Qiskit fall fest Kolkata chapter Hackathon 2022

Goal of the Hackathon challenge: Find the best test accuracy using one or more QML algorithms under the effect of noise.

Detailed description: In the workshop you learned two QML algorithms, namely (i) Variational algorithm, and (ii) Quantum SVM. Moreover, you learned different encoding techniques (e.g., angle encoding, basis encoding) and different ansatz as well (e.g., linear entanglement, circular entanglement). The goal of this hackathon is to find the optimal train and test accuracy for a classification problem, under the action of noise, using a QML algorithm of your choice. You learned about different noise models during the workshop, starting from individual models, such as depolarization, measurement error etc., upto mock backends which mimics the entire noise model of the hardware. In [1], the authors questioned the effectiveness of QML algorithms under the action of noise. They showed that finding the optimal parameter on an ideal simulator does not carry over properly to the noisy scenario. A question, then, remains on how to find the best test accuracy for QML algorithms under noise.

In this hackathon, you will use a QML algorithm of your choice for classification using the well studied iris dataset (https://archive.ics.uci.edu/ml/datasets/iris). First, use a classical ML algorithm to find the test accuracy obtained in classical computers. Then use one or more QML algorithms of your choice to obtain the optimal test accuracy in an ideal noiseless scenario. The open challenge is to improve the test accuracy as far as possible in a noisy scenario.

You can keep the following in mind, which you may consider to experiment on for this challenge:

1. It is still not known which ansatz or which encoding is least susceptible to noise.
2. It is still not known which type of noise (e.g., depolarizing, pauli, amplitude damping, coherent) affects the accuracy of the model most.
3. Often the classical optimizer is selected randomly. However, it is always good to have an optimizer which converges the fastest.

The above three points are simply ideas to decide on some directions that you can take to improve your project outcome. You are free to use one, or more, or none of these as long as they show the test accuracy of a QML algorithm on the iris dataset under noisy scenarios. Although not covered in the workshop, you may consider using some simple error mitigation methods to improve the performance of your QML algorithm.

Summary: Run a QML algorithm using one or more encoding, ansatz of your choice on the iris dataset to maximise the test accuracy of the classification problem.

Marking: Please keep the following in mind for the final presentation.

1. Every team member must be present in the final presentation in order to receive a certificate of participation in the workshop and hackathon.
2. Each team shall get 15-20 mins to present their project.
3. You need to upload the code in GitHub and share the link. You can be asked to run parts of the code live during the presentation.
4. There will be separate marks on project and presentation. It will be better if you can showcase your findings using proper graphs in your presentation.

Reference:

[1] Characterizing the Reproducibility of Noisy Quantum Circuits. S. Dasgupta, T. Humble. https://www.mdpi.com/1099-4300/24/2/244