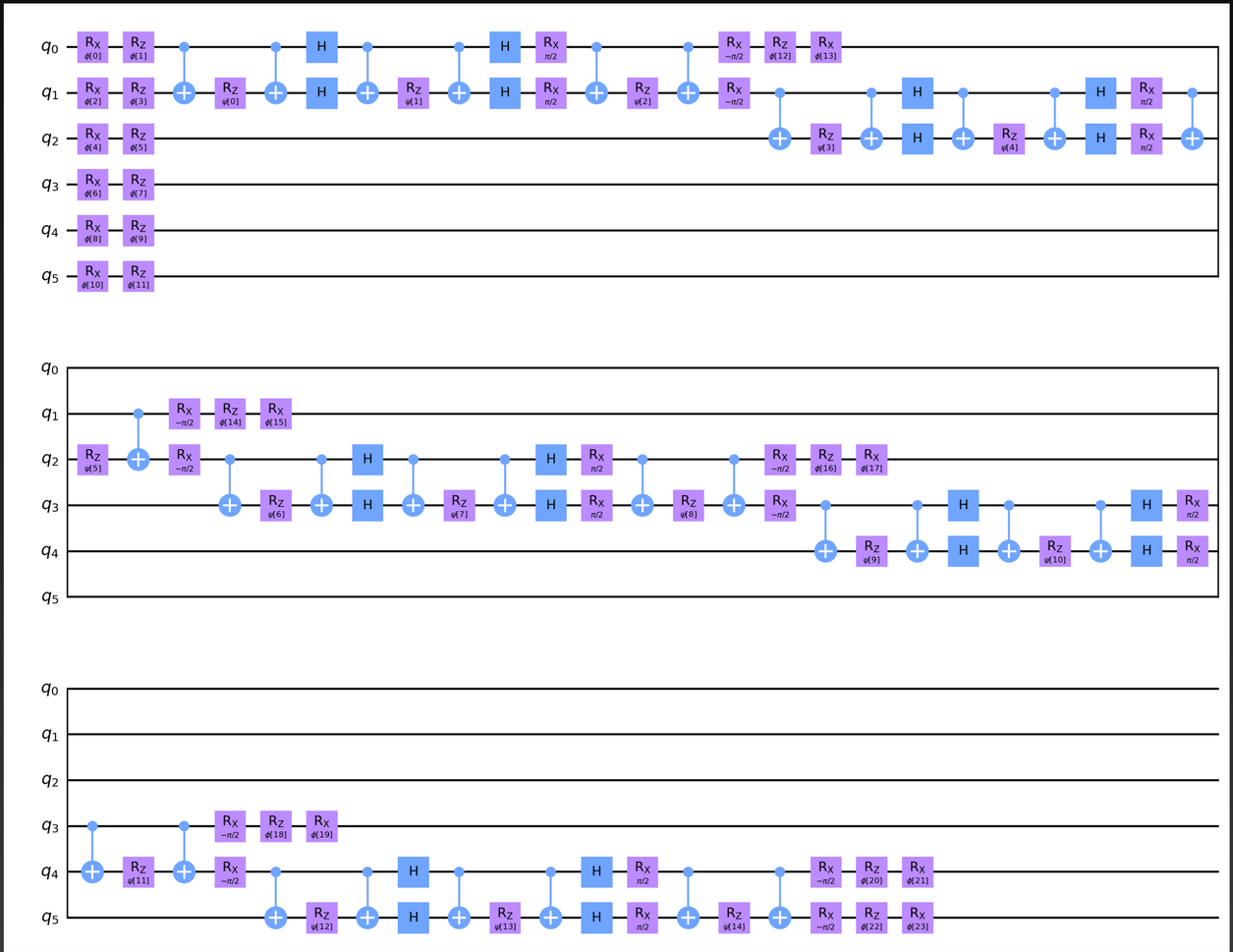
Problem Statement

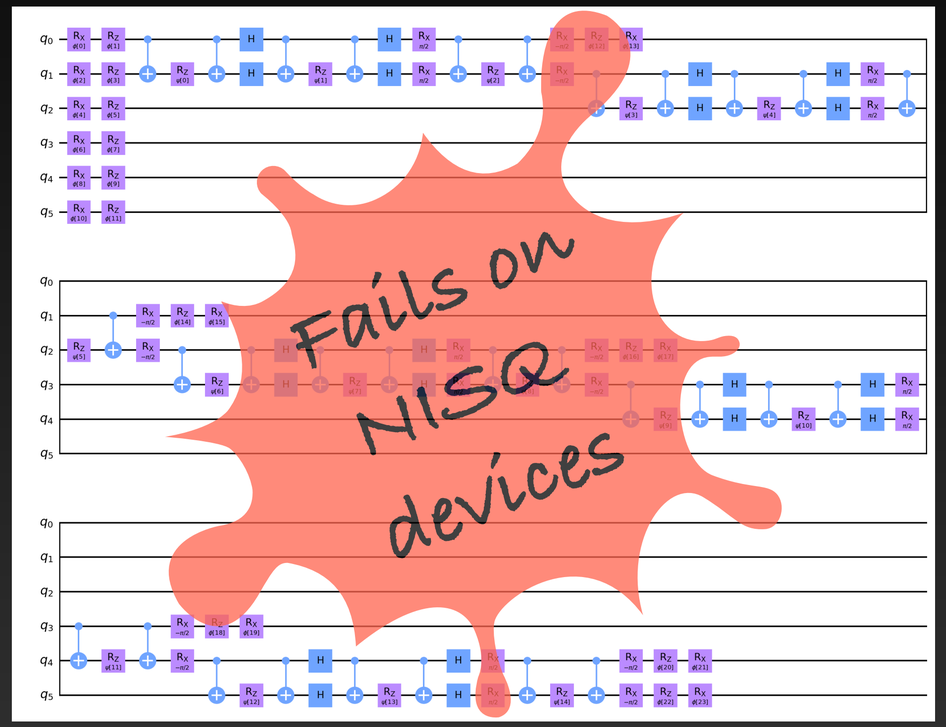
Conventional VQE