



Automated Segmentation Of Brain Tumour using Mr Images By Fuzzy-C Mean Algorithm

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Abstract:

Brain Tumor is the growth of abnormal cells in the brain. Detection, diagnosis and evaluation of Brain tumour is an important task. MRI are current technology. Our proposed method explains a Fuzzy C Means technique, is undertaken here for evaluating their relative performance in the segmentation of tumor. In this work the segmentation of Brain tumour is done for different samples of brain tumour images here a study on 20 samples is done. To extract the feature the enhanced images are segmented using segmentation methods. Image Segmentation finds its best usage in medical applications. The Classification involves labeling the images into normal and abnormal. So if the input MRI brain images are more in number, it would help the physician to save time for further analysis. The term abnormal indicates the presence of tumour and normal indicates the non presence of tumour.

Keywords: Brain MR Images, brain tumor detection, classification, Fuzzy Cmeans, Image Segmentation, magnetic resonance image, Pre-processing.

I. INTRODUCTION

This paper deals with the concept of automatic brain tumor segmentation by using fuzzy C-mean method. Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. An abnormal growth of cells within the brain is called brain tumour, which can be cancerous or non-cancerous. A tumour is formed by an abnormal growth of cells or tissues which is like a swelling. In this concept the segmentation of Brain tumour is done for different samples of brain tumour images. One of these imaging techniques is magnetic resonance imaging (MRI). This method permits researchers and physicians to study the delicate brain's functional and physical characteristics with less risk to the patient.

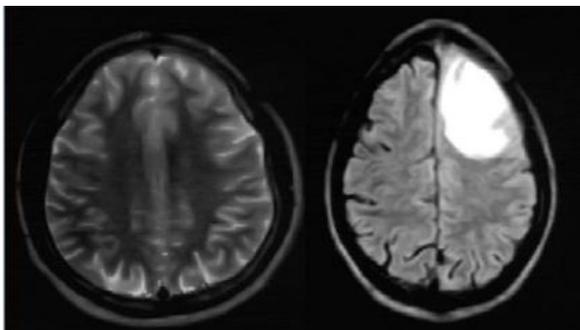


Figure 1. Normal and Abnormal Brain image.

II. EXISTING METHOD

The last 20 years, several techniques have been developed by researchers to identify anatomical of brain tumours. Some of them are based on edge detection, K-mean clustering and watershed segmentation methods. K-means clustering method is based on K-means algorithm this method may produce tighter clusters than hierarchical clustering, especially if the clusters are globular. The advantage of this method is, which has a fast speed operation in which it allows to run on large

datasets. But, its main disadvantage is that it does not produces same results with each run because the resulting clusters mainly depend on the initial random assignments. And is difficult in comparing quality of clusters produced. Fixed number of clusters can make it difficult to predict what K should be. Manual method analysis is gold standard approach for MRI quantitative measurements. And another disadvantage of this method is that it seems to be a difficult, time consuming and labor intensive task. The edge detection technique works effectively on high contrast images. But this method fails in detecting the edges in low contrast and noisy images due to the weak gradient magnitude. It is similar to edge detection technique, the clustering based method such as K-means algorithm has a fast speed operation which allows it to run on large datasets [8-9]. But, its main disadvantage is that it does not produces same results with each run, because the resulting clusters mainly depend on the initial random assignments. Markers controlled watershed segmentation was a basic and easy method which requires less processing time and minimize the over segmentation problem up to a large extent, but major problem with this method is that it produces over segmentation.

III. PROPOSED METHOD

In the Proposed method the brain MRI image of a person is taken as input image. Then the captured image is subjected to various pre processing steps like gray level transformation and enhancement. The noise in the image is filtered using median filter. The no of pixels present in segmented tumour area is calculated using fuzzy C-mean method. Before we apply the segmentation to the Brain tumour MRI brain image, we impose external markers manually. Because here the accuracy of imposing external markers manually to the images is more compared to without marked images the area of tumour is calculated by counting the number of pixels present in the segmented tumour part. Using the output we can able to detect

the presence of Brain tumour disease. This method is very simple and also time can be conserved as compared to clinical method. In this method the input image is subjected to various processing steps like Grayscale conversion and median filtering. In this chapter we discuss about the methodology in detail with the following block diagram.

