Task III : Open Task

Quantum Computing is a revolutionary computing paradigm which is based on the principles of quantum mechanics. Classical computers are the computers which we use in our daily life using which this document is typed out. These classical computers work on bits 0s and 1s. But quantum computers work on quantum bits or qubits. Qubits can exist in a superposition of states, that is they can represent both 0 and 1 simultaneously. This property of quantum bits has been exploited in quantum computing which allows for parallel computing and potentially exponential speedup for certain problems. One of the most remarkable abilities of quantum computing is its potential to solve complex problems very quickly. This includes tasks such as factoring large numbers, simulating quantum systems, optimizing complex processes, and solving certain types of optimization and search problems more efficiently.

Quantum Machine Learning (QML) can be thought of as an intersection between the principles of quantum computing and machine learning. Using quantum systems, machine learning models can be trained fast and with more efficiency. The training of machine learning models becomes faster because of the parallel computations taking place in quantum systems due to qubits. QML also leverages the potential of various quantum algorithms to potentially outperform classical machine learning algorithms in accuracy and efficiency.

Talking about quantum algorithms. One of the most fascinating algorithms is Shor's algorithm. This algorithm is renowned for its amazing ability to factor large integers into their prime factors which has applications in many cryptographic protocols such as the RSA encryption. Classically, integer factorization is considered as a computationally expensive problem, particularly for large numbers with hundreds or thousands of digits. Shor's algorithm demonstrates the potential power of quantum computing by solving this problem of integer factorization much faster.

One of the quantum software that I am quite familiar with is Qiskit developed by IBM Quantum which is an open source quantum computing SDK (Software Development Kit) for programming and simulating quantum circuits, as well as interfacing with real quantum hardware through IBM's cloud based quantum computing platform. It has a lot of features like quantum circuit design, quantum simulation, and quantum algorithm development. We can also get access to quantum hardware by IBM to run our quantum algorithms on their quantum hardware systems. I am also quite familiar with tensorflow quantum and cirq framework.

I would like to contribute more in the field of quantum machine learning and quantum deep learning. I feel these fields of research are very exciting and there's a lot to explore. Why I feel this exciting is the models that we develop and run on quantum computers stretch the capabilities of quantum computers to their maximum. I would like to contribute more into this field of research.