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The Detection, Separation and Quantification of Brain Tumour via MRI Images

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Abstract: Magnetic Resonance Imaging is generally used for the diagnosis of brain tumour. In this paper the gradient differential as a main principle for brain tumour detection, separation and quantification. The pre-processing step is done by denoising and enhancing image. It is partitioned into 4 equal quadrants and locates the maximum entropy area for evaluating the exact tumour portion. It avoids live cell and consider the dead cell. By applying the extended maxima and regional maxima the image is obtained. It will evaluate the tumour size, the execution time and entropy of images. The results show that proposed method requires 3.22 seconds. It is more efficient and easy to implementation.

Keywords: MRI, Tumour, Entropy, Boundary, Extended maxima transform.

I. INTRODUCTION

A brain tumour occur when abnormal cell form within the brain. The thousands of cells produce then edged and dies daily and new cells take the place of old cell. The reoccurrence cycle get interrupted when the cells change their shape and form bunch of irregular cell. This cell increases rapidly and causes brain tumour as it is not needed to human body. Basically there are two main types of tumour such as

1. Benign tumour – This type of tumour are non cancerous and having less size. It is not affected to other tissue having its natural border. It is noncancerous but causes serious health problems.

2. Malignant tumour – In this type cell grows rapidly in uncontrolled manner and it is also affected to the healthy tissues and another body part. This is more cancerous and life threatening disease.

Nowadays medical imaging is useful for the detection of human body. MRI is a medical imaging technique and the radiologists use it for visualization of internal structure of the human body. It is also use for analysing the behaviour of brain. The images of soft tissues could be obtained by using MRI. Non-invasive diagnosis also done by using computed tomography, x-ray, and positron emission tomography. These medical devices are used to diagnose the diseases and analysis of treatment.

These produces number of slices of the body part and it is easy to analyse the location of brain tumour. For detecting the brain tumour and the doctor have to study the various properties of the MRI images and defines the suspected tumour portion .There are many conventional method for finding out the tumour but in this paper the gradient differential used as main principle to detect the exact location of tumour and size of tumour in form of pixels.

II. RELATED WORK

In this section review of literature on image segmentation, enhancement, thresholding, detection technique and it is as follows: Nobuyuki Otsu [1] in their paper Presents a threshold selection method from gray level histogram. In this paper the nonparametric and unsupervised method of automatic threshold selection for picture segmentation. In this the thresholding is selected to maximize the separability of resultant image in gray level. Lynn M Fletcher Heath [2] has present paper on automatic segmentation of non enhancing brain tumours in magnetic resonance imaging in which separates the non enhancing brain tumour from healthy tissues in MR Images for tracking tumour size. Djamal Boukerroui et al [3] have presented the segmentation algorithm for noisy images within a Bayesian framework in this the global and statistics utilised in segmentation process. Yuri Boykov at al [4] has given an experimental comparison of min-cut/max flow algorithm for application in vision. Chunyan jiang [5] has proposed segmentation and quantification of brain tumour. In this method the brain tumour is detected clearly and the quantification is done by using CAD system. Rupali ladda [6] presents brain tumour detection using segmentation and thresholding techniques. Alian pitiot [7] represents adaptive elastic segmentation of brain MRI via shape model guided evolutionary programming. It is use to localize and parameterize variety of types of structure in these images for subsequent quantitative analysis. Weibei Dou at al [8] has given a fuzzy information fusion to automatically segment tumour areas of brain form the T1 weighted, T2 weighted and proton density of MRI images.

III. PROPOSED METHOD

The proposed algorithm is combination of pre processing, regional maxima and extended maxima transformation. The various processes are as follows:

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A. Convert RGB to Grayscale image – It converts the truecolor image RGB to the grayscale intensity image I. The command rgb2gray exchange RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance. In general digital image is data arranged in the form of matrix. For the conversion of colored to grayscale image there are two methods such as average method and luminosity method. The average method is given by taking average of three colors red, green and blue.

