REVIEW ON SPATIAL FUZZY CLUSTERING WITH LEVEL SET METHOD FOR MR IMAGE

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***Abstract*—The performance of level set segmentation is subjected to appropriate initialization and optimal configuration of controlling parameters which require substantial manual invention. A new spatial fuzzy level set algorithm is proposed in this paper to facilitate medical image segmentation. It is able to directly evolve from initial segmentation by spatial fuzzy clustering. The controlling variable of level set estimated from result of fuzzy clustering. Moreover fuzzy set algorithm is enhanced with locally regularized evolution. Such improvement facilitate level set manipulation and lead to more robust segmentation Performance of evaluation of the proposed algorithm was carried on medical images.**

***Index Terms*—MRI, Brain tumor, FCM, SFCM, level set method.**

I. INTRODUCTION

Magnetic resonance imaging (MRI) has a high resolution of soft tissue, and is non-destructive body testing. Therefore, it has been widely used in the study of brain function, pathology and anatomy. Now most clinicians segment a specific area of brain MRI by manual segmentation method, which is time consuming and different between observers. The different tissues namely gray matter (GM), white matter (WM), and cerebrospinal fluid (CSF) other abnormal tissues are spread over the entire brain. It is not easy to separate them individually when a brain image is considered. So, an accurate brain MR image segmentation algorithm is essential in clinical application. Noise and bias field (BF) are the main difficulties in clinical brain tissue MR images segmentation, which cause intensity non-uniformity (INU), motion artifacts, and other unfavorable factors. Moreover, the brain tissue usually has the complex shape, boundaries and topology, which make accurate and robust segmentation of the brain tissue MR images difficult.

The intensity inhomogeneity often exists in magnetic resonance imaging (MRI) images due to the imperfection of imaging devices. The intensity inhomogeneity can be generally modeled as a smooth and spatially varying field, multiplied by the constant true signal of the same tissue in the measured image. Bias correction is a procedure to estimate the bias field and restore the true signals, thereby eliminating the side effect of the intensity inhomogeneity.

Many segmentation methods have been proposed for the two main difficulties. Fuzzy C-means clustering (FCM) based algorithms are very popular, for FCM is good at solving the ambiguities and uncertainties in the image [1]. However, FCM can't deal with intensity inhomogeneity and noise problem. the application of modified FCM algorithm for MR brain tumor detection is explored. A comprehensive feature vector space is used for the segmentation technique [9].

This project deals with MRI fuzzy segmentation of medical image which is more complex due to intrinsic nature of images for detecting tumor, edema there is a need of segmentation and MRI is an important imaging technique for detecting abnormal changes in tissues and organs. MRI images posses good contrast resolution for different tissues and has advantages over tomography and CT. Clustering is the most popular segmentation method with FCM. FCM was shown superior on normal brains and worse on abnormal brain with tumor, edema and the greatest over FCM is its oversensitivity to noise. It is intensity based clustering algorithm which is not robust to noisy image. Spatial fuzzy C means (SFCM) and level sets segmentation is proposed in this project for automated brain MRI image segmentation into WM, GM and CSF. FCM deals with MR images corrupted by in homogeneities.

MRI is an important imaging technique for detecting abnormal changes in tissues and organs. Brain tumor are one of the most common brain disease, so detection and segmentation of brain tumor in MRI are important in medical to diagnosis and treatment of the disease. It is very important to improve the quality of medical image segmentation, because it could help to determine the lesion location for reducing the risk of surgery, and to assist image process in the surgery planning, surgical navigation and so on clustering approach is widely used in biomedical applications particularly for brain tumor detection in abnormal magnetic resonance (MRI) images. Clustering is the most popular segmentation method with FCM. Fuzzy clustering using fuzzy C-means (FCM) algorithm proved to be superior over the other clustering approaches in terms of segmentation efficiency.

II. LITERATURE REVIEW

Mohamed N. Ahmed "A Modified Fuzzy C-Means Algorithm for Bias Field Estimation and Segmentation of MRI Data". In this paper, present a novel algorithm for fuzzy segmentation of magnetic resonance imaging (MRI) data and estimation of intensity inhomogeneities using fuzzy logic. MRI intensity inhomogeneities can be attributed to imperfections in the radio-frequency coils or to problems associated with the acquisition sequences. The result is a slowly varying shading artifact over the image that can produce errors with conventional intensity based classification. Our algorithm is formulated by modifying the objective function of the standard fuzzy c-means (FCM) algorithm to compensate for such inhomogeneities and to allow the labeling of a pixel to be influenced by the labels in its immediate neighborhood [3].

Zexuan Ji, Yong Xia "Fuzzy Local Gaussian Mixture Model for Brain MR Image Segmentation". In this paper Accurate brain tissue segmentation from magnetic resonance (MR) images is an essential step in quantitative brain image analysis. However, due to the existence of noise and intensity inhomogeneity in brain MR images, many segmentation algorithms suffer from limited accuracy. In this paper, we assume that the local image data within each voxel's neighborhood satisfy the Gaussian mixture model (GMM), and thus propose the fuzzy local GMM (FLGMM) algorithm for automated brain MR image segmentation. This algorithm estimates the segmentation result that maximizes the posterior probability by minimizing an objective energy function, in which a truncated Gaussian kernel function is used to impose the spatial constraint and fuzzy memberships are employed to balance the contribution of each GMM [4].