ansatz has too many digital gates.



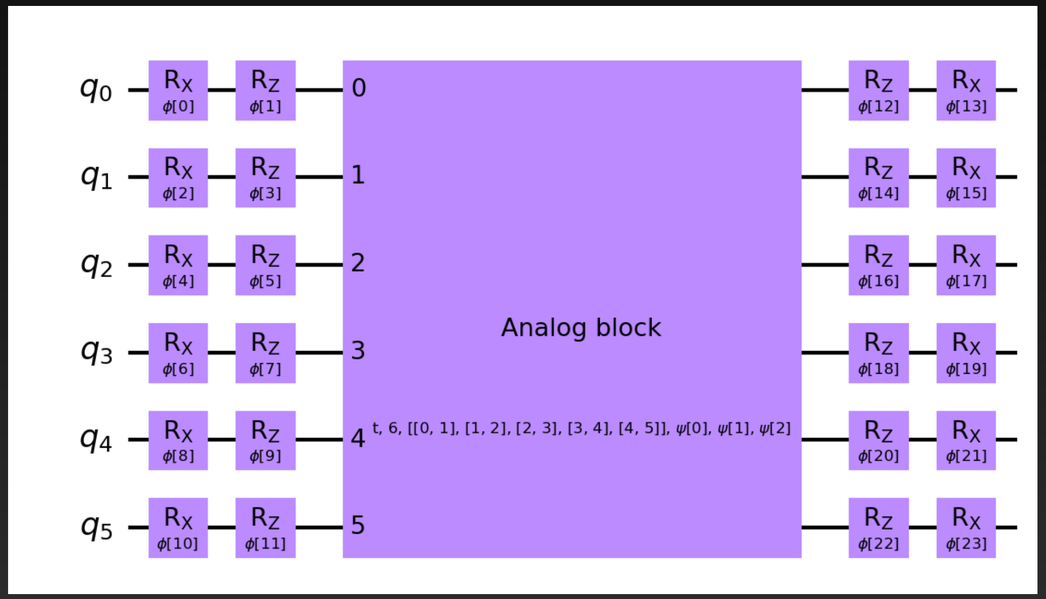
Solution & Approach

How does DA-VQE work?

