

# Tumor Segmentation in Brain MRI using a Fuzzy Approach with Class Center Priors

D.Balasubramaniam<sup>1</sup>, S.Saranya<sup>2</sup>, E.Sutha<sup>3</sup>, U.Umamaheswari<sup>4</sup>

Professor, ECE, GKM College of Engineering and Technology, Chennai, India<sup>1</sup>

Student, ECE, GKM College of Engineering and Technology, Chennai, India<sup>2,3,4</sup>

**Abstract:** This paper proposes a new fuzzy approach for automatic segmentation of normal and pathological brain MRI volumetric data sets. MRI is generally useful for brain tumor deduction because it provide more detailed information about its type, position, size. Brain tumor segmentation is the separation of different tumor tissues from normal brain tissue. In automatic brain segmentation MRI is a sophisticated tool for medical imaging. Fuzzy is used to segment all the tissues at the same time, and FCM algorithm is used to speed up tumor performances under and noisy and provide better accuracy and fast response. The result obtain from different segmentation by using fuzzy algorithm and comparing normal and pathological brain by automatic segmentation method.

**Index terms:** fuzzy,FCM, MRI brain image, segmentation.

## 1. INTRODUCTION

Image segmentation is most important task to extract information in image processing. To satisfy increasing requirement of the image segmentation variety of segmentation method have been developed over past several years, Fuzzy C-Means method in particular can be used to obtained segment via fuzzy pixel classification. This approach allows additional flexibility in many applications and has recently been used in processing of magnetic Resonance Image. Medical imaging modalities such as X-ray ultrasound computed tomography (CT) as greatly improved the diagnosis of human disease as they provide an effective means for non-invasively mapping the anatomy of the subject. MRI uses radiowaves and strong magnetic field rather than X-ray to provide remarkably clear and detailed picture of internal organs and tissue culture.

Image analysis technique are often used to detect the abnormalities in the human bodies through scan image the image analysis technique includes Image [preprocessing, Image segmentation, Histogram equalization, feature extraction etc. Image preprocessing is required as a the MRI image consist of unwanted artifact these are due to the operator handling MRI machine patient motion during imaging thermal noise and exist of any metal thing in imaging environment. Fuzzy Clustering Means (FCM) in unsupervised technique that has been successfully applied to future analysis, clustering in field such as Astronomy, Geology, Medical imaging, Image segmentation.

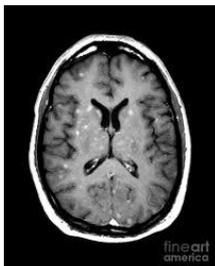


Figure: MRI brain image

## 2. SEGMENTATION

Segmentation is the extraction of diferent tumor tissues such as active, tumor, necrosis, and edema from normal brain tissues such as white matter, grey matter, and cerebro spinal fluid. It can be done in two ways like Manual segmentation and automatic. but automatic is most preferred than manual. Manual is time consuming process, tedious task and has many challenges to detect the tumor. In case of automatic segmentation the performance of brain tumor detection for medical purpose is easy to compute.

## 3. MAGNETIC RESONANCE IMAGING

Magnetic Resonance Imaging (MRI), Nuclear Magnetic Resonance Imaging (NMRI), or Magnetic Resonance Tomography (MRT) is a medical imaging technique used in radiology to image and the physiological processes of the body in both health and disease. MRI scanners use strong magnetic fields, radio waves, and field gradients to form images of the body.

MRI is a sophisticated tool for medical investigation scanning purpose. It is an advanced medical imaging technique used to produce high quality images in the human body. From this high resolution images we can derive detailed anatomic information to examine human brain development and discover abnormalities. The MRI scan is more comfortable as compared to CT scan for diagnosis. It does not affect the human body as it doesn't use any radiation.

## 4. FUZZIFICATION OF IMAGE SEGMENTATION

In Brain MRI segmentation methods such as Threshold and pixel. Threshold is the earliest and classical method. Thresholding is the simplest method of image segmentation. From a grayscale image, Thresholding can be used to create binary images. The simplest Thresholding methods replace each pixel in an image with a black pixel. The object of an image is compared by

intensities with one or more intensity threshold. These thresholds can be either local or global. pixel are portioned depending on their intensities value.

