Quantum Computing

Quantum computing is a new type of computing that uses the principles of quantum mechanics to solve problems. Unlike classical computers that use bits (0s and 1s), quantum computers use **qubits**. Qubits can exist in multiple states at once due to a concept called **superposition**. They can also be **entangled**, meaning their states are linked, no matter how far apart they are. These properties allow quantum computers to perform some calculations much faster than classical ones.

Quantum Machine Learning (QML)

Quantum Machine Learning applies quantum computing to machine learning tasks. The idea is that for specific problems, quantum algorithms might analyze data more efficiently than classical algorithms. For example, quantum computers can explore vast possibilities quickly. However, practical advantages over classical methods are limited to certain scenarios.

Quantum Algorithm: Variational Quantum Eigensolver (VQE)

VQE is a popular quantum algorithm used to solve optimization problems. It combines both quantum and classical computing. The quantum part processes data and measures results, while a classical computer updates the parameters to improve the results. VQE is widely used for finding the lowest energy states of molecules, which is essential in quantum chemistry.

Quantum Software: PennyLane

PennyLane is an open source software designed for quantum machine learning. It allows users to build and run quantum circuits easily, even without having direct access to a quantum computer. It supports both simulations (running quantum circuits on classical computers) and real quantum devices

Methods Which I would Like to Explore Further

- **Quantum Support Vector Machines (QSVM)**: This algorithm uses quantum kernels to classify data. It could be beneficial for scenarios where traditional SVMs struggle with large or complex datasets.