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RESEARCH ARTICLE

Fully Automated Approach to Identify Brain Tumors in 2D MRI Using Thresholding and Region Growing Method

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Abstract: Automated brain tumor segmentation and detection are vastly important in medical diagnostics because it provides information related to anatomical structures as well as potential abnormal tissue necessary to delineate appropriate surgical planning. As the segmentation of anatomical regions of the brain is the basic problem in medical image analysis. Segmentation of Brain tumor appropriately is a difficult task in MRI. The MRI image is an image that produces a high contrast images indicating regular and irregular tissues that help to discriminate the overlapping in margin of ach limb. But when the edges of tumor is not sharpen then the segmentation results are not accurate i.e. segmentation may be over or under. This may be happened due to initial stage of the tumors. So , in this paper a modified method of tumor line detection and segmentation is used to separate the irregular from the regular surrounding tissue to get a real identification of involved and noninvolved area that help the surgeon to distinguish the involved area precisely. The method proposed here uses a thresholding approach for initial segmentation then the region is filled using seeded region growing method and detect the tumor boundaries in 2D MRI for different cases. This method that can be validated segmentation on 2D MRI Data.

Keywords: Brain tumor, Magnetic resonance Imaging (MRI), Image segmentation

I. INTRODUCTION

Segmentation is a process of identifying an object or pattern in the given work space. In this project we are considering magnetic resonance image as our work space. Actually the MRI produces a high contrast image representing each part very clearly, but sometimes due to be determined accurately so a problem of segmenting it is always there. In these cases the physiologist always need to have keen observation of the anatomical structure. But this process is too much time consuming and if the initial segmentation result is not correct then other consequent results like volume calculation also produces incorrect measurement results. There are a number of methods for brain tumor segmentation like fuzzy logic approach, neuro fuzzy approach, Random walk etc, but these all methods

can produces unsatisfactory results due to unshaped edge boundaries and also the time to produce desire result is large[6] .

In this paper we are proposing a thresholding approach for initial segmentation, then automatic region growing method to segment the brain tumors. So in this method the users don't need to select the seed point manually therefore there is no need of human intervention [2]. In this project work our assumption is that the brain tumor have grown in considerable size and their structure may be of any type like snakelike or circular shaped etc[1].

II. PROPOSED METHOD

In this paper our method proposed has divided into five subparts. The output obtained from one part is taken as input to the next part.

A. Input Image

Input image is a 2- dimensional MRI medical image. Where tumor is present inside it. These images may contain one or more tumor segments.

B. Image pre processing

This step involves apply the pre processing filters like mean , median gabour and auto enhancement filters to increase the clarity of image, and reduce the unwanted information from the image.

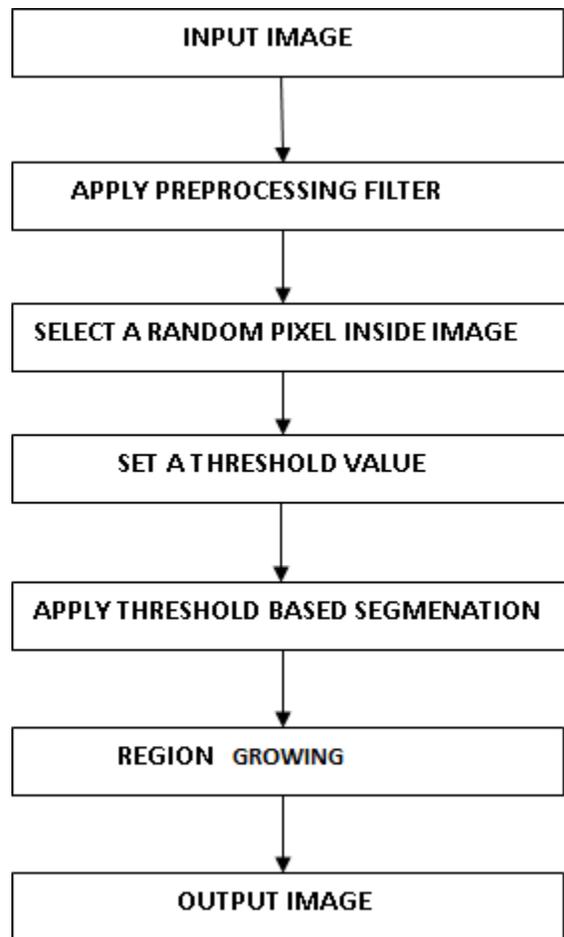


Figure1.1 Steps for tumor segmentation

C. Select a random pixel inside the image

Any pixel can be randomly selected inside the region. The gray value of this pixel can be selected as the threshold value, also we can select the threshold value automatically using some predefined methods or functions available in different tools [7].

