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# MRI Brain tissue Segmentation Using Level set approach

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***Abstract*—** Off recent level set methods have been used widely in medical image processing. This paper focuses on level set and its variation for MRI brain tissue segmentation. The different tissues are white matter (WM), gray matter (GM), and cerebrospinal fluid (CSF) in brain image. It is difficult to differentiate the boundaries for these tissues. A spatial fuzzy c means and level set segmentation methodology are adopted in this paper for brain MRI image segmentation into WM, GM, and CSF. Initially, segmentation is performed by using SFCM and level sets are used on the result of SFCM. The performance of SFCM and level sets is appraised on Brain Web Database where T1, T2, and ρ weighted images are chosen, whose thickness is 5mm with different intensity nonuniformity (RF) and noise. Experimental results demonstrate the supremacy of segmentation precision even on the noisy MRI brain image. The accuracy, sensitivity, and specificity are improved with better segmentation.

***Keywords*—** Image segmentation, Level set, SFCM

## I. INTRODUCTION

Nowadays, various imaging techniques are used by the physicians namely magnetic resonance imaging (MRI), computed tomography CT. Single photon emission computed tomography SPECT, positron emission tomography PET for diagnostics of brain diseases and brain disorders. The structures that appear in magnetic resonance images (MRI) are often segmented for a variety of clinical and research applications. Magnetic resonance imaging is very adaptable in case of whole-body imaging, like brain, abdomen, heart, knee, etc. Radiologists interpret the generated MRI images visually and qualitatively. In any case, quantitative data, such as the volume of WM, GM, and CSF in the brain are measured through the clinical procedures [1]. Medical image segmentation is a challenging problem due to the complexity of the anatomical structures, noise from image acquisition and sampling artifacts and intensity inhomogeneity or bias field. These challenges make the classical segmentation techniques, such as thresholding, edge detection, and region growing, ineffective at an accurate description of complex boundaries [2].

In the present approach of MRI brain image segmentation, we have proposed a completely automatic two-stage method for brain MRI image segmentation. In the first stage, a spatial FCM algorithm is used, which cluster the MRI brain image into WM, GM, and CSF. From these clusters, the desired cluster must be selected. In the second stage, the selected cluster is taken as input for a level set method which is used to get accurate boundary [3]. This combined method requires less time to segment and also gives good segmentation quality.

Among the existing image, segmentation approaches Fuzzy c- Means clustering (FCM) methods have been extensively implemented for the image segmentation problem. Fuzzy c-means was first proposed by Dunn and it was used as the general FCM clustering algorithm by Bezdak. This algorithm divides the image pixels into different groups based on the degree of the membership in other words each pixel can belong to multiple regions based on the membership value. FCM has been widely applied in many medical applications because of its good performance [4]. Unfortunately, the greatest inadequacy of FCM is its over-sensitivity to noise. Even though the original FCM algorithm provides very good results for segmenting noise-free images but it fails to segment images that are corrupted by noise, outliners and other imaging artifacts. The FCM algorithm is modified to improve the segmentation of meaningful regions [5]. This problem has been solved by Spatial FCM (SFCM) which was introduced by Chuang et al. [6]. SFCM fixes the noise issue by modifying the standard FCM objective function and taking into account the local neighborhood pixel information. Although the noise issue was partially solved but inaccurate edges produced by SFCM is still a weakness of this

 