Task V: Open Task Part

Hello there!

So let's talk something quantum! Quantum Computing is a field that brings together many other fields like Computer Science, Quantum Mechanics, Statistics, etc under one hood to solve problems that are generally perceived intractable in the classical computing world. The field has seen a tremendous growth in the past three decades especially in the last five to seven years with the creation of actual quantum computing hardware. But in all of this hype, there are still major obstacles that the quantum computing enthusiasts have to tackle before being able to harness the true potential of quantum computing. The major roadblocks are decoherence and large error rates which hugely hinder the scaling of the quantum systems where they can be used for some potential real world application. Well however, all these obstacles are more on the hardware side and different types of hardware show different improvements over these obstacles. Like, superconducting qubits(quantum bit of information) have shorter decoherence times, but are relatively easy to scale, in the same way trapped ion qubits can stay coherent for sufficiently longer times but need to be implemented very carefully in particular states which is difficult. Similarly, each type of hardware poses some kind of advantage but also lacks in some other procedure.

One of the hot topics currently in the Quantum Computing world is Quantum Machine Learning. Quantum Machine Learning is an emerging field that adds 'quantumness' to classical machine learning techniques to provide better performance over potentially large datasets taking advantage of the large state space of qubits. Quantum Computing not only increases the performance of classical machine learning methods but also it does so using less computational resources to add more advantage. However, all of this because we are currently in the NISQ(Noisy Intermediate Scale Quantum) era where almost all the algorithms put into use follow a hybrid approach combining suitable classical techniques to quantum methods to leverage the various problems faced due to obstacles mentioned above. One potential application that has caught my attention is the use of quantum convolutional networks for quantum error correction. I am really interested to work on this as it can really accelerate the development of full stack quantum computer if proven efficient and tractable. This shows that as quantum computing can prove helpful for improving classical techniques, same way classical methods can solve some fundamental quantum computing problems.

However, even though being in the NISQ era, I am looking forward to a time when quantum computing would be absolutely 'quantum' without any hybridness attached to it and am highly motivated and passionate about turning that into reality.

Thank You!