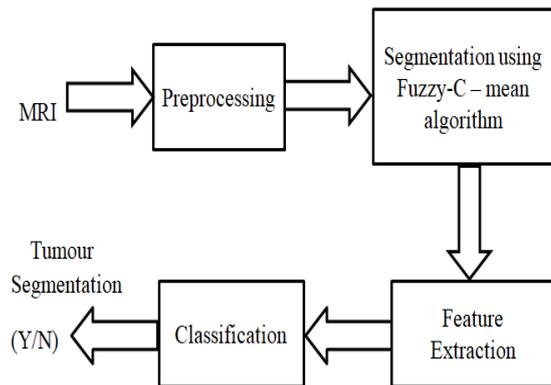


Figure .2. Block Diagram of Proposed Method.

IV. PREPROCESSING

Load and View Different sample of brain MR Images in MATLAB Environment. It performs grayscale and filtering operations. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI are very less. It may arrive due to the thermal effect.

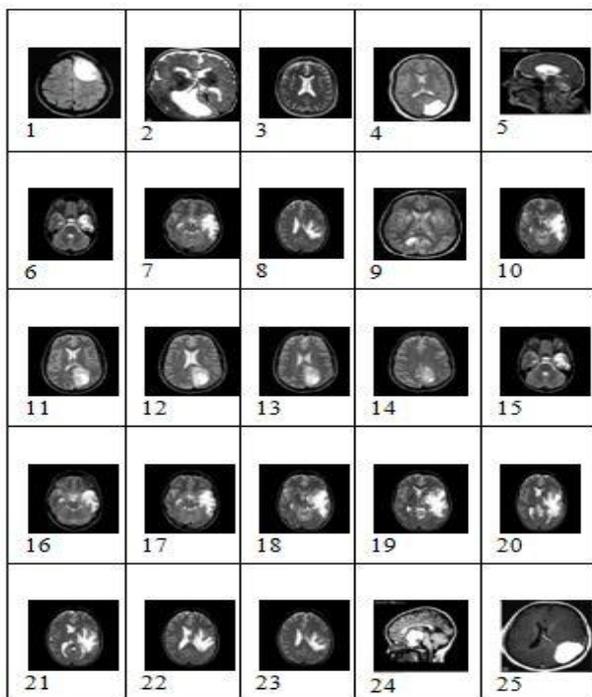


Figure.3. Original Data Sets

Figure 3.2 shows some input original data sets of different types of brain MR Images. For extracting the tumour part present in the Axial, saggital and coronal slices it is necessary initially to undergo the some Preprocessing steps. In first step check whether loaded input images in Matlab environment are in MRI form and in next step enhancing the given image from any size into a particular size is done which is termed as image enhancement. The input images can be enhanced to particular size of 256 x256, 512 x512 and so on. Here all the input images to be enhanced are considered to particular size of 256 x256. In this step the recognition of image in the MRI form at

a particular size is important. So it is necessary to understand what Image Recognition is and it is explained in detail below. Image recognition or analysis is a process of discovering, identifying and understanding patterns that are relevant to the performance of an image based task. One of the principle goals of image analysis is to endow a machine with the capability to approximate similar to human beings. An automated image analysis system is capable of exhibiting various degrees of intelligence.

Segmentation Using Fuzzy-C Mean method

The main aim of this paper is to detect and segment the tumour cells. And it is done successfully by using Fuzzy-C mean method. This method uses an algorithm known as Fuzzy-C mean algorithm. Algorithm and flowchart with steps is explained below:

Algorithm:

The algorithm used for Fuzzy-C mean method is explained with the following steps:

1. First, the MR input images are captured and applied for preprocessing steps.
2. The input image is converted to gray scale image.
3. Only gray part of the image is founded.
4. Apply median filtering for Image smoothening and removing of impulse noise.
5. The segmented tumour part is obtained by selecting the threshold value.

Flow of Fuzzy-C Mean Algorithm

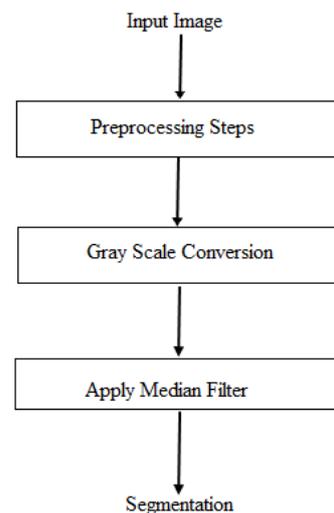


Figure.4. Flow of Fuzzy-C Mean Algorithm.

