From Classical via Hybrid to Quantum model: Quantum Machine Learning Applications for Fake Art Identification

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Abstract

Artificial Intelligence has been used for the real and fake art identification and different machine learning (ML) models are being trained then employed with acceptable accuracy in classifying artworks. Fake art can distort the understanding and appreciation of an artist's true work and style. Accurate identification of genuine pieces ensures the preservation of artistic heritage and prevents the spread of misinformation. As the future revolutionary technology, quantum computing opens a grand new perspective in the art area. Using Quantum Machine Learning(QML), the current work explores the utilization of fully quantum models, hybrid models along with classical model implementation. The study utilizes Normal Arbitrary Superposition state (NAQSS) for encoding image into quantum circuit. The learning of trainable parameters for image classification Quantum Neural Networks (QNN) for a fully quantum models. With a Hybrid approach, Hybrid Quantum Neural Network with parallel quantum dense layers (HQNN-Parallel). ResNet model is being used for classical model. The study addresses the quantum speed up in training time of models, accuracy and computational complexity of the models. Starting with a simplest example of 4 * 4 images up to 32 * 32, the accuracy has been improved for full quantum model with the increasing size of the images as the circuit depth increases linearly with the image size namely $(2^{n+1} - 1)$.
The three models are discussed and the potential of QML and parameters influencing accuracy are extensively investigated. The implementations have been carried out using Qiskit and Torch for training the models.

Figures

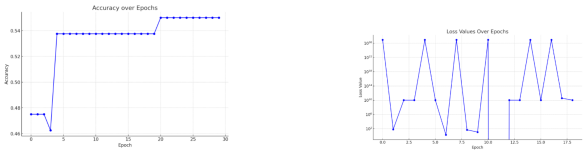

Figure 1: . Training accuracy for 2*2 image classification of Quantum Neural Network with NAQSS Image Encoding.

References

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