Chapter 3
True Color Image Segmentation Using Quantum-Induced Modified-Genetic-Algorithm-Based FCM Algorithm

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ABSTRACT

In this chapter, a quantum-induced modified-genetic-algorithm-based FCM clustering approach is proposed for true color image segmentation. This approach brings down the early convergence problem of FCM to local minima point, increases efficacy of conventional genetic algorithm, and decreases the computational cost and execution time. Effectiveness of genetic algorithm is tumid by modifying some features in population initialization and crossover section. To speed up the execution time as well as make it cost effective and also to get more optimized class levels some quantum computing phenomena like qubit, superposition, entanglement, quantum rotation gate are induced to modified genetic algorithm. Class levels which are yield now fed to FCM as initial input class levels; thus, the ultimate segmented results are formed. Efficiency of proposed method are compared with classical modified-genetic-algorithm-based FCM and conventional FCM based on some standard statistical measures.

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INTRODUCTION

True color image segmentation always be a highly research oriented field as it is treated in the fields of vision, medical image processing, biometric measurements etc for the purpose of detection, face recognition, tracking of an object. Image segmentation is the process to partition an image into some non disjoint regions by groupifying the pixels having same characteristics such as intensity, homogeneity, texture etc. A true color image contains much more information than a gray scale image as a color image convey much more features than gray scale image. The underlying data of a true color image deal with the information in primary color components viz Red(R), Green(G) and Blue(B) and also their admixtures. So a proper segmentation algorithm always be needed for more perfect and accurate result, otherwise it may be happened that after segmentation a new color component may be generated which does not belong to the original true color image.

Different classical and soft computing based techniques are used for segmentation purpose. Classical techniques are categorized into three categories: feature space based segmentation, image domain based segmentation and graph based segmentation. Thresholding, region growing and merging, edge detection, clustering are popularly used some classical segmentation techniques. On the other hand, soft computing techniques have been manifested for the solution of control problems. Fuzzy Logic, artificial neural network, genetic algorithm are three components of soft computing techniques. Fuzzy logic mainly deals with the problem of imprecision and uncertainty, artificial neural network used for learning and adaptation and GA is opted for optimization problem. By using classical segmentation techniques, uncertainties may be arrived as segmentation results if incomplete, imprecise and/or ambiguous information used as input data, overlapping boundaries between classes are present and extracting features and relations among them are indefinite. Soft computing techniques deal with these kinds of problems and produce more convenient result.

Fuzzy C-Means (FCM) [Bezdek, 1981] clustering, a soft clustering technique, is widely used for image segmentation. It follows the rule of fuzzy set theory [Zadeh, 1965]. Though it is more efficient than many other clustering techniques but it also has some deficiencies like it may be stuck into local minima point unless to reach global maxima point; second at the very first time cluster centres are initialized by the programmer; and third it is only applied to hyper spherical structured clusters. Incorporating different evolutionary algorithms like GA [Goldberg, 1989], PSU [Mekhmoukh, 2015] into FCM above stated problems can be solved. Evolutionary algorithms produce global optimal solutions which will be gone to FCM as input data. Though this kind of hybrid algorithm produces optimal solutions but they take high computational time.