Quantum Marcher

Teaching VQA Training with Pygame

Who are we?

Team QHike:

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- Saad Mufti
- Jyoti Rani
- Alice Liu
- Emiliia Dyrenkova

3 Time zones

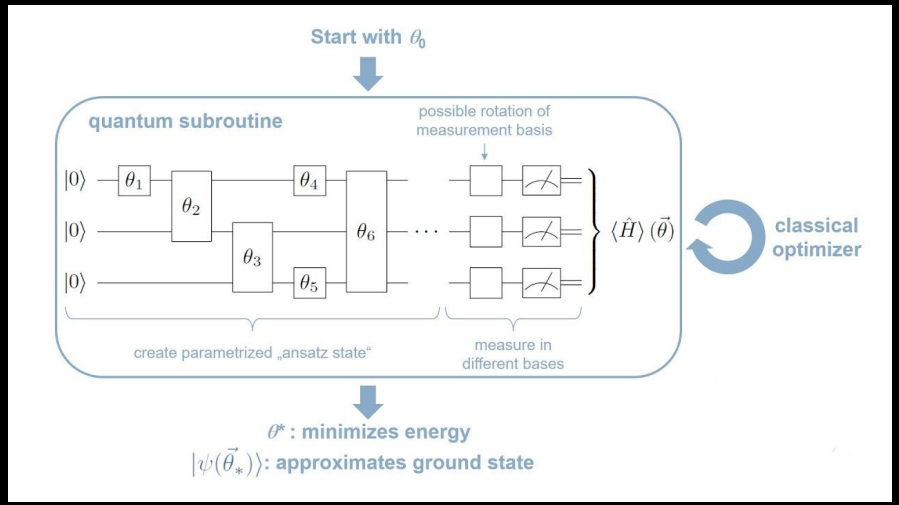
1 HIGH SCHOOL

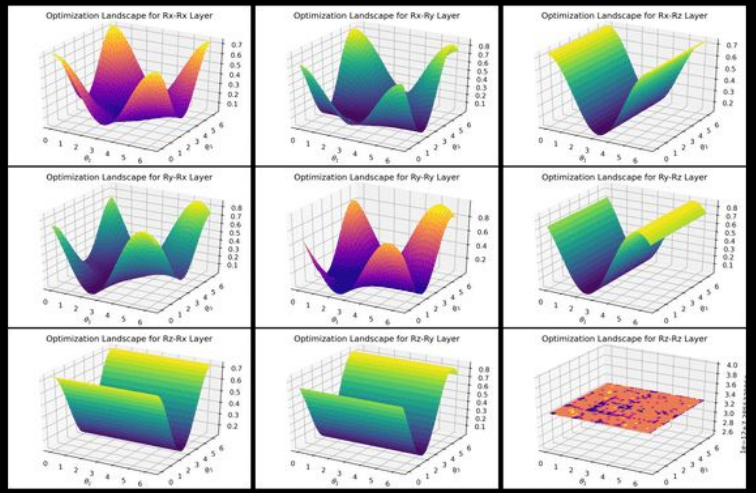
3 UNDERGRADS

1 GRAD STUDENT

VQE - Variational Quantum Eigensolver

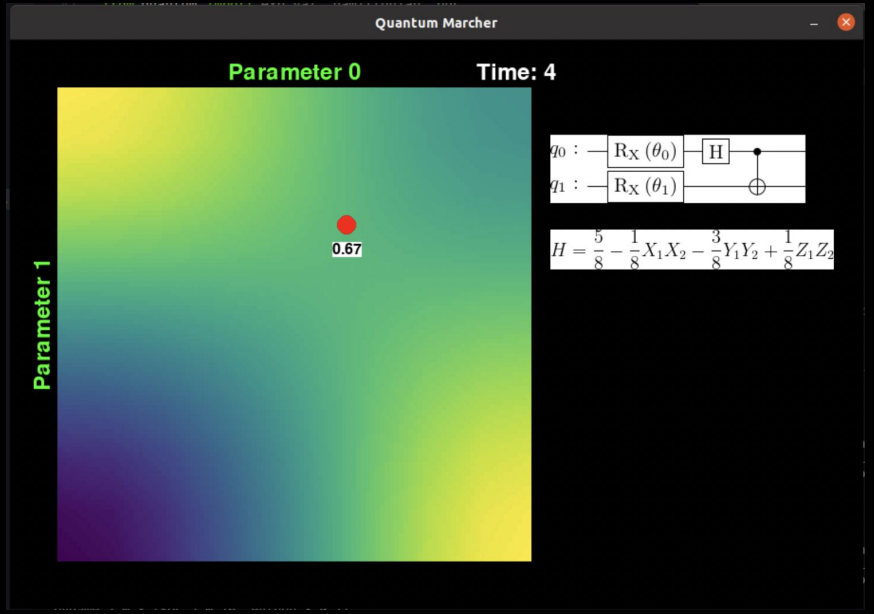
- Popular near-term algorithm
- Active research on the properties of generated landscapes
- Goal is to search through parameter space of a parameterized quantum circuit to find the approximation of a state with the lowest energy, i.e. the ground state
- It's hard to visualise more than 2 parameters at a time





