**A Hybrid Technique for Medical Image Segmentation**

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[Abstracts]

1. Introduction

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 a method to convert a gray scale image into a binary image, so that objects of interest are separated from the background [3]. The histogram thresholding, which is based on shape properties of histogram, is the most convenient and widely used technique. The image histogram has different peaks and valleys, with each peak corresponding to one distinct region and each valley as one threshold value to separate two different regions [4, 5]. In terms of computational complexity, the segmentation algorithms based on thresholding are then generally more efficient than other segmentation methods, and one of the most representative methods for image segmentation which is Otsu’s clustering-based thresholding [6].

In addition, in image clustering and segmentation, a method has been widely and successfully applied that is fuzzy clustering [7]. And one of the basic methods of it is fuzzy c-means (FCM) clustering [8, 9], which is a soft segmentation method that has been widely used to improve the compactness of the regions with its cluster validity and simple implementation. If we assume that each feature is of equal importance then FCM depends on the Euclidean distance between pixels. This assumption may seriously affect clustering performance because features are not considered equally important in most real-world applications. Thus, many techniques have been proposed to improve the performance of FCM, 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 [10, 11]. Based on the advantages of thresholding and fuzzy clustering algorithms for image segmentation, hybrid techniques combining various FCM-based methods with thresholding have been proposed by some authors. First, Tobias and Seara proposed histogram thresholding using fuzzy theory [12] in which the image histogram is thresholded based on a criterion of similarity between gray levels and a measure of fuzziness is used for assessing this similarity. Because of the used assumption, in which objects and background must occupy non-overlapping regions, the application of the proposed method is limited to images that satisfy such a requirement. Chaabane Ben et al. proposed a hybrid method that combines automatic thresholding with FCM [13]. However, this technique yielded good results such that significant peaks and valleys are identified properly. To overcome the FCM’s sensitiveness to the initialization condition of cluster centroids and selection of the number of clusters, another hybrid approach was introduced by Tan and Isa, which is the using the histogram thresholding [14]. However, some of the flat parts of the histogram curves had been recognized as the dominant peaks and that is a drawback of this algorithm. To overcome the drawbacks of above methods, we propose a hybrid technique using Otsu thresholding and enhanced SFCM (EnSFCM). Furthermore, we use vector median filtering to reduce impulsive noise that is widely presented in magnetic resonance (MR) images.

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

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