ABSTRACT

The world is moving towards the Fourth Industrial Revolution which is driven by the advancement in technology like Quantum Computing, AI, Internet of Things (IOT), and other technologies. These technologies have been developed to integrate with each other and with other applications/services that use them to make our life easier. One such technology is Quantum Computing which is based on the laws of Quantum Mechanics and promises to solve the computation limitations that we find in any modern-day computers. Classical computers have always been limited in terms of processing power for fields like Computer Vision. Image processing plays an important role in algorithms in machine learning and AI that use it to classify images, enhance the image, or extract useful information out of it. Classical systems require a tremendous amount of memory to store and reconstruct the image which in turn increases the computation costs. These systems use finite states (0 and 1) to represent the information, while quantum computers consist of quantum bits (Qubits) that can be in superpositions of states 0 and 1. This property of qubits along with other laws like inference, entanglement, and coherence allows building a system that can outperform a classical system in terms of computation. This study provides a primer of quantum computing basics that is essential for understanding the underlying quantum computers. The study also juxtaposes current quantum technologies that are available in the market. The study then investigates the implementation of the FRQI model of image representation in the quantum simulator for storing and retrieval of pixel information to check on the efficiency of quantum computers for image processing. The results from the experiment illustrate that we could only recover up to 88% of the image from the current quantum circuit. This result when compared to the classical algorithms, requires more research on building efficient algorithms with the limitations of the current quantum processors and simulators. The study also reflects that the current quantum computer provides no advantage over their classical counterparts for image processing with FRQI image model representation