Grayscale image (I) = (R+G+B/3)

This forms the image having black concentration. The RGB color have different wavelength to contribution to form black image. As we know the wavelength of red color is more than other two colors. Green color give calming effect to eyes and its wavelength is less than the red color. So enhancing the green and blue color and minimises the effect of red color which sets the new range and the equation will be

New Grayscale Image = (0.3*R) + (0.59*G) + (0.11*B)

It adds Red 33%, Green 59% and Blue is just 11%.

B. Pre-processing – In this the median filter is used to remove the noise and preserve edges. It is nonlinear median filter mostly used for noise removal and retains the original information.

C. Contrast enhancement – The process of contrast enhancement is more important in image processing. In this technique image is improved by enhancing .It is capable to clean up discarded noise and improves the brightness and contrast. Due to this we get better results for further processing .The imadjust function is used for the contrast enhancement and creates gamma transformation.

D. Partition image into quadrant – Now partition the image into 4 equal quadrants. It evaluates the maximum and minimum value of pixels in each quadrant. In this we have to analyse the main characteristics entropy and intensity of each quadrant. Due to that we can focus on quadrant which is having high intensity and high entropy. It reduces the efforts of working on whole image. This will concentrate on highest entropy quadrant to obtain the most susceptible part of brain tumour. The entropy given by,

Entropy = -sum (p.*log2 (p))

Where, p contains the histogram counts returned from imhist.

E. Locate quadrant with max intensity and entropy – The matrix is build for finding the values of intensity and entropy. From this value of intensity and entropy we get the quadrant which is having highest entropy. Now locate the quadrant having high value and ignoring the other quadrants. These two parameter having high values compare with other part of the image.

F. Evaluate sequential lower bound threshold – The temporal lower bound is used to degrade of blur, signal dependent-independent noise and the nonlinearity is derived. It acts as degradation function of parameters for imaging system. The obtained value of temporal lower bound and upper bound threshold applied to the maximum intensity quadrant.

G. Extended maxima, regional maxima transformation – The next step is to apply the extended maxima transformation and regional maxima transformation.

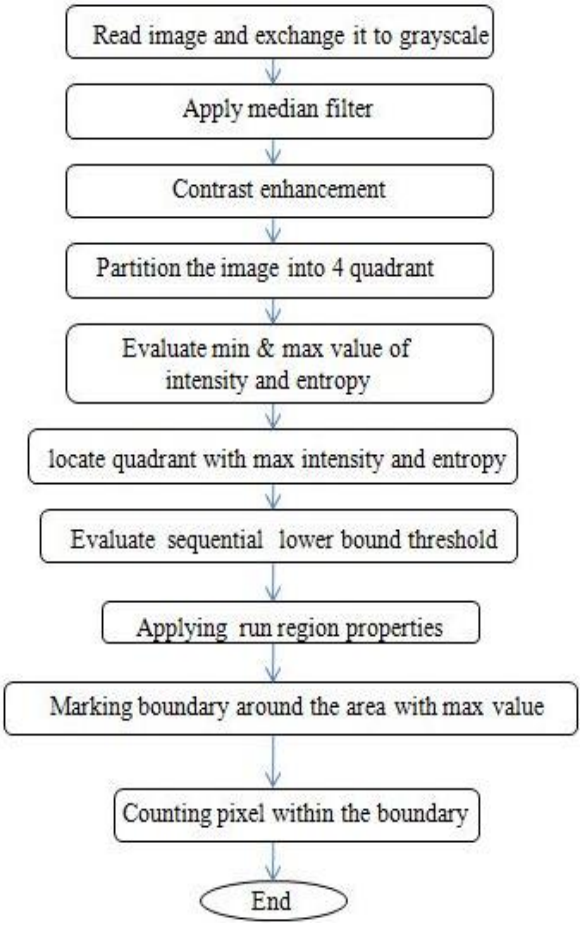

Figure.1: Work flow of proposed algorithm

H. Run region properties – The run region properties used to detect the brain tumour. The regionprops command of the matlab is used to calculation of solid area or region of tumour.

I. Now separate the tumour region by marking the boundary around it, this will clearly defines the exact tumour region from image.

