SMU Undergraduate Research Programme

Quantum Reinforcement Learning for Combinatorial Optimization | Aug 2024 - Present

RESEARCH AIM

Context:

- Investigate **Quantum Reinforcement Learning approaches** to approximating **Combinatorial Optimization problems**
- QRL has a scalability issue: Time complexity is $O\left(2^n\right)$, where n is the number of qubits.

My role:

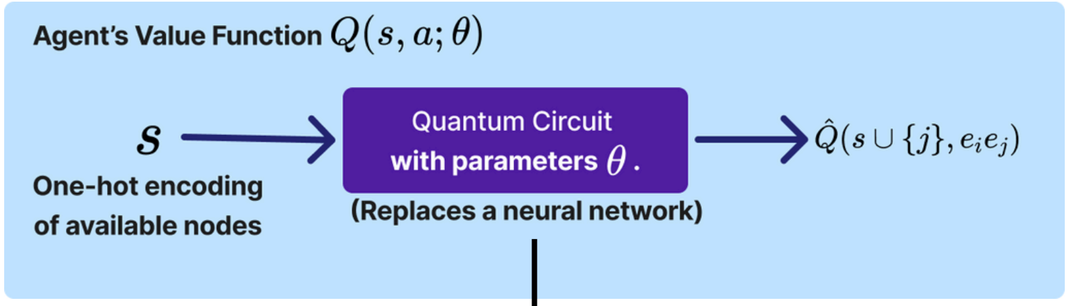
- Propose a QRL method for moderate **Travelling Salesman Problem to about 30 - 50 nodes**.
- Improve **explainability for QRL circuit structures.**

PROGRESS

- Modify the current **state of the art ansatz design** as a form of ablation experiments on the performance of the RL agent as a better understanding of what gates are crucial for good RL performance.

PROJECT ILLUSTRATION

- The classical neural network representing the agent's policy function is replaced by a **Parameterized Quantum Circuit,** which **significantly reduces number of trainable parameters.**



The **ansatz** refers to the underlying circuit design, which is a sequence of gate operations on a system of qubits.