**A Hybrid Technique for Medical Image Segmentation**

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[Abstracts]

1. Introduction

Medical image segmentation is an important processing step in image understanding and computer-aided diagnosis and therapy. The objective of image segmentation is to partition an image into homogeneous regions with respect to some attributes such as intensity and texture [1]. The representative image segmentation methods are generally based on the following techniques: thresholding, clustering, and edge detection and region extraction [2]. In this study, a combination of both thresholding and fuzzy clustering techniques will be considered because thresholding finds out the uniform regions for fuzzy clustering that makes the clustering performance better.

For thresholding method, it is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images [3]. The most convenient and widely used technique is histogram thresholding which is based on the shape properties of the histogram. Histogram thresholding is a fast and simple method, however, drawbacks of this method are that it ignores the spatial information, is complicated to take the threshold of the multidimensional histogram, and is easily influenced by noise appear in the image. Thresholding-based segmentation algorithms are then generally efficient in terms of computational complexity, and Otsu’s clustering-based thresholding [4] is being one of the most representative methods for image segmentation.

For fuzzy clustering method, it has been widely studied and successfully applied in image clustering and segmentation [5]. Fuzzy c-means (FCM) clustering [6, 7], which is one of the basic methods of fuzzy clustering. FCM depends on the Euclidean distance between pixels based on the assumption that each feature is of equal importance. However, in most real-world applications, features are not considered equally important, and the biggest drawback of this method is sensitive to noise and extraneous elements in the image data, meaning that the cluster centers may be located far from the real center of the cluster. To improve the performance of FCM, many techniques have been proposed, such as rival checked FCM and suppressed FCM (SFCM), which integrates the hard c-means (HCM) and FCM in order to improve the convergence speed and clustering performance [8, 9]. So we propose a hybrid technique using Otsu thresholding and enhanced SFCM (En-SFCM). Furthermore, we reduce impulsive noise that is widely presented in magnetic resonance (MR) images by employing vector median filtering.

The rest of this paper is organized as follows. Section 2 introduces the proposed image segmentation approach and Section 3 presents experimental results of the proposed approach and well-known image segmentation algorithms.

Finally, Section 4 concludes this paper.

2. Proposed Image Segmentation Framework

The proposed image segmentation approach consists of vector median filtering, Otsu thresholding, and En-SFCM, as shown in Figure 1.

In the first step, vector median filtering is utilized to reduce impulsive noise in medical images. Otsu thresholding is then employed for rough segmentation of brain MR images, and finally En-SFCM is applied to have well-segmented images. More details about the proposed approach are described in the following sections.

2.1. Vector Median Filter.

2.2. Otsu Thresholding.

2.3. Enhanced Suppressed Fuzzy C-Means.

3. Experimental Results

3.1. Segmentation Results for Gray Matter and White Matter.

3.2. Segmentation Accuracy.

4. Conclusions

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References