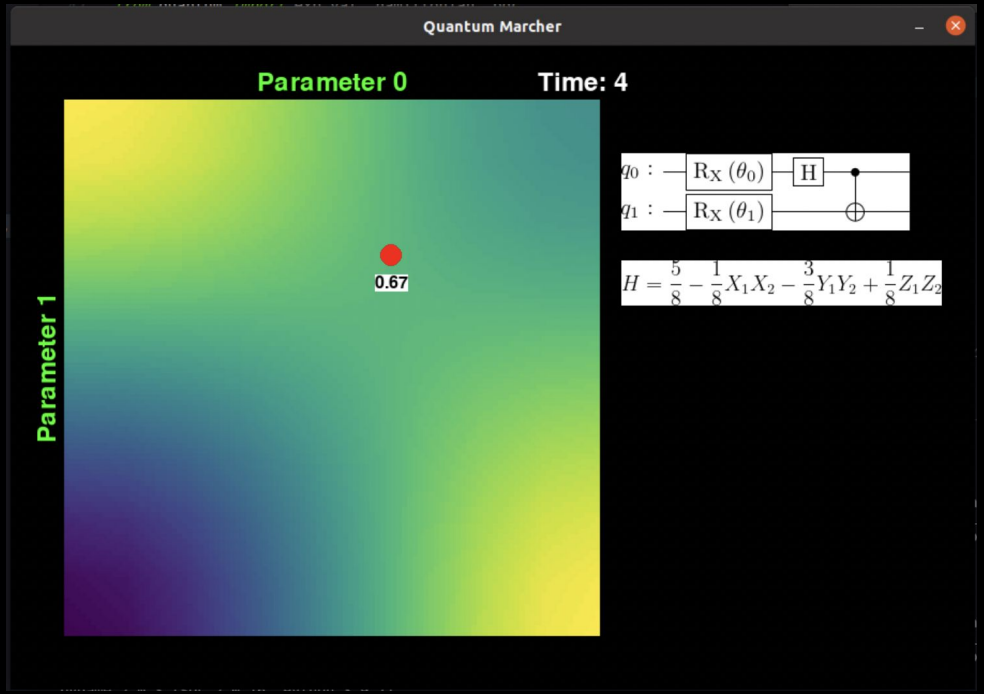
Gameplay

- Player moves a red circle around the screen trying to achieve the lowest possible value (0).
- Landscape is generated given a parameterized quantum circuit and a Hamiltonian (Energy landscape)
- Player has 10 seconds on every parameter slice to move around and explore
- Pressing SPACE, a, or s changes the parameters that are currently presented



