SEGMENTATION OF BRAIN TUMOUR FROM MRI IMAGES BY IMPROVED FUZZY SYSTEM

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ABSTRACT

The objective of this work is to detect the brain tumour by using symmetric analysis. In this paper the brain tumour is first detected and then it is segmented. The brain tumour is quantified by using MRI of an image. The problem of segmenting tumour by using MRI is considered by multiple step. Segmentation of images is a significant position in the region of image processing. It becomes more significant while using the medical images; Magnetic Resonance (MRI) Imaging gives more and perfect information during medical examinations than that of the other medical images such as ultrasonic, CT images and X-rays. Here we propose a novel method of segmenting brain tumour. An image with the brain tumour is first used and then from that image the brain tumour is detected and segmented. A segmentation method which is used to segment the tumour from a particular area. In the first step, we propose a tumour image to detect .then it is to be segment the tumour. In some process the morphological analysis is used as an image processing tools for sharpening the regions and filing the gaps for binarised image.

KEY WORDS: *MRI image, Segmentation, Tumour detection, Fuzzy system.*

I. INTRODUCTION

A technique in which the image is digitized in mathematical operation, it is to enhance the image with recognition task. An image which is used in several parts of the region such as pattern recognition, TV screens, 2D, 3D images. An image can be processed optically or an image can be processed optically or digitally with a computer. Image processing is a well diversified field using in such of medical, defense, quality control and in entertainment. Brain tumour is defined as an abnormal growth of cells within the brain or the central spinal canal. Brain tumours include all tumours inside the central spinal canal. The uncontrolled growth of cell division in brain of neueron,glial cell, myelin ,blood vessels, in the cranial nerves, in the brain envelopes. Any brain tumour is inherently serious and life threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. However, brain tumours (even malignant ones) are not invariably fatal. Brain tumours or intracranial neoplasm can be cancerous (malignant) or non-cancerous (benign); however, the definitions of malignant or benign neoplasm differs from those commonly used in other types of cancerous or non - cancerous neoplasm in the body. Level depends on the combination of factors like the type of tumour, its location, its size and its state.

While in earlier period the brain tumour is detected by using the CT scans. In CT the not only the brain tumour part detects the tumour portion whole area will be detected. But in MRI the tumour region only will be detects. The primary brain tumours that commence within the brain. An inferior or metastatic brain tumour takes place when cancer cells extend to the brain from a primary cancer in a different component of the body. Brain tumours are classified as primary and second tumour.

Primary brain tumours are the tumours that originated in the brain from where they occur. They are benign that is they are non-cancerous cells it do not attack the neighbor cells. But the secondary type that which affects the whole region of the brain. Most frequently cancers that increase to the brain to reason secondary brain tumours begin in the lumy, breast, and kidney or from melanomas in the skin.
A systematic brain tumour using MRI image of brain is used by type II fuzzy system. The proposed type II fuzzy it has two modules. On this preprocessing and the other is segmentation method .In preprocessing method a rule base is developed. In segmentation method the PCM is analyzed.

II. DESCRIPTION – EXISTING METHODOLOGY

In the existing methodology, the brain tumour can be diagnosed by CT scan, ultrasonic, MRI scan. While dealing with CT scans the whole area of brain part is detected. But in MRI the brain tumor part only that get detects. In olden technique the brain tumour is diagnose with the whole region. So we cannot segment the tumor with accurate .For these reasons, the brain tumor is detected by MRI .while using MRI the brain tumor is accurately detected and can be segmented with accurate measurements.
The Segmentation of an image entails the division or separation of the image into regions of similar attribute. The ultimate aim in a large number of image processing applications is to extract important features from the image data, from which a description, interpretation, or understanding of the scene can be provided by the machine. Segment the brain to remove non-brain data. However, in pathological cases, standard segmentation methods fail, in particular when the tumour is located very close to the brain surface.
Therefore we propose an improved segmentation method, relying on the approximate plane. In this fuzzy system there are two types: Type I and type II fuzzy system. The type I fuzzy system the framework of fuzzy sets, systems, and relations is very useful to deal with the absence of sharp boundaries of the sets of symptoms, diagnoses, and phenomena of diseases. However, there are many uncertainties and vagueness's in images, which are very difficult to handle with Type-I fuzzy sets. These fuzzy sets are not able to model such uncertainties directly because their membership's functions are crisp. But in Type-II fuzzy sets are able to model such uncertainties as their membership functions are themselves fuzzy. Therefore, Type-II fuzzy logic systems have the potential to provide better performance. For these reasons, Type-II fuzzy modeling is used. The proposed Type-II expert system has been tested and validated to show its accuracy in the real world. The results show that the proposed system is superior in recognizing the brain tumour and its grade than Type-I fuzzy expert systems.
In this paper first the image is preprocessed and then it is segmented. In segmentation method the image is first calculated and then it is segmented through symmetric analysis methods or it varies upon the rule base methods. In pre-processing some fundamental image enhancement and noise lessening procedure are applied. The noise is reducing by the conversion of gray scale image. Then this gray scale image pass in to the filter. We use here a high pass filter imfilter in Matlab to filter an image, replaces each pixel of the image with a weighted average of the surrounding pixels. The weights are determined by the values of the filter, and the number of surrounding pixels is determined by the size of the filter used. Then the gray image and filtered image are merged together to enhanced the image quality. Here we use Median filtering which is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges. Then we convert the filtered image into binary image by the thresholding method which computes a global threshold that can be used to convert intensity image to a binary image with normalized intensity value between 0 and 1.

