Enhancement of Magnetic Resonance Images Using Soft Computing Based Segmentation

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***Abstract*—Segmentation is the process of extracting points, lines or regions, which are then used as inputs for complementary tasks such as registration, measurement, movement analysis, visualization , etc in MRI. The noise in MR images degrades the image quality and also affect on the segmentation process which can lead to wrong diagnosis. The main aim of this study is to suggest a system to enhance the quality of the human brain MRI. In the proposed system, median filter is used for image enhancement of brain MRI and fuzzy *c*-means for segmentation purpose. The proposed method is completely automatic that is there is no user involvement in the proposed system. The system is tested on different kinds of brain MR images and proved robust against noise as well as segments the images fast with improvements.**

***Index Terms*—Dunn's index, fuzzy *c*-means (FCM), image segmentation, median filter.**

I. Introduction

Segmentation subdivides a digital image into non-overlapping regions or objects having the similar features. In other terms, Image segmentation splits an image into significant portions with respect to some particular problem.

Magnetic Resonance Imaging (MRI) is a medical imaging method widely employed by the radiologist to diagnose the severity of the disease. Segmentation and Classification of images has become an important and effective tool for many technological applications like brain tumor segmentation from MR images, classify image a benign or malignant and many other post-processing techniques.

Segmentation is considered to be an essential step for many applications of the image processing. Up till now, no general segmentation method is proposed yet that is appropriate for all the image analysis application. Segmentation partition an image into groups that have homogenous information inside them and are heterogeneous of each other. These groups are known as segments. These segments further used for analysis and extracting useful information from the image. General segmentation techniques methods are categorized into major four following categories: Thresholding Approaches, Region Based Approaches, Markov Random Field and Artificial Neural Network (ANN) [1].

Tumor segmentation from MRI data is an important but time-consuming manual task performed by medical experts [2]. To Automate this process is difficult and challenging task due to high diversity in appearance of tumor tissue among different patients and, in numerous cases, resemblance with normal tissue.

In the past decade, many researchers proposed several automated segmentation methods with the combination of different techniques. These methods include, thresholding-region growing, edge detection-morphological and surface growing, seeded region growing algorithm based method, histogram-morphology based method, deformable surface modeling etc. All the segmentation methods are intensity dependent and may cause problem with phase map data. The one possible solution is fuzzy clustering. Brain has very complex structure in its nature. All tissues are connected with each other and MR images always present overlapping intensities for different tissues because of the noise and blur in acquisition [3]. Separation of these tissue classes and automatic segmentation is challenging due to the wide variety of tumor locations, sizes and shapes. In particular, boundaries between tissues are not clearly defined and memberships in the boundary regions are inherently fuzzy [4]. The conventional (hard) clustering methods restrict each point of the data set to exactly one cluster. Fuzzy sets give the idea of uncertainty of belonging described by a membership function. Therefore, fuzzy clustering methods turn out to be particularly suitable for the segmentation of MRI medical images [5].

There are many types of noises like *speckle*, *Gaussian*, *poison* and *salt & pepper* etc. But the most frequently occurring noise in the images is *salt & pepper*. Now-a-days the technologies are tremendously improving but the noise have been an exigent problem. The noise in images can occur due to faulty scanners, transmitting data from machine to computer or transforming the image from one format to another.

The key intention of this study is to develop an automatic system which enhances the image quality and performs the segmentation process in an efficient and automatic way.

The major contributions of the study are:

- Proposed Method is entirely unsupervised and fully automatic i.e. there is no user involvement in the system.
- It finds the optimal clusters by following some clusters validation criteria.

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