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Survey of Tumor Detection and Measuring from MR Image using Segmentation

KEYWORDS: Image segmentation, Magnetic resonance Imaging, brain tumor, Area calculation, ROI, Thresholding

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ABSTRACT Tumor cancer is one of the dangerous cancer diseases and can cause a large amount of death every year all around the world. Normally tumor cells are of two different types, they are mass and malignant. Their detection is always requires special attention for the researchers in field of image processing. Image segmentation is one of most important and fundamental approaches of digital image processing and widely being used for the specific suppose of detecting and measuring the size of tumor in the human body. This paper represents the extensive study and survey of different approaches for tumor Detection and measuring from MR Image using segmentation. It is also observed that Thresholding method followed by Region of Interest (ROI) can give better and accurate results as compared to other methods in detecting and measuring tumor size.

I. INTRODUCTION

This paper presenting review indented to give an overview of the state of the art in magnetic resonance imaging (MRI)-based medical image analysis for brain tumor detection and size measuring studies. Here a prevalence of 1<0% in the Indian population, brain tumors are not very common. Tumor is even and anon associated with a neoplasm, which is caused by uncontrolled cell proliferation. Brain tumor detection is very challenging problem due to complex structure of brain. The exact boundary should be detected for the proper treatment by segmenting enhanced cells.

Brain tumor Detection and Measuring can be done in different stages i.e.

1) Input Brain Image

In this, first Stage it start with the input brain image is using most commonly techniques like Computed Tomography (CT), Magnetic Resonance imagining (MRI) [5] Positron emission tomography (PET) [12] and is used to locate brain tumor.

2) Preprocessing

Now this stage the preprocessing step converting the image, reduce the noise [4] and enhance the image for further processing [9].

3) Segmentation

After enhancing the brain CT, MRI or PET image, the next step of our proposed technique is to segment the brain region from brain image. This process in which the image is sub-divided into regions parts that are meaningful. The meaningful region can be complete or a part of the object [11].

4) ROI (Region of interest/ Crop the image [1]

Complete above all stage we get a one segmented image in which there is clearly able to see the detected tumor.

5)Post-processing

After completion of segmentation process several morphological operations are applied on the image to extract the brain image so that area of focus can be clearly highlighted and easy to measure the size of the segmented image.

Normally tumors cells are two types. There are Mass and Malignant. The detection of the malignant tumor is somewhat difficult to mass tumor [4].

The main objectives of Image segmentation are to detect the tumor after measuring the size of Segmented brain Image.

First Start with MRI Image, Brain Images is considered as an input by MRI scan of brain and the output of MRI provides gray scale images. A MR image gives better result compare to other technique used in the field of medical science like CT images and X-rays [14].

The main purpose of Preprocessing step there is one input MR image and removing noise or reduces the noise and improves the image quality for detecting the correct tumor. Image is converted to gray scale [9]. Grayscale conversion and histogram equalization are applied on the images as a part of preprocessing the image [5].

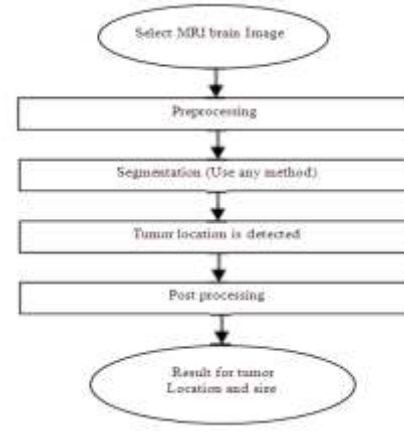

Figure.1 Basic stages of Brain tumor detection and measure size.

Segmentation is an important process to extract suspicious regions from MRI brain images. MRI brain image segmentation is done in order to change and MRI image in to more meaningful from which will make it easier for us to identify the tumor in the brain [5]. A few prevailing segmentation

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techniques include Region Growing, Threshold based, Clustering algorithm, Histogram based approach and gray level methods [3].

Completion of segmenting the brain region from brain MRI image, several post-processing operations include Morphological operation [5], thresolding segmentation [5], and histogram equalization [9], and watershed transformations. Morphology and shape features can provide useful information for tumor diagnosis and have been proven effective for the application of a computer-aided diagnosis (CADx) system [6].

II. SEGMENTATION

The manual image segmentation of the tumor is very time consuming process, and hence we should concentrate on automatic and accurate segmentation image. Automatic localization of brain tumor that can be imaged by Magnetic Resonance Image (MRI) modality can be explored; such methodology could be based on Iterative closest point (ICP) matching technique by using axial MRI symmetry [2].

The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. The result of image segmentation is a set of segments that collectively cover the entire MRI brain image, or a set of contours extracted from the MRI brain image.

A. Thresolding

Thresholding techniques can be used for MRI brain tumor segmentation. According to intensity/brightness is a simple technique for images which contain solid objects on a background of different but uniform, brightness. Each pixel is compared to the threshold: if its value is higher than the threshold, the pixel is considered to be" foreground" and is set to white, and if it is less than or equal to the threshold it is a considered "background" and set to black [12].

Thresholding based segmentation the image is considered as having only two values either black or white. But the bit map image contains 0 to 255 gray scale values.

A grayscale image is turned into a binary (black and white) image by first choosing a gray level T in the original image. After completion of selecting a gray level image, turn every pixel black or white according to whether its grey value is greater than or less than T:

A Pixel becomes:

White if its grey level is > T,

Black if its grey level is<= T [12].

It will be transformed into image using "imshow" command as shown in below figure (2).

Fig. 2. Original image

Fig. 3.