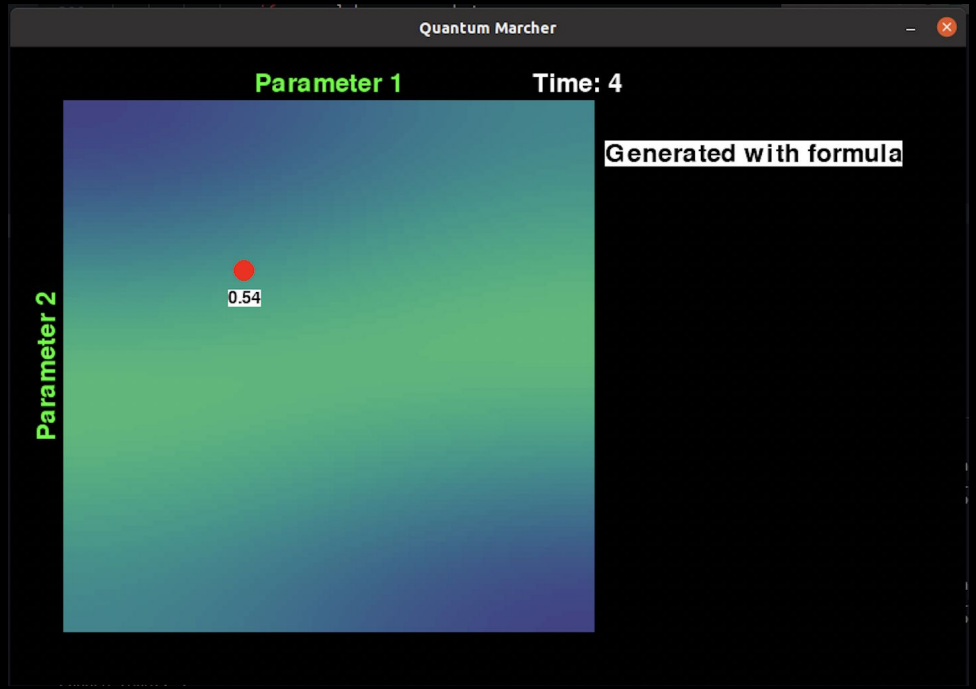
Level 1

- Player can move the red circle around a 2D parameter space generated by a quantum circuit
- Moving the circle changes the values of presented parameters
- Quantum circuit and Hamiltonian used for generating the landscape are shown on the right

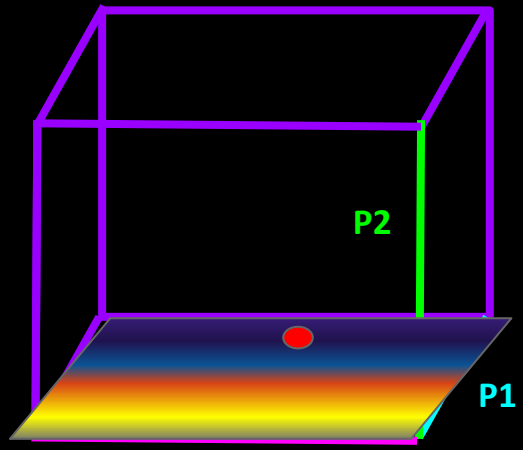


Levels 2 and 3

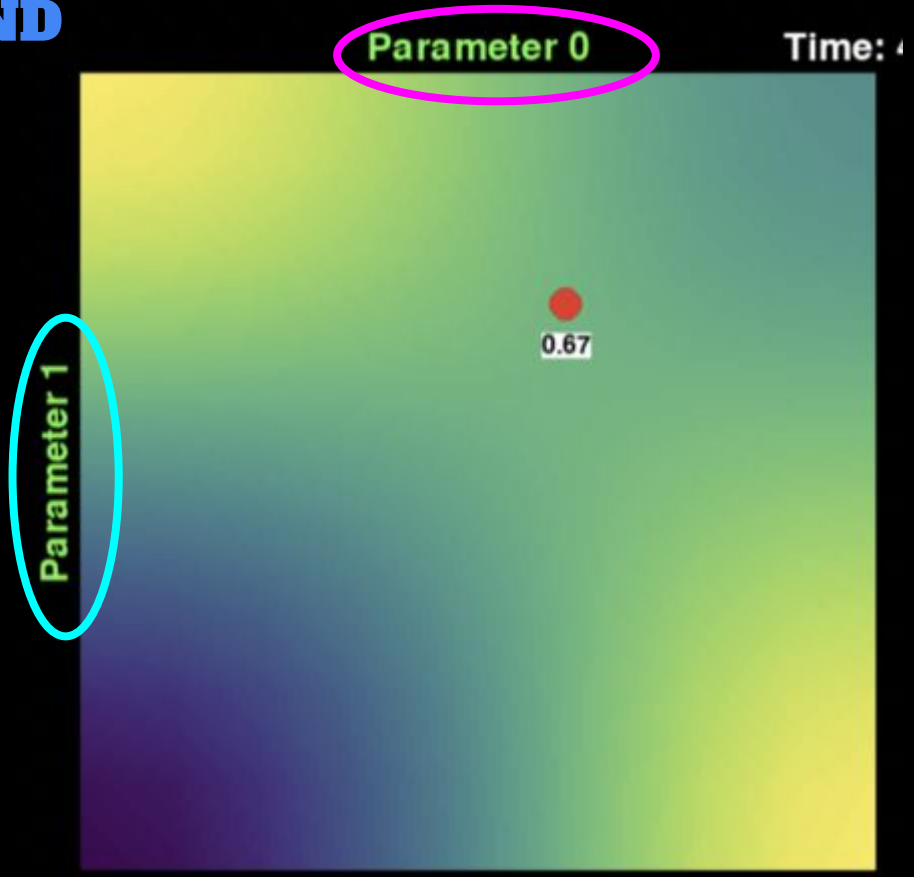
- Analytic formulas for landscape.
- 3 and 4 parameter spaces - finding the minimum becomes more challenging and fun!