Conventional VQE ansatz



Equivalent digital-analog VQE ansatz

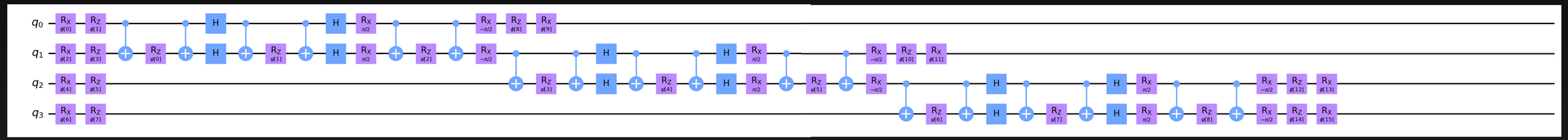


We show equivalence between
complex Digital Circuits
and
simpler Digital-Analog Circuits!

Our Solution

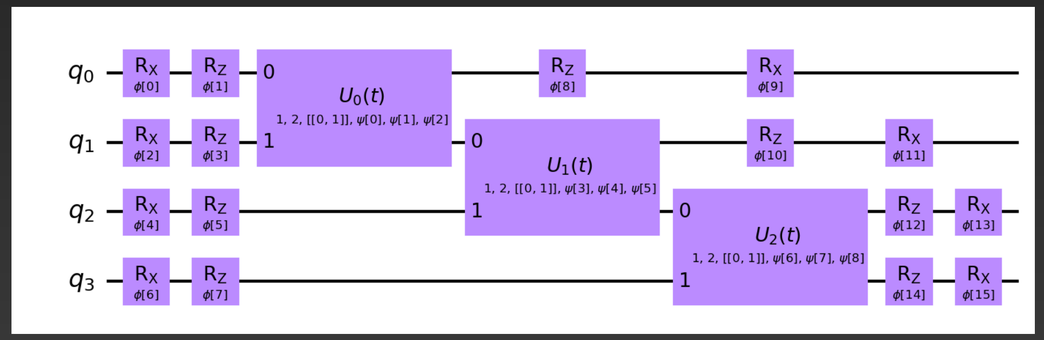
Implementation

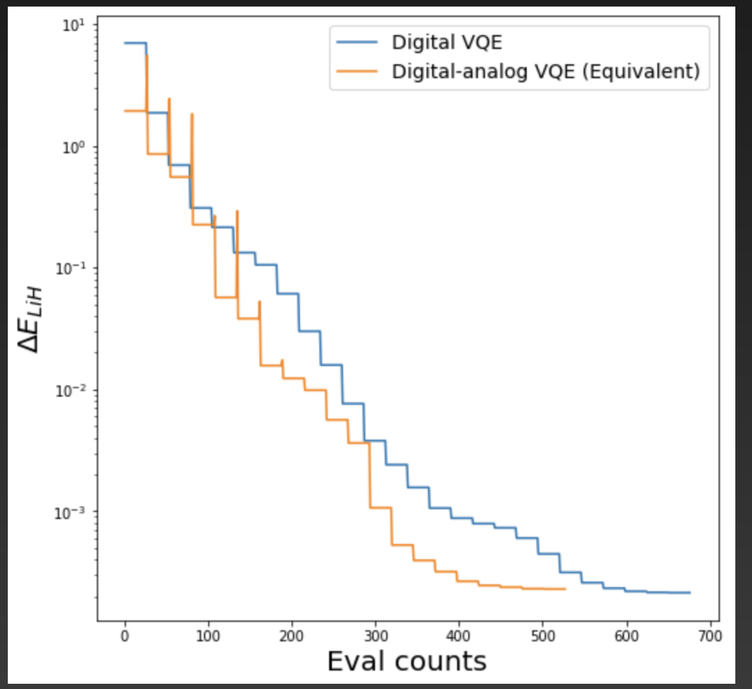
Conventional VQE ansatz



Reduce the number of gates!