Wee-Chung Liew "An Adaptive Spatial Fuzzy Clustering Algorithm for 3-D MR Image Segmentation". In this paper An adaptive spatial fuzzy c-means clustering algorithm is presented in this paper for the segmentation of three dimensional (3-D) magnetic resonance (MR) images. The input images may be corrupted by noise and intensity non uniformity (INU) artifact. The proposed algorithm takes into account the spatial continuity constraints by using a dissimilarity index that allows spatial interactions between image voxels. The local spatial continuity constraint reduces the noise effect and the classification ambiguity. The INU artifact is formulated as a multiplicative bias field affecting the true MR imaging signal. The efficacy of the proposed algorithm is demonstrated by extensive segmentation experiments using both simulated and real MR images and by comparison with other published algorithms [5].

Basavaraj S. Anami, "A Combined Fuzzy and Level Sets' Based Approach for Brain MRI Image Segmentation". In this paper the different tissues namely gray matter (GM) white matter (WM), and cerebrospinal fluid (CSF) are spread over the entire brain. It is difficult to demarcate them individually when a brain image is considered. The boundaries are not well defined. Modified fuzzy C means (MFCM) and level sets segmentation based methodology is proposed in this paper for automated brain MRI image segmentation into WM, GM and CSF. The initial segmentation is done by MFCM approach and the results thus obtained are input to the level set methodology. Most of the results obtained using MFCM are 'Adequate'. The results obtained using combined method are 'Satisfactory'. The time required to segment using combined approach is also less compared to level set method. The segmentation using proposed methodology is helpful for radiologists in hospitals for brain MRI image analysis [6].

Kaihua Zhang, "A variational multiphase level set approach to simultaneous segmentation and bias correction". This paper presented a novel level set approach to simultaneous tissue segmentation and bias correction of Magnetic Resonance Imaging (MRI) images. They first model the distribution of intensity belonging to each tissue as a Gaussian distribution with spatially varying mean and variance. Then a sliding window is used to transform the intensity domain to another domain, where the distribution overlap between different tissues is significantly suppressed. A maximum likelihood objective function is defined for each point in the transformed domain, which is then integrated over the entire domain to form a variational level set formulation [7].

Chunming Li "A Level Set Method for Image Segmentation in the Presence of Intensity inhomogeneities with Application to MRI". Intensity inhomogeneity often occurs in real-world images, which presents a considerable challenge in image segmentation. The most widely used image segmentation algorithms are region based and typically rely on the homogeneity of the image intensities in the regions of interest, which often fail to provide accurate segmentation results due to the intensity inhomogeneity. This paper proposes a novel region-based method for image segmentation, which is able to deal with intensity inhomogeneities in the segmentation [8].

III. EXPERIMENTAL STUDY

Magnetic resonance imaging (MRI) is a scanning device that capture images of the brain on film and non-invasive medical test that helps physicians diagnose and treat medical conditions. MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. MRI does not use ionizing radiation (x-rays). Detailed MR images allow physicians to evaluate various parts of the body and determine the presence of certain diseases. Functional magnetic resonance imaging (FMRI) is a relatively new procedure that uses MR imaging to measure the tiny metabolic changes that take place in an active part of the brain.

The images used are 256*256 gray level images with intensity value ranges from (0 to 255). Initially, these MRI images are normalized to gray level values from (0 to 1) and the features are extracted from the normalized images. Since normalization reduces the dynamic range of the intensity values, feature extraction is made much simpler.

Fuzzy c-means (FCM) is one of most popular algorithms in fuzzy clustering, and has been widely applied to medical problems. The fuzzy logic is a way of processing the data by giving the partial membership value to each pixel in the image. In bias estimation and correction using fuzzy c mean of MR images Segments (clusters) an image in object classes, and estimates the slow varying illumination artifact (bias field). It is also possible to set values further away from the mean to allow better class separation. Spatial fuzzy c means clustering used for clustering. The effectiveness of the SFCM algorithm is improved by modifying the cluster center and membership value updating criterion.

A level set method utilizes dynamic variation boundaries for image segmentation. In image segmentation, Level set methods are numerical techniques designed to track the interface between two different regions. Active contours are dynamic curves that move toward the object boundaries.

IV. CONCLUSION

In this proposed work firstly reduce noise and bias correction of the brain image using modified fuzzy clustering algorithm. A spatial fuzzy clustering is the possibility of obtaining more homogeneous regions and less noise sensitivity. A level set segmentation by spatial fuzzy clustering for tumor detection of brain MR image. The proposed algorithm is robust to the initializations, therefore allowing for fully automatic applications.

V. REFRENCES:

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