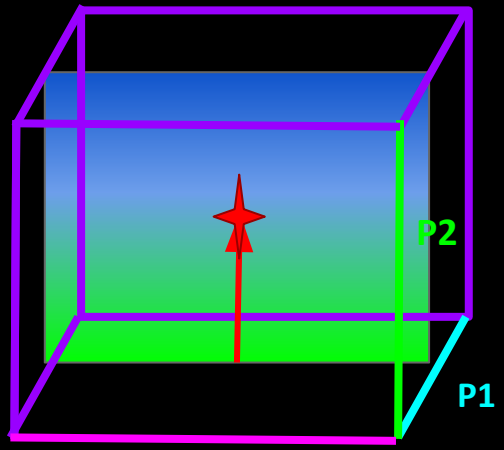
L2: GETTING TO THE GROUND



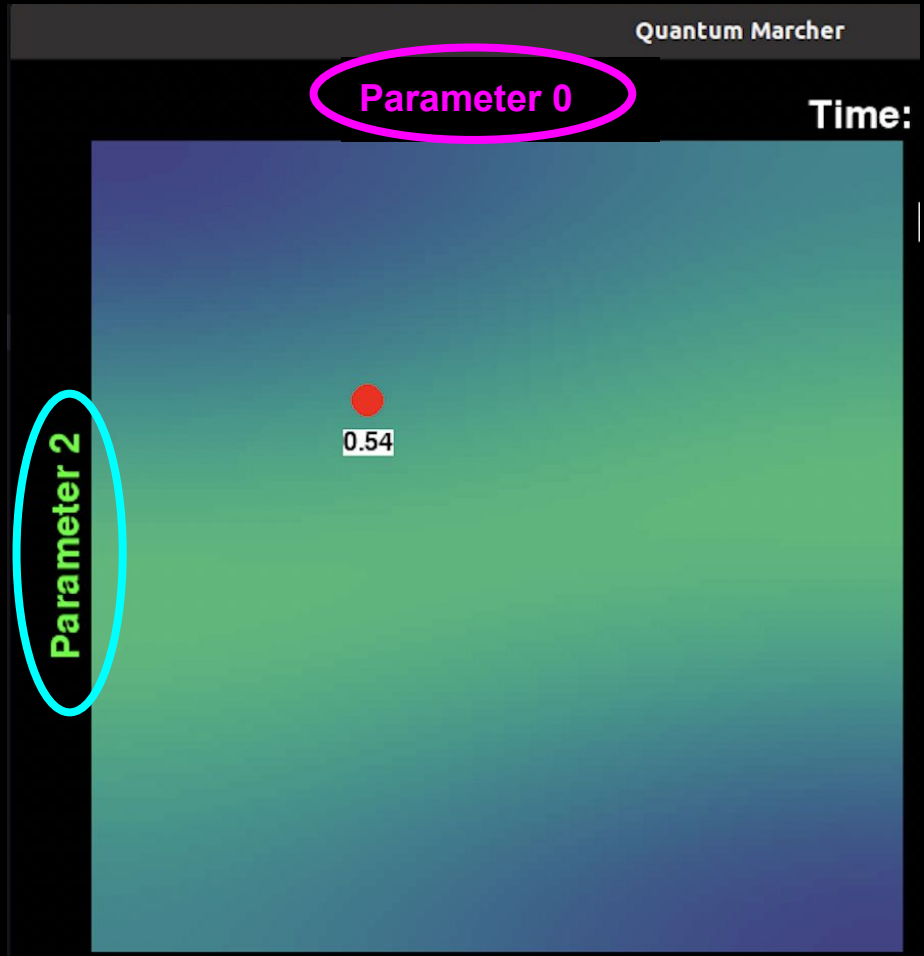
Parameter 0 (P0)