Equivalent digital-analog VQE ansatz

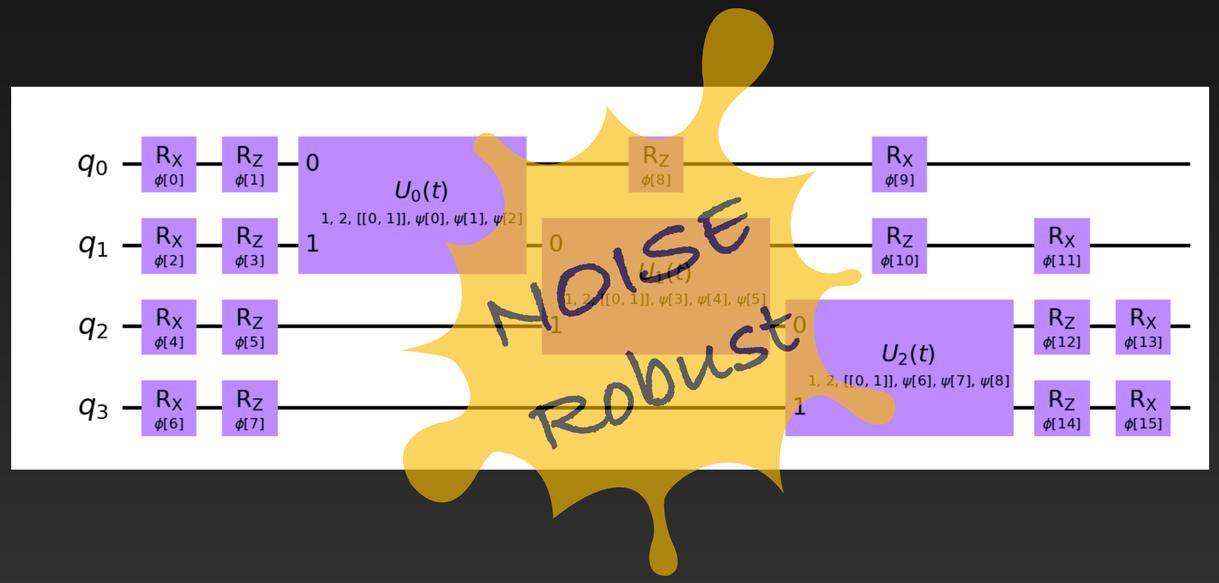




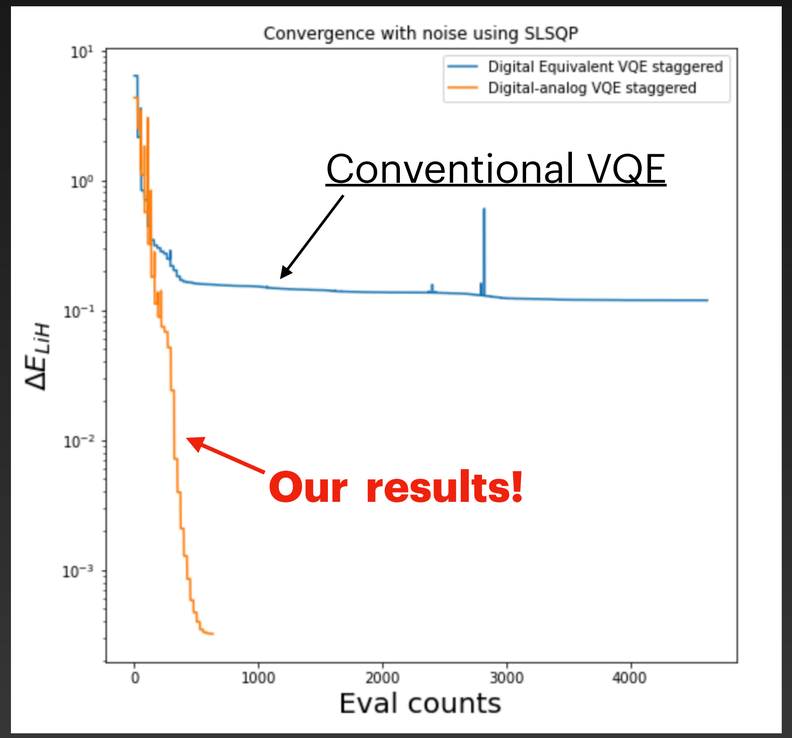
Our Solution

Scalability

Our method is noise-robust and scalable



Energy convergence under noise



Less quantum gates = better performance on a NISQ device!

Quantum Machine Learning

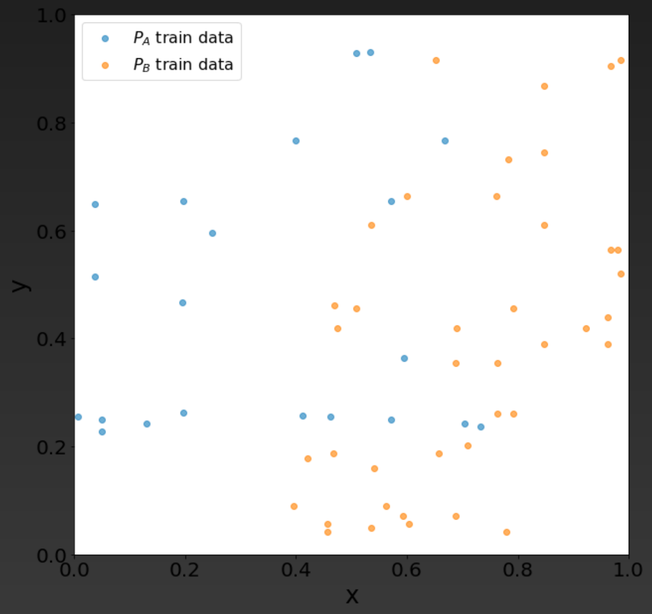
A Toy Model

