CS4084 Quantum Computing

Assignment 2 **4 wtg**

You are free to write code on Qiskit or PennyLane.
You may select any optimizer of your choice.
Qubits allowed <= 8 for Statlog Heart
Qubits allowed <= 12 for Ionosphere

Task: Design a Variational Quantum Classifier (VQC) model for the specified datasets using the details provided below.

Instructions:

Datasets: Utilize the following datasets:

Statlog Heart : https://archive.ics.uci.edu/dataset/145/statlog+heart
Ionosphere : https://archive.ics.uci.edu/dataset/52/ionosphere

Data Split:

Training: 70%
Validation: 10%
Testing: 20%

Feature Maps:

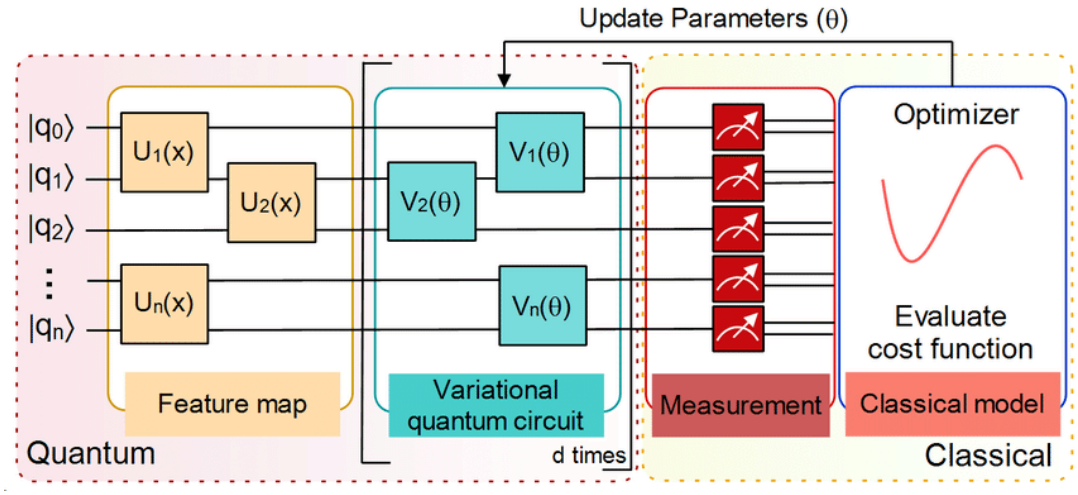
Use ZZFeatureMap(..., reps=2)
Use PauliFeatureMap(..., reps=2, paulis=["Z", "YY"], entanglement="full")

Custom Ansatz:

Design a custom variational quantum circuit (ansatz) from scratch for both feature map and for both datasets (total 4), rather than using predefined ansatz options. **(You will be majorly graded based on the uniqueness of your circuit)**
The goal is to create an ansatz that maximizes the classification accuracy.

Evaluation Metrics:

Use Accuracy, Precision, Recall, and F1 Score to evaluate the model's performance.



References for your help

https://github.com/qiskit-community/qiskit-community-tutorials/blob/master/machine_learning/vqc.ipynb
https://docs.quantum.ibm.com/api/qiskit/qiskit.circuit.library.PauliFeatureMap
https://qiskit-community.github.io/qiskit-machine-learning/tutorials/02a_training_a_quantum_model_on_a_real_dataset.html
https://github.com/MaldoAlberto/example-of-VQC/blob/main/Variational%20Quantum%20Classification_example_values.ipynb
https://learning.quantum.ibm.com/course/variational-algorithm-design/variational-algorithms
https://medium.com/qiskit/building-a-quantum-variational-classifier-using-real-world-data-809c59eb17c2