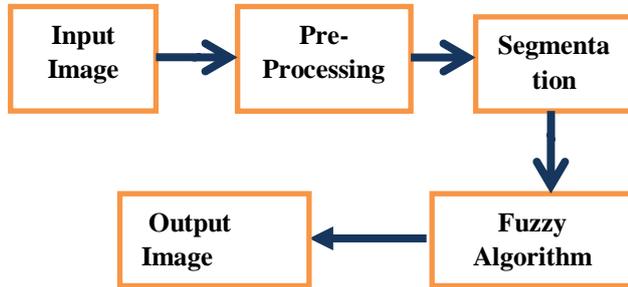


Fig. Block diagram of Image Segmentation

Global threshold is given by

$$g(x,y) = \begin{cases} 1, & \text{if } f(x,y) > T \\ 0, & \text{if } f(x,y) \leq T \end{cases}$$

local threshold mean  $T$  depends on neighbourhood of  $(X,Y)$ .

Pixel classification method: In a pixel classification having a two types.

- a) Supervised classification
- b) Unsupervised classification

Unsupervised clustering is motivated by the need to find interesting patterns or groupings in a given set of data. In the area of pattern recognition an image processing, unsupervised clustering is often used to perform the task of “segmenting” the images (i.e., partitioning pixel on an image into regions that correspond to different objects or different faces of objects in the images). This is because image segmentation can be viewed as kind of data clustering problem where each datum is described by a set of image features (e.g., intensity, color, texture, etc) of each pixel.

### 5. FUZZY C-MEANS ALGORITHM

Fuzzy c-means (FCM) clustering algorithm which is a popular model widely used in image segmentation due to its good performance One pixel value depending on two or more clusters centers. It is also called soft clustering method. One of the most widely used fuzzy clustering algorithms is the Fuzzy C-means (FCM) algorithm. The FCM algorithm is partition of  $n$  element  $X = \{x_1, x_n\}$  into a collection of  $c$  fuzzy clusters with respect to below given criteria.

It is based on minimization of the following objective function:

$$J_m = \sum_{i=1}^N \sum_{j=1}^c U_{ij}^m \|x_i - c_j\|^2, \quad 1 \leq m < \infty$$

where,

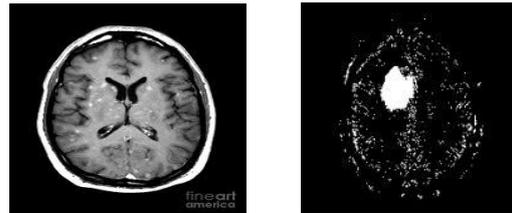
$m$  = level of fuzziness and real number greater than 1.

$u_{ij}$  = degree of membership of  $x_i$  in the cluster

$c_j$  = data value Fuzzy C-means is a popular method for medical image Segmentation but it only considers image intensity thereby producing unsatisfactory results in noisy images. A bunch of algorithms are proposed to make FCM robust against noise and in Homogeneity but it’s still not perfect.

### 6. SIMULATION RESULT

The performance of the proposed FCM is evaluated for the segmentation of normal and pathological brain MRI volume. It is a comparative study of different approach used for image segmentation. It provides better accuracy, robustness against noise and convergence speed. It gives prior information about the tumor location, size, orientation with the help of two segmentation methods such as thresholding, pixel classification and we compare the performance of resultant tumor output by these two segmentation method.



### 7. CONCLUSION

In this paper a new soft computing approach based on the Fuzzy C-Means algorithm is responsible for the automatic segmentation of capital MRI Volumetric data sets. These data sets are classified to three main classes (WM, GM, CFS). It gives the prior information about the MRI tissues in the estimation process. The new method used to analysis normal MRI brain and MRI brain images with the tumor. Brain image with the spatial information and the segmented a normal MRI brain image and MRI Brain image is with tumor can be analyzed successfully. We present a comparatively study of different segmentation approaches, the method presented in this paper used with new approaches of the image segmentation for the better accuracy and precision of the results.

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