We also developed a new VQE-based QML algorithm that is applicable to:

- Supervised data classification
- Quantum phase separations

Train data :

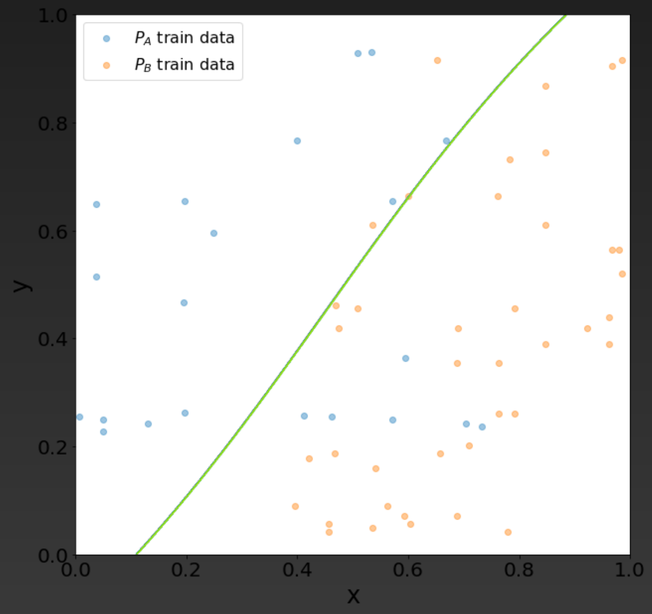
Two distribution $P_A(x, y)$ and $P_B(x, y)$



Our new algorithm

Find (x, y)

$P_A(x, y) = P_B(x, y)$



We provide

Explainable speedup in VQE

&

New quantum machine learning algorithm

Sincere thanks and appreciation to the IQM team!