III. MATERIALS AND METHODS

The basic concept to detect tumour, is the component of the image hold the tumour generally has extra concentration then the other segment and we can guess the area, shape and radius of the tumour in the image. We calculate the area in pixel. Noise existing in the image can decrease the capability of region growing filter to grow large regions or may result as a fault edges.

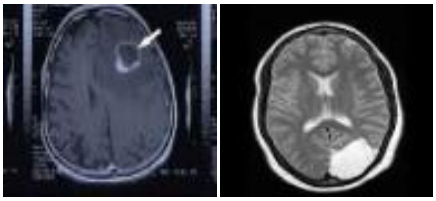

Figure 1a Tumourwith noise **Figure 1b**Tumour without noise

The figure 1a is tumour with noise and figure 1b is tumour without noise. The basic type names which are Anaplasia, Neoplasia, and Necrosis. More generally a neoplasm may cause release of metabolic end products.

Table 1 Tumour types

Anaplasia	Loss of differentiation of cells
Neoplasia	Uncontrolled division of cells
Necrosis	Premature death of cells

In the type II fuzzy system, the figure 1b astrocytoma tumour is took for an example. The astrocytoma tumour that is graded into four types. GradeI, GradeII, GradeIII and Grade IV.These grades that are tabulated with the diagnosis list.

Table 2 Grade types

Grades	% of brain tumour	Survival of years
Grade I	1.8	91
Grade II	1.3	67
Grade III	4.3	46
Grade IV	22.6	9

Astrocytoma can be subdivided into four grades: Grade I (Pilocytic Astrocytoma), Grade II (Diffuse Astrocytoma), Grade III (Anaplastic Astrocytoma), and Grade IV (Glioblastoma Multiforme).These grading systems have been shown with survival. So the survival ranges are more than 5 years for grade II, between 2 and 5 years for grade III, and less than 1 year for Grade IV.

3.1 Proposed methodology- type II fuzzy system

In this paper, the type II fuzzy system is proposed. The fuzzy is divided into two types. One is type I and type II fuzzy system. The type I fuzzy system that has the membership functions of crisp data sets .so it cannot be used for the sets and algorithms. But the type II fuzzy system, the data sets and membership functions are fuzzy. In any uncertain vagueness or images the type II fuzzy is used.

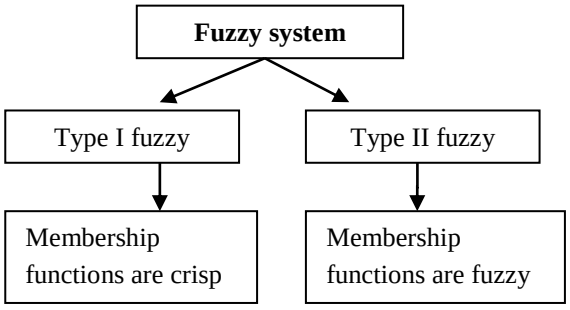

Figure 2 Fuzzy System Classifications

Step 1-- defining the initial membership functions: For tuning the parameters of initial interval Type-II membership functions, the Cluster the output data.
In this process, the CSF is cerebrospinal fluid is the black area, so the membership function is black intensity. On the other hand, the Abnormality is the brightest part of MRI, so its initial membership

function must include the white intensities. The White Matter (WM) is bright and the Gray Matter (GM) is gray, but their intensity levels are very similar.

