Project: Quantum Neural Networks for Image Classification Tasks

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Introduction:

Quantum computing presents a promising avenue for revolutionizing classical machine learning tasks, particularly in image classification. By harnessing quantum effects alongside classical methodologies, the proposed project seeks to amplify the capabilities of traditional models. The integration of quantum elements into neural networks holds the potential to significantly enhance accuracy and efficiency, addressing pertinent challenges across diverse domains such as healthcare and security that have a great use case for computer vision.

Problem Statement:

This project aims to explore the efficacy of hybrid quantum-classical models in improving image classification accuracy and efficiency compared to classical approaches.

Methodology Overview:

The project will develop two hybrid quantum-classical models: a neural network featuring parallel quantum layers and a neural network incorporating a quanvolutional layer. These models will be designed to address image classification tasks. Quantum circuits with trainable variational parameters will be employed, utilizing parallel variational quantum circuits to facilitate efficient neural network learning.

Expected Outcomes:

The project anticipates demonstrating the potential of hybrid quantum-classical models to significantly enhance image recognition and classification. Through leveraging quantum effects like superposition and entanglement, the models aim to surpass the performance of conventional classical approaches, thereby advancing the state-of-the-art in image classification across various domains.

References:

1. https://www.tensorflow.org/quantum/tutorials/qcnn
2. https://ieeexplore.ieee.org/document/9550027