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Brain Tumor Segmentation & Detection Of Tumor Stage In Brain MR Images Using K-Mean Clustering

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Abstract— **This paper deals with the simple clustering technique for detection of range and shape of tumor in brain MR images. Most cells in the body grow and then divide in an orderly way to form new cells as they are needed to keep the body healthy and working properly. When cells lose the ability to control their growth, they divide too often and without any order. The extra cells form a mass of tissue called a tumor. Brain tumors are abnormal and uncontrolled proliferations of cells. Generally MRI or CT scan that is directed into intracranial cavity that produces the complete image of the brain tumor. Magnetic resonance imaging (MRI) provides detailed information about brain tumor anatomy, cellular structure and vascular supply, making it an important tool for the effective diagnosis, treatment and monitoring of the disease . This image usually examine by the physician for detection and diagnosis of brain tumor. From those methods brain tumors are detected but inefficient for accurate determination of stage & size of tumor To avoid that, this project uses computer aided method for segmentation of brain tumor based on the K mean clustering algorithms. In addition, it also reduces the time for analysis. At the end of the process the tumor is extracted from the MR image and its exact position and the shape also determined. The tumor stage is determined on the basis of area calculated from the cluster of extracted tumor.**

Key words— **Magnetic Resonance Imaging, Preprocessing, K-means, , Thresholding.**

I. INTRODUCTION

Tumor is due to uncontrolled growth of the tissue in any part of the body . Some originate in the brain itself, in which case they are termed primary. Others spread to this location from somewhere else in the body through metastasis, and are termed secondary. Primary brain tumors do not spread to other body sites, and can be malignant or benign. Secondary brain tumors are always malignant. This paper deals with the concept for automatic brain tumor segmentation. Normally the anatomy of the brain can be viewed by the MRI scan or CT scan. The MRI scan is more comfortable than CT scan for diagnosis. As there is no radiation, it does not affect the human body. It is based on magnetic field and radio waves. In medical imaging an image is captured digitized and processed for doing segmentation and for extracting important information. Manual segmentation is an alternate method for segmenting an image. This method is not only tedious and time consuming but also produces inaccurate result. Segmentation by expert is variable [2]. So we need to develop some computer aided system to improve the accuracy and speed of the segmentation .This paper deals with the K Mean segmentation & Fuzzy C Mean algorithm for brain tumor segmentation. The behaviour of both the algorithms depends on the number of data point as well as on the number of cluster[5].The developing platform for the detection is mat lab because it is easy to develop & execute.

II. EXISTING METHOD

In medical imaging the image is captured, digitized & processed for segmentation to extract the important information. The existing method is based on thresholding and region growing. Thresholding method is frequently used for image segmentation [6]. This is simple and effective segmentation method for images with different intensities. The technique basically attempt for finding threshold value, which enables the classification of pixels into different categories. A major weakness of this segmentation method is that it generate only two classes. Therefore this method fails to deal with multichannel images . In case of the region growing based segmentation it needs more user interaction for the selection of seed .Seed is nothing but the center of the

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tumor cell. The technique is not fully automatic and it work only in homogeneous area. It will also not provide the acceptable results for all the images [2].The typical output for thresholding is given as shown in figure.

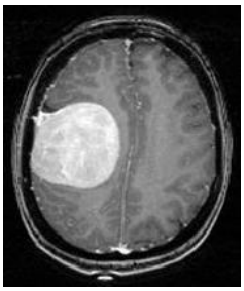

Fig. 1 Input image for thresholding

Fig.2 Output image for thresholding.

Fig.1 is the input image for thresholding From the MR image itself we can see the tumor area but it is not enough for further treatment . For that it is given to the thresholding process Fig.2 is the output image for thresholding . It consist of only two gray values. That is white as 1 and black as 0 The background value is assigned to binary value 0 and object gets the value 1. So we cannot extract the tumor from the image. This is the main drawback of the existing method . Due to this we go for the proposed method of tumor segmentation.