Explanation in Detail

Initially this method undergoes some preprocessing steps. And later some more steps such as grayscale conversion and median filtering are done for segmentation procedure. The individual steps used for Fuzzy-c mean algorithm with brief explanation is shown below:

[1]. Grayscale conversion:

The gray scale image represents distribution of the pixels in the image. It can be visualized as each pixel is place bin a bin corresponding to the color intensity of that pixel.

[2]. Median Filtering:

The median filter replaces the center value in the window with the median of all the pixel values in the window. As for the

mean filter, the kernel is usually square but can be any shape. Features of the median filter: it remove 'impulse' noise (outlying values, either high or low). It preserves step edges without blurring. In the presence of noise it does blur edges in images. Within the class of nonlinear filters, order statistic (OS) filters encompass a large group of elective image enhancers. But getting the system to be completed it needs the process of noise removal.

[3]. Segmentation (Threshold Analysis based on Pixel value):

The next step is segmentation to extract the segmented tumour for calculating no of pixels present in tumour area. We have used Fuzzy-c mean method. In this chapter we discuss about the segmentation methods in detail. Fuzzy-c mean is conceptually the simplest approach used for segmentation. This technique that is useful for scenes with solid objects resting on a contrasting background. All pixels below that level are assumed to be outside the object and all pixels above a determined (threshold) grey level are assumed to belong to the object. Threshold level selection will affect any measurements of parameters concerning the object. In fixed (or global) Thresholding, the threshold value is constant throughout the image. It determines a single threshold value by treating each pixel independently of its neighborhood. The segmented tumour part is obtained by selecting the threshold value. It is done by using the formula

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

This final step deals with the Thresholding analysis, in this step the binary mask is applied over the entire image. It makes the white pixel become brighter and dark pixel become darker. Threshold coding includes comparing each transform coefficient with a threshold. If it is larger than the threshold, it will be considered as one and if it is less than the threshold then it is considered as zero. The Thresholding method is adaptive method, here only those coefficients whose magnitudes are above a threshold are retained within each block. Finally the segmented tumour part can be easily obtained by using threshold analysis.

Feature Extraction:

After the step of segmentation procedure the next step is to extract the feature, here the feature extracted in this paper is "Area" which is calculated by using the binarization method. Binary image has only two values either black or white (0 or 1). Since maximum image size of a jpeg input image taken here is 256x256. The binary image can be represented as a summation of total number of black and white pixels.

Classification:

The Classification we label the images into normal and abnormal. The term 'abnormal' indicates the presence of tumour and the term 'normal' indicates the normal condition. The MATLAB functions such as FIG-Files and M-Files of GUI have been used for the classification of the Brain MR images into tumour and non tumour parts. These two files are generated for the first time when we save or run the GUI. A FIG-file with extension .fig, which contain a complete description of the GUI layout and the components of the GUI. An M-file is saved as .m extension, which contains the code that controls the GUI including the 21 callbacks for its components. These two files correspond to the tasks of lying

out and programming the GUI. When lay out of the GUI in the Layout Editor, Work is stored in the FIG-file. Your work is stored in the M-file when you program the GUI. These functions are to be used to differentiate whether a given MR image is normal (NO) or abnormal (Yes).

V. EXPERIMENTAL RESULTS

Results

The proposed algorithms have been tested on 25 different types and sizes of MRI images of Brain tumour only. Area present in the segmented tumour is one of the features we have extracted here. Segmentation procedure is done for input. The algorithm is implemented on personal computer (1.8GHz CPU, 2GB RAM) using MATLAB tool (7.11 version). Figure 1: shows the input color image in MR (Magnetic Resonance) form. MRI is the current technology which enables the detection, diagnosis and evaluation of Brain tumor.

