QCNN for Multi Channel Classification

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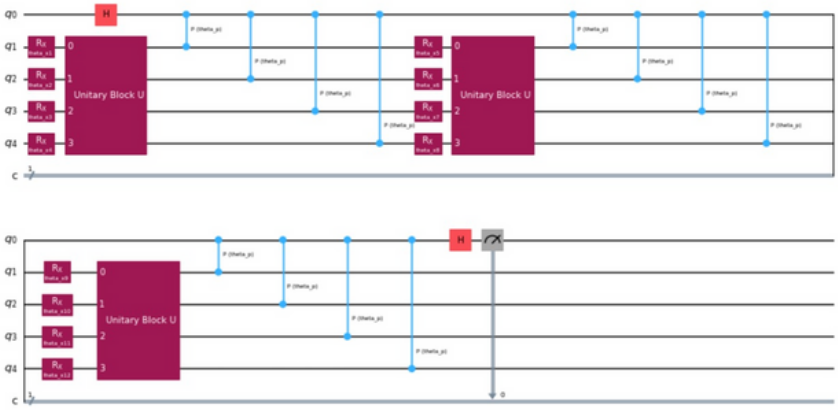
ABSTRACT

Abstract — Quantum computing presents unique opportunities for advancing machine learning through Quantum Convolutional Neural Networks (QCNNs). This report explores the implementation of three methods: the Channel Overwrite (CO) method, the Weighted Expectation Value (WEV) method, and the Control QCNN. The CO method encodes classical data into quantum states, employing controlled phase operations to entangle inter-channel information. The WEV method combines quantum convolutions with classical weighting, creating a hybrid approach. The Control QCNN processes individual channels independently and aggregates results post-measurement. A modification to the CO method is also introduced, incorporating dynamic phase controls and deeper unitary blocks to improve feature extraction and hardware efficiency. These methods were evaluated on multi-channel datasets, showcasing distinct capabilities in quantum-classical hybrid learning and inter-channel feature analysis.

METHODOLOGY

We modified the **Channel Overwrite** (CO) method by introducing dynamic phase controls, allowing the system to adapt entanglement based on the data to extract more detailed features. These changes were designed to improve how inter-channel information is processed and make the method more efficient for use with current quantum hardware



RESULTS