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BRAIN TUMOUR IDENTIFICATION BY PIXEL BASED SEGMENTATION

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ABSTRACT:

Excrescence of unusual cells appear in the brain is called as Brain tumour.For the recognition of brain tumour MRI acts as an effective medium.Primeval diagnosis is necessary else oppressive medical issues occur if the tumour is discovered at the later stage.In this paper we automatically locate the tumour in MRI images by pixel based segmentation method.It involves enrichment,segmentation and classification steps.To bring out characteristics the enhanced images are segmented and collocated by characterizing images into normal and abnormal.Itis applied for various MRI instances.If samples are large number,medic could save time.

Keywords: Identification; segmentation; classification.

I.INTRODUCTION

By applying pixel oriented segmentation method a precise proposal of intuitive identification of brain tumour is interpreted .The interpretation of the brain can be proposed by the kinds of scans called as MRI scan or CT scan. In this approach MRI scanning is used for the entire technique. It is more accessible than the CT scan for diagnosis since it neither affects the human body and nor uses any dissemination. It is reliant on the radio waves and magnetic field.Different kinds of methods were spotted for the identification of brain tumour. But there may have few disadvantages in the recognisation and extraction section. And it can be overthrown by our approached intuitive pixel based segmentation algorithm which gives the better product for segmentation procedure.Brain Tumour is a syndrome which is currently present within the brain or can be in the central spinal canal. Tumour is of two types primary or secondary type.If the tumour is positioned at its provenance,then it is primary and if the tumour is proliferated over other areas then it is secondary .Normally tumour disturbs cerebral section and may instigate stroke. Subsequently the medic can give medication for the strokes but not for syndrome. Hence necessary steps are antecedent identification and conventional medication is important steps to upgrade the disease from out coming and it is acquired based on detailed investigation. The senescence of the person experienced by the brain tumour may upturn about 2-3 years if it is recognized at the current stage. In this paper we focussed on detailed identification of tumour part by applying automatic pixel based segmentation algorithm. The advanced platform for the identification is matlab becauseit is satisfying and convient for the development and execution process.

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II.DIFFERENT CURRENT METHODS

In the last 2 decades, several techniques have been put forth by the analysts to recognize anatomical part of the brain tumors. Some of them are connected on edge identification, cluster recognisation, velutinuous senses and watershed transformation.The edge identification strategy works better on high contrast images. But this method miscarries in identifying the edges in low contradiction and smoothening of the images due to the weak gradient degree. Corresponding, the clustering based technique such as K-means technique has a fast speed operation which permits it to run on large datasets[8-9]. But, its main disadvantage is that it will not be able to give the same results with each iteration, because the resulting clusters highly works on the fundamental random allotment. A basic and easy way was marked controllers watershed segmentation which required less exertion time and decreases over segmentation complexities.

Fuzzy C Means technique is a logic for processing the data which is implemented by allotting the partial membership degree to each pixel in the given input MRI.[7] For example let us consider that a certain data point that stands close to the center of a cluster , has a larger grade of membership to that cluster and another data point that stands far away from the center of a cluster has a less degree of membership to that cluster. The membership value of the velutinuous set ranges from 0 to 1. And it followed by the following steps:

a. A starting guess for the centers of clusters is made which are allowed to point out the mean position of each cluster. But the beginning guess for these cluster centers is atmost probably wrong.
b. In the second step , Fuzzy C Means allots every data point or cluster a membership degree .
c. Then for each data point or cluster haphazardly on iterative basis refreshing the cluster centers and the membership degree has to be allocated , later Fuzzy technique by iteratively transmits the cluster centers to the right position within a data set.[6]

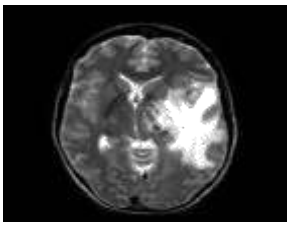

Fig.1. Original Image

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Fig.2. Segmented Image

Figure 1 and figure 2 represents the input and output image of Fuzzy C Means Method which shows the Original and its Segmented part of an image respectively.