III. PROPOSED METHOD

Block diagram of proposed method:

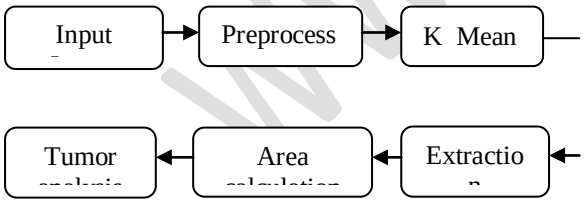

Fig.3 Block diagram of proposed method

The proposed system has mainly four modules preprocessing, segmentation, feature extraction an approximate reasoning. Preprocessing is related with denoising of the image. Preprocessing is done by the filtering. Segmentation is carried out by advanced K-mean segmentation. Feature extraction is by thresholding and finally Approximate reasoning to recognize the tumor shape and position in MR image using edge detection method.

- **Preprocessing:**

According to the need of next level the preprocessing step convert the image. It performs filtering of image and sharpening the edges in the image.RGB to gray conversion and reshaping also takes place here. For removal of noise the median filter can be used.The median filter is by taking all the pixel within mask & sorted according to the magnitude.The pixel with the median magnitude is then used to replace the pixel of extreme level [4]. For better understanding the function of median filter ,we add the salt and pepper noise artificially and removing it using median filter.

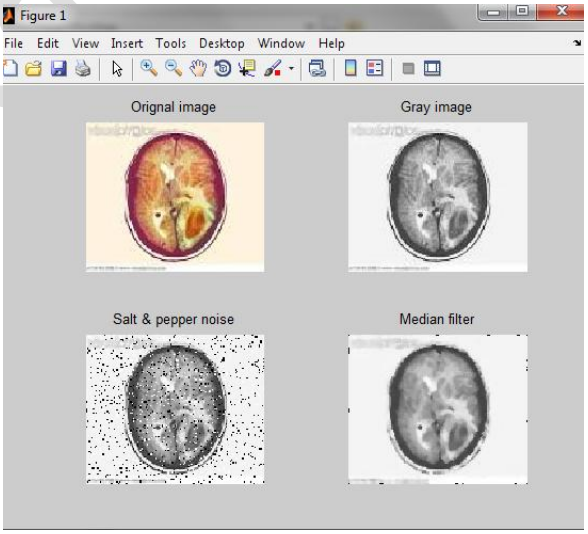

Fig.4 Preprocessing.

- **Segmentation**

K mean clustering detail: K- mean is one of the unsupervised learning algorithm for the clusters. Clustering

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the image is grouping the pixels according to some characteristics. It may be colour, texture or gray scale. In this method segmentation is done on the basis of gray scale. The procedure follows a simple way to classify the given datasets through a certain number of clusters. Assume K number of clusters. The main idea is to define the K number
of centroids. One for each cluster. The next step is to take the each pixel value belonging to a given dataset and associate it to the nearest centroid. This process continues till all the pixels of given image are assigned to the nearest centroid.
[2], [5], [7], [9].

K-Mean Algorithm:

- Assign no. of cluster K.
- Define the centroids for each clusters.
- Find the absolute difference between centroid & pixel value.
- Find the min. difference.
- Shift the pixel to the cluster of nearest centroid.
- Continue the process till all the pixels are shifted to the cluster of nearest centroid.

