Image Classfication using Quantum Convolutional Neural Network

Abstract

A novel approach for image classification using a quantum convolutional neural network (QCNN) has been proposed in this project work. The main objective of this work is to exploit the potentials of quantum computing in enhancing the performance of deep learning models for image classification tasks. The proposed QCNN model is built on the principles of both convolutional neural network (CNN) and quantum computing. Quantum gates are utilize to perform convolutional operations on the image data, which allows efficient representation and processing of the image features. QCNN model is designed and implemented on quantum simulation which is to be compatible with current quantum hardware. To evaluate the performance of QCNN model, the experiments are conducted on several benchmark datasets and compared with state-of-the-art classical CNN models such as Restnet, VGG16, VGG19, and etc. The standard performance metrics such as accuracy, precision, recall, F1-score, error rate, and etc. Experimental results will show that the QCNN model achieves comparable or better classification accuracy in general. In particular, QCNN will out perform while reducing the number of trainable parameters. The significant advantage of QCNN model reduces the computational cost and memory requirements of the model. The effect of different types of quantum gates will be analysed on the performance of the model. The results of the analysis will provide insights into the most suitable quantum gates for image classification tasks and how they can be used to improve the performance of the model.

Submitted by M. Ragupathi, M. Kannan, B. Abdul Qaiyum

Under the Guidance of Dr. R. Ragupathy