III. CALCULATION OF OTHER TERMS

The projected procedure is examined through the computation of the following terms :tumour area , specificity Sp, sensitivity Sn and accuracy A. These parameters are defined applying the formula [4]:

$$Sn = \frac{nTP}{nTP + nFN}, \quad Sp = \frac{nTN}{nTN + nFP} \text{ and}$$

$$A = \frac{nTP + nTN}{nTP + nTN + nFP + nFN} \cdot 100 \quad \textbf{..... (1)}$$

The notations in above formula indicates: nTP :Tumour is viewed as Tumour only

nTN : Non-Tumour is found as Non-Tumour only nFN : Tumour is identified as Non-Tumour only nFP : Non-Tumour is recognised as Tumour only

IV. BLOCK DIAGRAM OF PIXEL BASED

SEGMENTATION METHOD

The executed technique has necessarily four blocks. They are pre processing, segmentation, extraction of feature and Separation. Preprocessing includes mainly enrichment and refining of image. Segmentation is hovered out by Pixel based Segmentation method. In Feature recognisation, area is extorted by thresholding and lastly Collocation involves characterizing the images into normal and abnormal.

Normal is termed as **"N"** and abnormal is termed as **"Y"**.

A. Preprocessing

Load and glimpse various instances of brain MR Images such as Axial, Saggital and coronal Images in

MATLAB tool . The pre processing steps includes some alteration. Intially it follows grayscale, histogram and refining operations. It involves average type of refiner for smoothening purpose . The opportunities of existence of noise in MRI are very low which can be be even removed by using this filter

.

Figure 4 below shows some of the input original data sets of different types of brain MR Images . For deriving 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 wheather loaded input images in matlab environment are in MRI form and in following step enriching the given image from any size into a particular size is done which is termed as image enhancement . Here all the input images are enhanced to

particular size of 256 x256 .

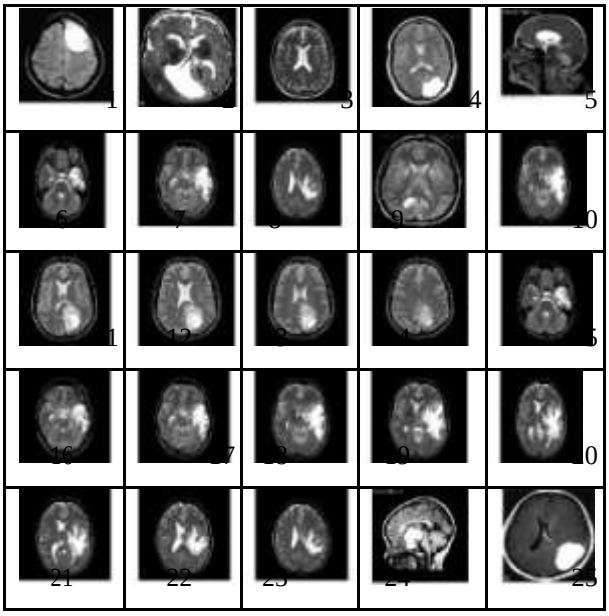


Figure. 4: Original Data Sets.