Thres hold Segmented Image After segmentation process applying ROI (Region of interest) method on the obtained segmented image. ROI is the process for selecting the area in the image. ROI is used for the cropping of the image, so this step crops the detected tumor and measuring its size in next stage or process. Applying ROI method on the obtained segmented image. ROI is the process for selecting the area in the image. ROI is used for the cropping of the image, so this step crops the detected.

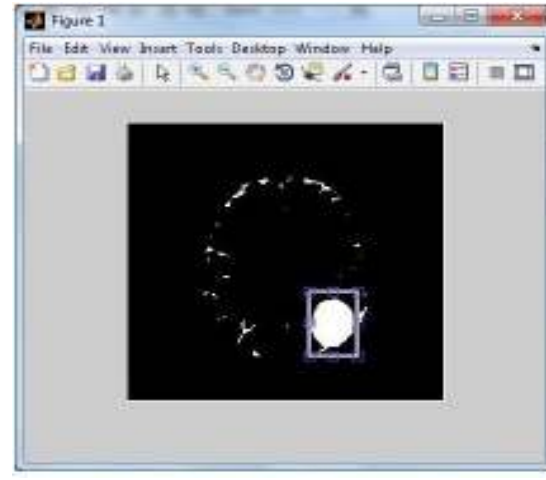

Fig.4. Region of interest Image [1]

A. Clustering:

The Method of clustering organizes the objects into groups based on some feature, attribute or characteristic. Hence a cluster consists of groups of similar objects. Clustering can be supervised and unsupervised. In supervised approach, the criteria for clustering are specified by the user. In unsupervised approach, the criteria are decided by the clustering system itself. A Survey of clustering-based image segmentation methods can be found [11].

B. Region growing:

Region growing methods have region are iteratively grown by comparing all unallocated neighboring pixels to the regions. Used this method for the boundaries between region based on discontinuities in intensities (gray-level or color-level) [11]. It is a pixel -based image segmentation technique because it is parts the captured initial seed points. This approach to segmentation examines neighboring pixel of initial seed points and determines whether the pixel neighbors should be added to the region [12].

C.Edge-detection based:

It is far the most common method of detecting boundaries discontinuities in a segmented image [1]. The parts on which immediate changes in gray tones occur in the images are called edges. Edge detection techniques transform images to edge images benefiting from the changes of grey tones in the images. As a result of this transformation, edge based brain segmentation image is obtained without encountering any changes in physical qualities of the main image [13]. This image processing consist of image enhancement using histogram equalization, edge detection and segmentation process to take patterns of brain tumors, so the process of making computer aided diagnosis for brain tumor grading will be easier [10]. Edge is nothing but boundary between two images. Edge detection technique refers to the identification and locating the sharp discontinuities in the image.

D. Boundary based method:

This method is used the assumption that pixel values change rapidly at the boundary between two regions [7]. Edge detectors used in these techniques canbe simple ones such as the Sobel or Roberts operators, or more complex. The output of most existing edge detectors can only provide candidates for the region boundaries, because these

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obtained color edges are normally discontinuous or over-detected.

E. Watershed transformation:
Watershed transformation considers the gradient magnitude of an image as a topographic surface [12]. Watershed transformation is pixal having the highest gradient magnitude intensities(GMIs) correspond to watershed lines. Watershed method comes under edge based detection. The term Watershed is the geographical. The rain that falls on either side of the watershed linewill flow into the same lake of water. This idea can be fruitfully cashed in the digital images[8]. The aim of watershed is to search the areas having high intensity gradients (watersheds) that divide neighbored local minima(basins) [8].

III.POSTPROCESSING
After segmenting the brain region from brain MRI image, several postprocessing operations are applied on the image to enhance the brain region so that area of focus can be clearly highlighted. These postprocessing operations include Morphological operation [5], thresolding segmentation [5], and histogram equalization [9].

For measuring size first of all count the number of pixels in the segmented image area and based on that counting number of pixels system can able to calculate the size in millimeter (mm).

Fig.5. Cropped Image/Tumor [1]

After segmentation process and ROI the next process is the post processing in which several operation applied on the image to clearly locate the tumor in the MR image.

Post processing is the step where apply the morphological operations to extract the image. Here for morphological operations we used erosion and dilation technique [1].
1) Tumor area calculation using erosion and dilation techniques

Erosion:
Erosion of A by B is denoted as below
$A \ominus B = \{z \mid (B), ((A\}$ [16]
Here the B is commonly referred as structuring elements.[1]
Dilation:
Dilation of A by is denoted as below
A al B = {z l(B),n A * 0} [16]
Here the B is commonly referred as structuring elements.

2) Tumor area calculation in MATLAB command window
The tumour area is calculated using the binarization method. That is the image having only two values either black or white (0 or 1). Here 256x256 jpeg image is a maximum image size. The binary image can be represented as a summation of total number of white and black pixels [15]. Area of an image is the total number of the pixels present in the area which can be calculated in the length units by multiplying the number of pixels with the dimension of one pixel [17] [18]:

$$\text{Image, } I = \Sigma 255w=0\Sigma 255H=0[f(0) + f(1)] \ldots\ldots\ldots\ldots\ldots\ldots(1)$$
Pixels = Width (W) X Height (H) = 256 X 256
f (0) = white pixel (digit 0)
f (l) = black pixel (digit 1)
$$\text{No\_ of\_ white pixel } P = \Sigma 255w=0\Sigma 255H=0[f(0)] \ldots\ldots(2)$$
Where, P = number of white pixels (width*height)

IV. CONCLUSION
From Survey, it is conclude that MR image segmentation is one of the essential tasks in detecting tumor size in medical area. It is concluded that the segmentation methods giving the segmented image or result of the MR image to detect the tumors and also measuring the size of the tumor or segmented image. It is also observed that Thresholding method followed by Region of Interest (ROI) can give better and accurate results as compared to other methods in detecting and measuring tumor size.

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