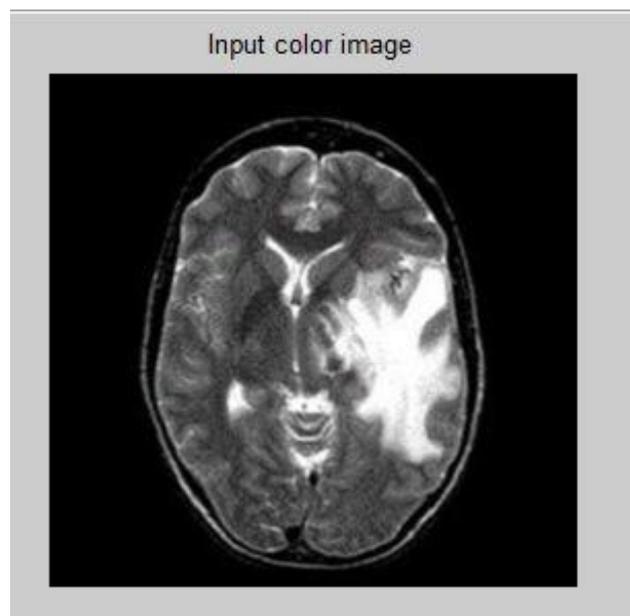


Figure. 1. shows the input MR image

Figure 2: shows that the grayscale transferred image form the MR Image. Because we would not extracting the boundary of segmented tumour part form MR image is not possible. But we can easily extracting the segmented tumour part from the grayscale (intensity) image. So the MR image is transferred into grayscale image.



Figure.2. Gray scale image

Figure 3: shows the Area of Unsegmented part in the tumour image. In this step by calculating the area of grey part in the MR image gives total area of unsegmented part.

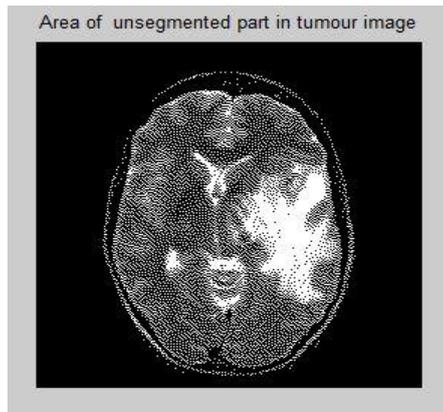


Figure.3. shows the Median filtering of an image.

In this step the Median filtering is applied for removal of noise and image smoothening. It is the image preprocessing for image enhancement. The main purpose of Median filtering is to predicting the boundaries of segmented tumor part.

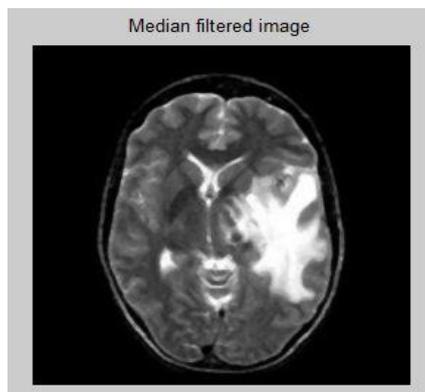


Figure. 4. Median filtered image

The Figure 5: shows that the Fuzzy C-mean based segmented tumor part. By using the Fuzzy C-mean based segmentation we set the pixel value as 1(white) this is the segmented tumor area. And we set the pixel value as 0. This is the background of an segmented tumor part. Then the no of pixels present in the segmented tumor image is calculated as area of the brain tumour.

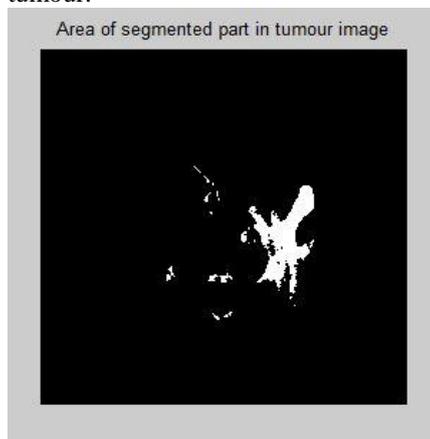


Figure. 5. Segmented tumour area

VI. CONCLUSION AND FUTURE WORK:

Conclusion: Since it is concluded that our method performs well in enhancing, segmenting and extracting the brain tumour feature from MR images. The measurement of brain tumour

area can assist tumour staging for effective treatment and surgical planning. Here, our goal is to examine different Brain MRI samples and get the accuracy of segmentation. The automated approaches presented for the segmentation of Brain tumour images overcomes the area limitations of the current solutions and provides the accuracy of segmentation. So we illustrated this method on brain tumour area cases using MR imaging modality. This segmentation technique is not tedious, labor intensive and requires very less time to generate tumour area measurements as compared to clinical method. This method is applied to 25 different types and shapes of MRI slices and better segmentation results are achieved. Also this method has been tested and result is validated numerically. If samples are more in number, physician could save time using this method. In our study of the reliability of brain tumour area measurements, even we quantitatively compared results of with manual traced segmentation and without manually traced segmentation.

Future Work

In future 3D assessment of brain using 3D slicers with Matlab can be developed.

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VII. REFERENCES

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