# Chapter 10
# Image Processing Using Quantum Computing:
## Trends and Challenges

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## ABSTRACT

*Image processing via the quantum platform is an emerging area for researchers. Researchers are more interested to move on towards quantum image processing instead of classical image processing. This chapter starts with the review of different quantum image computing-based research papers with a brief idea of the ethics which inspire quantum computing in the background and focus on the current scenario of recent trends of quantum image representation, pitfalls, and summarization of the pros and cons of it, with the limitations of the technologies used and focus on the recent work to be going on and application of it in a different field. In the next, it will focus on the different methods used by the researcher in the previous papers. The next section discussed the different methods based on quantum image representation used. Some different techniques of image storage, retrieval, and representation in a quantum system are discussed. Also, this chapter briefs the pros and cons of using different techniques in quantum systems in comparison to classical systems.*

## INTRODUCTION

Recently some years ago, there were two concepts like the field of computer science and biological science. 'Emergent Computing', 'Complexity Theory', and 'Evolutionary Computing' have emerged as a new field in the era. Further, later on, challenging the classical explanations in quantum physics. (Batouche et al., 2009) Quantum mechanics is one main interesting branch of quantum physics, further subdividing quantum mechanics; we get an interesting branch called quantum computing. The main

function of quantum physics is based on the elementary atomic structure. By achieving the desired manipulation of quantum physics computing speed and performance can be significantly improved. Digital image processing with the effect of growing technology its continuously upgrading itself by the effect from in volume and relevancy, with the continuous demands of storing data, information, transmission, and power to process. The improvement is done in the standard image processing by the utilization of quantum computing in the form of encoding the given information of an image to the quantum mechanical systems and also replacing the classical information processing into the quantum information processing. By the analysis of different work based on this, in this research, try to chase the issues and challenges found within it and further what will be the future scope of it in the coming generations. As the quantum image processing is the point of attraction in the field of digital image processing and gains more consideration in modern years with respect to quantum image representation, operation, and encryption. With the development of revolutionary technology, information hiding in the form of image scrambling and digital watermarking is the crucial state in this scenario. These were the issues that are considered to be forward in this research paper.

## Quantum Computing

Quantum computing is significantly new technology. As per Moore's law, computer supremacy doubles itself approximately in two years. The concept of quantum computing will help us in building or electronic devices that will perform the calculation much faster and in a robust manner after the principle of quantum physics, the quantum machine is several times faster than a conventional machine. Quantum computing is still an experimental phase but experiments are being carried out on a smaller scale with the desired result. There are several private and government organization which are developing a quantum computer. Quantum computers can be used in a number of fields such as information technology, research, and development, health care finance education, etc. Al detailed diagram below...shows the working of a quantum computer.

One of the major uses of quantum computing is in the field of image processing. The image processing algorithm can be significantly improved in terms of accuracy and speed with the use of quantum computers. This paper mainly focuses on the use of quantum computing in image processing. Other areas of concerns will be processing compression, enhancement, storing and retrieval and restoring, 2D image data and visual information.

## Quantum Image Processing

In today's world, most of the data is in the form of images. These include the images that are transmitted and stored in a digital environment. The major use of images is in health care, social media, satellite communication, and another day to day life. The image can be processed by a digital computer which is also called digital image processing also the image can be processed by the quantum computer; this process is called quantum image processing. Quantum image processing is a branch of quantum information processing. Quantum image processing implies the use of cohesion, entanglement, superposition, and parallelism. So we can sum up quantum image processing as a method that uses a quantum method to speed up image processing, making it more efficient and quick. As shown in fig1. Several image processing techniques such as retrieval representation, noise filtration, processing, and storage can be made more efficient as compared to classical computing by using quantum image processing (Chakraborty et al., 2018)

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