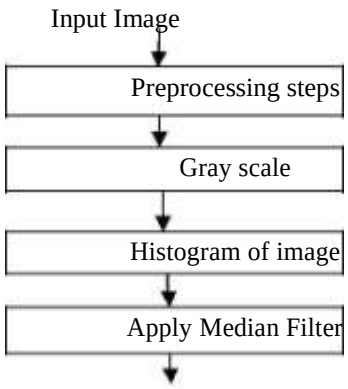
B. Segmentation by Pixel Based Method

The valuable job is to recognise and segment the tumour portion. And it is accomplished favorably by applying Pixel Based Segmentation algorithm. At first this method is subjected to some preprocessing steps. And coming after few steps such as grayscaleconverstion, median filtering and histogram of an image is finished for

segmentation process. Graph resembling pie of an MRI resembles the allocation of pixels in the MRI image against the grayscale is accomplished. Median filter is an kind of filter .This filter is of sliding-window type which restores the intermediate value of the window with the middle of all the pixel values in the window [3]. Fundamental instrument in image processing is Histogram and popular as one of the excellent technique in collecting facts about an image. It is basically beneficial in viewing the difference of an image . Grey-level gives description high & low contrasts image established on there consolidation near a certain level .

1. Pixel based segmentation algorithm :

Last step is the thresholdingexamination , in this step the dual cover is applied to the entire image. It supports to evolve into the white pixel to brighter and dim pixel to darker. Beginning portion of coding includes basically correlating each transform coefficient with a threshold value. If the value is larger than the threshold, it will be analysed as one and if it is less than the beginning then it is analysed as zero. This thresholding procedure is an flexible method, here only those coefficients whose importance are above a threshold are kept inside each block. Lastly the disjointed tumour part can be easily acquired by applying threshold analysis. Figure 5 below shows the flowshart of pixel based segmentation algorithm.



Segmentation

Figure. 5: Pixel Based Segmentation Algorithm

2. Steps used for pixel based segmentation algorithm

The algorithm contains following steps:

STEP 1: First, the MR input images are captured and used for preprocessing steps.
STEP 2: In this step change of Input image to gray scale is executed .
STEP 3: Here, graph resembling pie is applied to the obtained gray scale image.

STEP 4: Use median filtering for Image equalizing and getting rid of impulse noise.

STEP 5: Pick the threshold value from the histogram. STEP 6: The disjointed tumour part is obtained by picking the threshold value . It is done by applying the formula

$$g(x,y) = \begin{cases} 1 \text{ if } f(x,y) > T \\ 0 \text{ if } f(x,y) <= T \end{cases} \quad \text{..... (2)}$$

But for gaining the process accomplishment it needs the process of noise removal. For additional understanding the task of this median filter, we finished the process of adding and removing the salt and pepper noise artificially.

3. Output image of an mri sample by pixel based method :

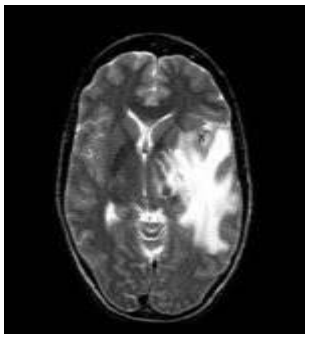


Figure.6 Original Image

Figure.7 Segmented Image

Output of Tumour area calculation of above sample [6] is shown below :

No of white pixel (P) present in segmented tumour image is

1611.8

Area in mm^2 is
10.598

Figure 6 and figure 7 shows the input and output image of Pixel Based Segmentation algorithm which represents the Actual and its disjointed part of an image respectively.[6]

C. Feature Extraction

After the segmentation method, the next step is to extract the characteristics , here the characteristics which is to be extracted in this paper is **"**Area**"** and it is examined by applying the binarization technique. Binary image has only dual values either white or black .Since maximum input MRI size of an jpeg image taken here is 256x256. The binary kind of image are represented as a total value of summation of all black and white pixels .

Equation for input MRI ,

$$= \Sigma\, 255 \qquad \text{..... (3)}$$

I

Equation for Pixel,

$$P = \text{Height (H)} * \text{Width (W)} \qquad \text{..... (4)}$$

$$\textbf{No of white pixel } P = \Sigma\, 255 \qquad \text{..... (5)}$$

Where,

f (0) = white pixel (Consider as digit 0)

f (l) = black pixel (Consider as digit 1)

P = number of white pixels (width*height)

1 Pixel = 0.264 mm

The formula to calculate the area in mm^2 is

Size of tumour is ,

$$S = [(\surd)^{*}\ 0.264]\ mm^2 \qquad \text{..... (6)}$$

Where,

P= no-of white pixels, W=width and H=height.

