Chapter 7
True Color Image Segmentation by MUSIG Activation Function Using Self-Supervised QMLSONN Architecture With Context-Sensitive Thresholding

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ABSTRACT

In this chapter, the authors propose the true color image segmentation in real-life images as well as synthetic images by means of thresholded MUSIG function, which is learnt by quantum-formulated self-supervised neural network according to change of phase. In the initial phase, the true color image is segregated in the source module to fragment three different components—red, green, and blue colors—for three parallel layers of QMLSONN architecture. This information is fused in the sink module of QPSONN to get the preferred output. Each pixel of the input image is converted to the corresponding qubit neurons according to the phase manner. The interconnection weights between the layers are represented by qubit rotation gates. The quantum measurement at the output layer destroys the quantum states and gets the output for the processed information by means of quantum backpropagation algorithm using fuzziness measure.

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INTRODUCTION

To recover the object from the noisy environment is a difficult task and the research is continuing up to the knowledge of extent to collect more information regarding image processing. Though image processing starts from early 1990, at that time the object extraction from the blured and noisy environment has been evolved by the MLSONN architecture and is designed by few scientists (Ghosh et al., 1993) for extraction the object. Sigmoid response for the graded neuron is used in case of the neural model (Hopfield, 1984). In this regards the neuron characteristics is very similar to that of McCulloch - Pitt's neurons model for this deterministic characterization. Here, neurons collectively act together to operate just like biological neurons. The basic neural network architecture is shown in Figure 1 reckoning with different nodes comprising input layer, hidden layer and output layer. Extraction of the binary objects from the noisy environmental images is an intricate work in the computer vision research fields. After few times have been elapsed the binary object is extracted by means of QMLSONN architecture (Bhattacharyya at al., 2014). It is used significantly to train the qubit neurons with the noisy atmosphere, constituting three layered architecture by applying the sigmoidal activation function. At that juncture authors have designed to recover the object from the noisy perspective for pure noisy color images (Bhattacharyya et al., 2015) using quantum version parallel neural network architecture by applying the quantum back propagation algorithm and guided by the sigmoidal activation function. Authors use three parallel QMLSONN networks each having three layers input, hidden and output for red, green and blue color components segmentation accordingly.

The image segmentation is another application to reconstruct the object from the noisy perspective. It is a nice approach to segment the image in various portions / class depending on the application of the thresholding strategy. Here the segmentation of the image to detect the boundary or object (Singh et al., September 2010) to maintain the visualization characteristics of the pixels. Each pixel is grouped with similar types of characteristics like intensity, color, texture, etc. to maintain the grouping of the class. For the binary image segmentation Model-Based Segmentation is very much useful where local information processing can be taken place. When the local visualization is not sufficient to collect the local information for collecting the pixels to make a similar class then the geometric shape of the object may be considered and compared with the characteristics of the local information.

Another kind of learning principle such as autoencoders (Baldi P., 2012) can be used to solve the segmentation process by the neural network architecture, but it is applicable for unsupervised principle and also in deep architecture for transferring the learning information. The linear autoencoders can solve the numerical problem on real numbers and Boolean autoencoders is used to solve the learning clustering