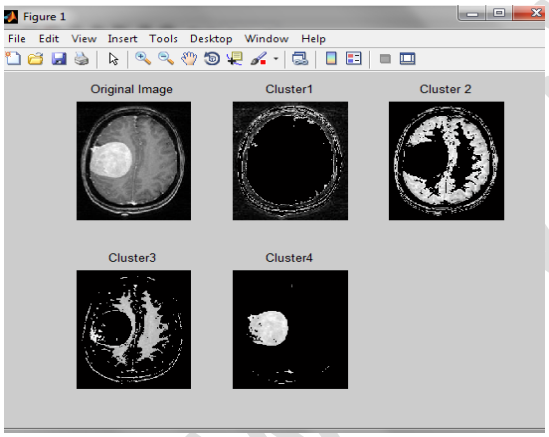

Fig.5 Output image for K- mean clustering for K=4

- **Feature Extraction:**

The cluster which shows the predicted tumor at the k mean or FCM output is extracted in feature extraction . The extracted cluster is applied to the thresholding process. It applies binary mask over the entire image. In this process the binary mask is applied over the entire image. In threshold coding, each transform coefficient is compared with a threshold. If it is less than the threshold value then it is considered as zero. If it is larger than the threshold, it will be considered as one. The thresholding method is an adaptive method where only those coefficients whose magnitudes are above a threshold are retained within each block. Let us consider an image 'f that have the k gray level. An integer value of threshold T, which lies in the gray scale range of k. The thresholding process is a comparison. Each pixel in 'f 'is compared to T. Based on that, binary decision is made. That defines the value of the particular pixel in an output binary image 'g'

$$g(n) = \begin{cases} \text{'0' if } f(n) < T \\ \text{'1' if } f(n) >= T \end{cases} \text{----------(6)}$$

Fig.6 Output image of thresholding.

- **Approximate Reasoning:**

In the approximate reasoning step the tumor area is calculated using the binerization method. That is the image having only two values either black or white (0 or 1). Here 256 x256 jpeg image is the maximum image size. The binary image can be represented as summation of total number of white & black pixels.

Image I $= \sum_{w=0}^{255} \sum_{H=0}^{255} f(0) + f(1)$ --------- (7)

Pixels=Width (W)x Height(H)=256x256
f (0) = black pixel (digit 0)

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f (1) = white pixel (digit 1)

No. Of white pixel P= $\sum_{w=0}^{255}\sum_{H=0}^{255} f(1)$------ (8)

Where,
P = number of white pixels (width*height)
1 Pixel = 0.264 mm
The area calculation formula is

size of tumor s=[($\sqrt{P}$) 0.264 mm^2----------(9)

- **Algorithm:**

The algorithmic step involved for brain tumor shape detection is as follows.
Step1: Get the MRI scan extracted tumor input brain image.
Step2: If image is in RGB format convert it into gray scale.
Step3: Find the edge of the extracted tumor image using sobel, prewitts, canny edge detection techniques.[8]
Step4: Calculate number of white pixel in the image.
Step5: Calculate the size of the tumor using the formula.
Step 6:Display the size and stage of the tumor.

IV. RESULT

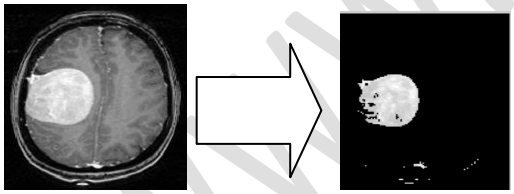
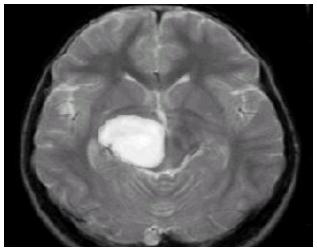


Fig.7 Output image for tumor area calculation.

The predicted tumor area is calculated at approximate reasoning step .The stage of tumor is based on the area of tumor. We consider that , if the area is greater than 6 mm^2 it will be at critical stage.



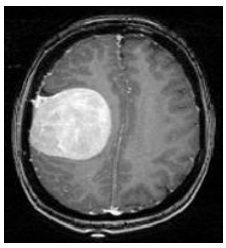


Fig.8 Input image 1 **Input image 2**

Input image	Tumor area	Tumor stage
Image 1	8.55 sqmm	Critical
Image 2	11.55 sqmm	Critical

V. CONCLUSION AND FUTURE SCOPE

There are different types of tumors are available. They may be mass in brain or malignant over the brain. The noise free image is given as input to the K-mean or fuzzy c mean & tumor is extracted from the MR image. After the feature extraction tumor area can be calculated. By using that area value we can classify the tumor stages. In future 3D assessment of brain using 3D slicers with matlab can be developed.

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