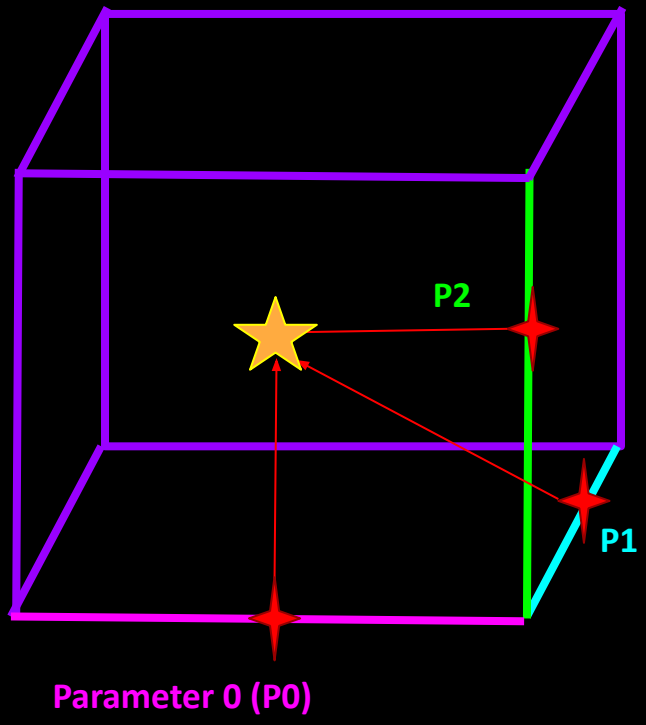
GETTING TO THE GROUND



Parameter 0 (P0)

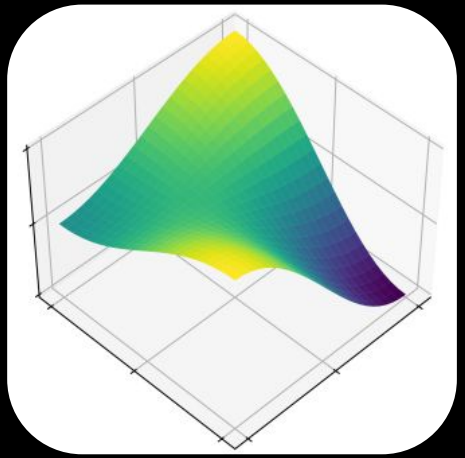


SAVED FROM THE STORM

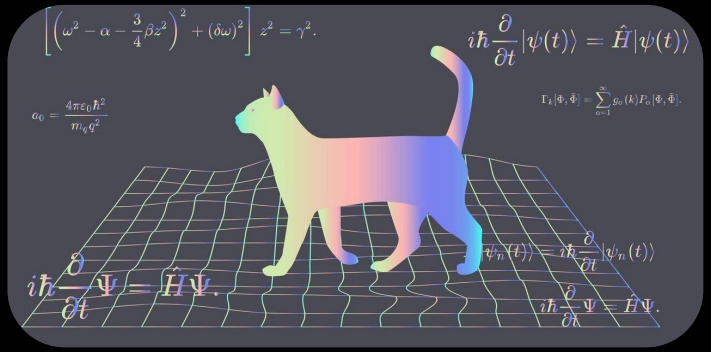


Demo!

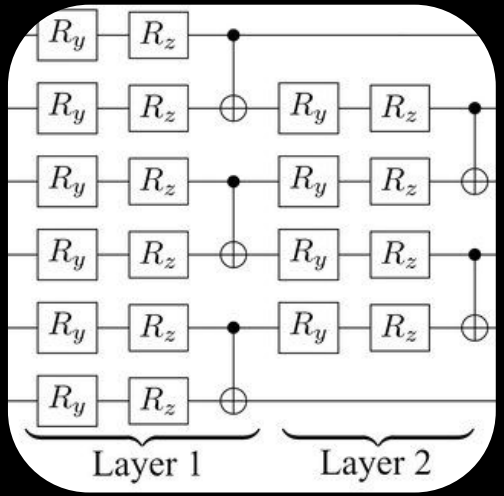
What's next?



3d rendering



Game UI/UX



Quantum Intuition

Thank you!
Questions?