J. The final step in which count the no of pixels present within the boundary. It will count the pixels and

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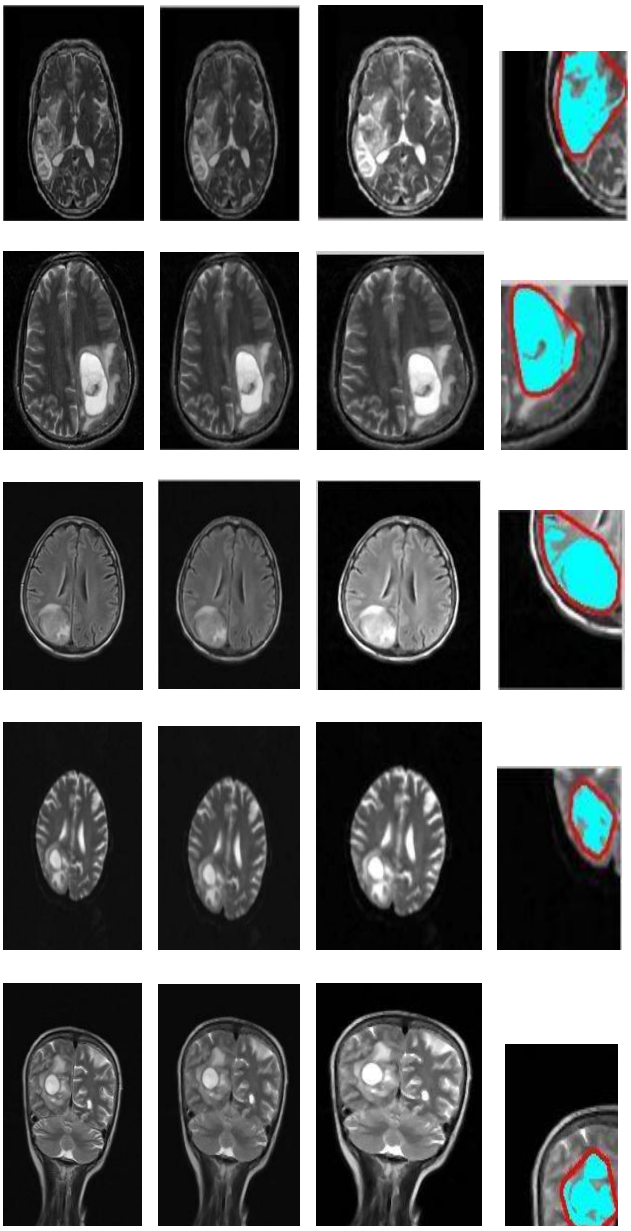
quantifying tumour with less time. It will present the execution time for calculating the tumour.

IV. PERFORMANCE ANALYSIS

The results and analysis for five different cases is given below.



(a) (b) (c) (d)

Figure 2.Output of five different cases (a) Input image (b) Filtered image (c) Enhanced image (d) Quadrant with colored tumour region.

The Previous algorithm shows the tumour size for image is 62002 pixels and the execution time is 2.342 seconds. As comparing with the previous one the proposed method shows that tumour size is reduced and it calculate only the affected part. This shows that for image btd1 tumour size 1692 pixels and execute with 3.1388 seconds. These show that the maximum entropy of the quadrant is 1.8068. The results for the five different cases are as given below:

Table 1

Image name	Image Size	Tumor Size (pixel)	Execution time (sec)	Entropy with max quadrant
Btd1	200×200	1692	3.1388	1.8068
Btd2	200×200	1999	3.0293	2.0026
Btd3	200×200	1824	3.0622	2.2799
Btd4	200×200	706	3.0272	0.90422
Btd5	200×200	970	3.2291	1.546

V. CONCLUSION

In this paper, the brain tumor is detected. The proposed method gives the reduced tumor size. From the results we can analyze the exact tumor portion by selecting the maximum entropy. In proposed algorithm it selects the quadrant having maximum entropy whether working on whole image. It also shows the execution time. Finally the exact tumor region is calculated with more accurate and time efficient.

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