Table 3: Normal tissue in brain image

CSF	dark
GM	gray
WM	bright

CSF: cerebrospinal fluid; GM: gray matter; WM: white matter

Step2--Tuning the parameters of Type-II membership functions: Tuning the parameters of a Type I membership function is possible formula. However, the output of a Type-II membership function cannot be represented. Given an input and output training pair (x_i, μ_{ij}), an interval Type-II fuzzy is designed so that the error function ($\hat{e}_{ij}$).

$$e_{ij} = \frac{1}{2}(\mu_j(x_i) - \mu_{ij})2$$

Where μ_j (x_i) is the real membership value of i_{th} data in j_{th} class and μ_{ij} is the calculated membership value of i_{th} data in j_{th} class.

3.2approaches for segmenting tumour image

In processing the tumour method, it consists of certain blocks of systematic images. Here the salt and pepper noise is added.

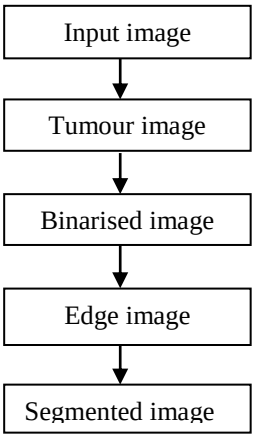

Figure 3 Flow Chart of Proposed Segmenting Tumour

In this system first the image is stated as a tumour image, then the image gets binarised .The binarised image that gets filtered, and the added image is involved to get the segmented image.

3.3Algorithm for detecting brain tumour

Input: MRI of brain image.
Output: Tumour portion of the image.
Step1:- Read the input color or grayscale image.
Step2:- Converts input colour image in to grayscale image this is done by forming a weighted sum of each three (RGB) component, eliminating the saturation and hue information while retaining the luminance and the image returns a gray scale color map.
Step3:- Resize this image in to 200 × 200 image matrix.
Step4:- Filters the multidimensional array with the Multidimensional filter. Each element of the output an integer or in array, then output elements that exceed the certain range of the integer type is shortened, and fractional values are rounded.
Step5:- Add step2, step4 image and a integer value 45 and pass it in to a median filter to get the resultant enhanced image.
Step6:- Computes a global threshold that can be used to convert an intensity image (Step5) to a binary image with a normalized intensity value which lies in between range 0 and 1.
Step7:- Compute watershed segmentation by Matlab Command watershed (step6 image).

Step8:-Compute the morphological operation by two Matlab Command imerode and imdilate and strel with arbitrary shape.
Step9:- Store the size of the step 8 image into var1 and var2 i.e. no. Of rows and column in pixels by [var1 var2] =size (step8 image)
Step10:- Convert in to binary image and traces the exterior boundaries of objects, as well as boundaries of holes inside these objects, in the binary image and into an RGB color image for the purpose of visualizing labeled regions.
Step11:- Show only tumour portion of the image by remove the small object area.
Step12:- Compute edge detection using sobel edge detection Technique

IV. RESULTS

In this paper an interactive segmentation method that enables users too quickly and efficiently segment tumours in MRI of brain. The tumour is a general problem in medical field. In the tumour process there are primary and secondary tumours .while in the secondary tumour type many variety of tissue is mostly depends on the primary one. So based on these types of sets we can detect or segment the tumour.

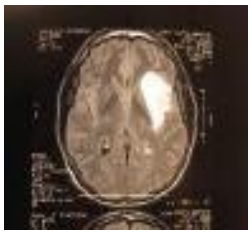

Figure 4 Tumour image

The tumour image that gets binarised. The salt and pepper noise is added When the median filter is used the image of noise that is reduced.

Figure 5 binary image

By adding the median filter, theedge image gets extracted to optimise the featured data .

Figure 6 Edge image

Finally the tumour that is segmented

Figure 7 Segmented image

By using the type II fuzzy system ,the tumour image is segmented and the denoised threshold image is obtained.then the tumour part is clustered .

Figure 8 Denoised threshold image

The threshold image that gets denoised. Fuzzy clustering are more advantageous over crisp clustering .the total vector to a given class is not required in each iteration. The thresholding method is used to recognize the characteristics of the pixels values.

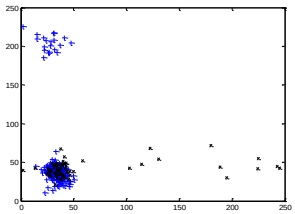

Figure 9 clustered tumour image

V. CONCLUSION

In this project an iterative method is to enable the tumours by detecting and segmenting the tumour from MRI image. Segmentation is used to segment the particular area or part of the image. In this paper the goal is to detect and segment the tumour from MRI of brain. The type II fuzzy system is used in this paper .Rather comparing with Type I fuzzy system, the type II is used because if there is any uncertainties or vagueness in images the type I fuzzy has a membership function of crisp. But in type II fuzzy the membership functions are fuzzy.

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