The tumour area can be obtained by applying simple matlabcommand . It is shown below:
img = n; BW = img; bwarea(BW)

D. Classification:

The Classification involves labelling 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 is used for the classification of the Brain MR images into tumour and non tumour parts. These two files are produced for the first time immediately after we save or run the GUI. A FIGURE-HOLDING file with confine as .fig, contains of a detail explanation of the GUI with its outline & also the parts of the GUI. An M- file with confine as .m, consists of the code that controls the GUI including the total flow for its respective components.

These two files relates to the work of outlining and programming the GUI. When you have a outline or lay out of the GUI in the Layout Editor section , your task will be saved in the FIG-file. And if u do the programming of the GUI, your work will be saved in the M-file.

These functions are to be used to differentiate whether a given input MRI is normal or abnormal.

V.RESULT

The implemented technique have been tested fully on 25 different samples of Brain tumour only. Area present in the segmented tumour is one of the feature we have extracted here. Segmentation method is done for input image and its respective manually traced image so that some of the parameters such as Sensitivity *Sn* ,Specificity*Sp* and Accuracy *A[%]* can be calculated.The resultscalculated are tabulated in Figure 7 which represents the segmentation quality in the tumour. This method is implemented on a personal computer applying MATLAB software .

Table1. Segmentation Quality in the Tumour

Slice	**Tumour Area in mm^2**	**Sensitivity *Sn***	**Specificity *Sp***	**Accuracy *A[%]***
1	14.665	0.99	0.98	98.35
2	24.378	0.95	0.97	97.27
3	6.6722	0.93	0.98	98.22
4	12.907	0.95	0.99	98.67

5	13.830	0.98	0.98	98.67
6	5.716	0.92	0.98	98.2
7	8.128	0.98	0.97	97.4
8	7.082	0.98	0.97	97.7
9	7.323	0.98	0.99	99.40
10	10.679	0.99	0.97	97.8
11	6.432	0.91	0.99	99
12	7.051	0.93	0.99	98.96
13	4.739	0.922	0.99	99.05
14	2.488	0.96	0.995	99.5
15	5.808	0.95	0.982	98
16	5.825	0.99	0.97	97.5
17	8.039	0.96	0.973	97.26
18	10.679	0.99	0.97	97.7
19	10.999	0.97	0.97	97.52
20	10.593	0.97	0.95	96.09
21	11.120	0.99	0.95	96.37
22	10.950	0.98	0.96	96.33
23	7.087	0.98	0.97	97.25
24	17.585	0.98	0.98	98.87
25	23.332	0.97	0.98	98.57

Segmentation approach and its area calculation is done by applying the proposed segmentation method and is tabulated above in table1.

VI.CONCLUSION

Since it is concluded that the suggested technique implements better in embellishing, segmenting and extracting the brain tumour characteristics from MR images.The calculation of brain tumour area can help for tumour staging for persuasive treatment and surgical planning.Our goal is to examine different Brain MRI samples and get the accuracy of segmentation . The proposed approach presented for the segmentation of Brain tumour images overcomes the area limitations of the current solutions and provides the veracity of segmentation . So we illustrated this method on brain tumour area cases applying MR imaging method. The automatic segmentation technique is not monotonous, labor intensive and requires very less time to obtain tumour area measurements as compared to clinical method . This method is applied to 25 different types and shapes of MRI slices and cosiderably good segmentation results are achieved as compared to earlier methods . Also this proposed method have been well tested and result is validated numerically. If there are more thenthe physician

could apply his method.

Some parameters such as Sensitivity,Specificity and Accuracy are calculated during the computation of brain tumour area measuremets.

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