D. Selection of Threshold Value

The key parameter in the thresholding process is the choice of the threshold value. Several different methods for choosing a threshold exist; users can manually choose a threshold value, or a thresholding algorithm can compute a value automatically, which is known as automatic thresholding (Shapiro, et al. 2001:83). A simple method would be to choose the mean or median value, the rationale being that if the object pixels are brighter than the background, they should also be brighter than the average. In a noiseless image with uniform background and object values, the mean or median will work well as the threshold, however, this will generally not be the case. A more sophisticated approach might be to create a histogram of the image pixel intensities and use the valley point as the threshold. The histogram approach assumes that there is some average value for the background and object pixels, but that the actual pixel values have some variation around these average values. However, this may be computationally expensive, and image histograms may not have clearly defined valley points, often making the selection of an accurate threshold difficult. One method that is relatively simple, does not require much specific knowledge of the image, and is robust against image noise, is the following iterative method:

(a) An initial threshold (T) is chosen, this can be done randomly or according to any other method desired.

(b) The image is segmented into object and background pixels as described above, creating two sets:

1. $G_1 = \{f(m,n):f(m,n) > T\}$ (object pixels)

2. $G_2 = \{f(m,n):f(m,n) \leq T\}$ (background pixels) (note, $f(m,n)$ is the value of the pixel located in the m^{th} column, n^{th} row)

(c) The average of each set is computed.

1. $m_1 =$ average value of G_1

2. $m_2 =$ average value of G_2

(d) A new threshold is created that is the average of m_1 and m_2

3. $T' = (m_1 + m_2)/2$

(e) Go back to step two, now using the new threshold computed in step four, keep repeating until the new threshold matches the one before it (i.e. until convergence has been reached).

E. Region Growing Method

For the seed point selection our assumption is that tumor’s region has grown in considerable size .The following steps are performed to find the seed point:

- (a) Convert the given colored image into the gray image.
- (b) First of all count no pixels whose intensities are greater than hundred and less than hundred and store them in separate variables.
- (c) Find difference between both variables if difference is small then go to step „d“ else convert the image into negative and again set the intensity of external part of the brain to zero and go to step „d“
- (d) Convert the obtained gray image into the binary image.
- (e) Find maximum length and breadth of the brain then From the center convert the pixels in the area of rectangle shape of size twenty rows and ten columns to black color.
- (f) Find the sum of all rows individually and store it in the array.
- (g) Find the sum of all the columns and store the results in another array.
- (h) Find the intersection of row and column having maximum sum .This is taken as seed point.

This approach to segmentation examines neighboring pixels of initial “seed points” and determines whether the pixel neighbors should be added to the region. The process is iterated on, in the same manner as general data clustering algorithms. The main goal of segmentation is to partition an image into regions. Some segmentation methods such as "Thresholding" achieve this goal by looking for the boundaries between regions based on discontinuities in gray levels or color properties [7]. Region-based segmentation is a technique for determining the region directly. In our project work 8 connected neighbor region growing method has been used. The basic formulation for Region-Based Segmentation is:

$$(a) \bigcup_{i=1}^n R_i = R.$$

(b) R_i is a connected region, $i = 1, 2, \dots, n$

$$(c) R_i \cap R_j = \emptyset \text{ for all } i = 1, 2, \dots, n.$$

(d) $P(R_i) = TRUE$ for $i = 1, 2, \dots, n$.

(e) $P(R_i \cup R_j) = FALSE$ for any adjacent region R_i and R_j .

$P(R_i)$ is a logical predicate defined over the points in set $P(R_k)$ and \emptyset is the null set.

- (a) means that the segmentation must be complete; that is, every pixel must be in a region.
- (b) requires that points in a region must be connected in some predefined sense.
- (c) indicates that the regions must be disjoint.
- (d) deals with the properties that must be satisfied by the pixels in a segmented region. For example $P(R_i) = TRUE$ if all pixels in R_i have the same gray level.
- (e) indicates that region R_i and R_j are different in the sense of predicate P .

III. RESULT

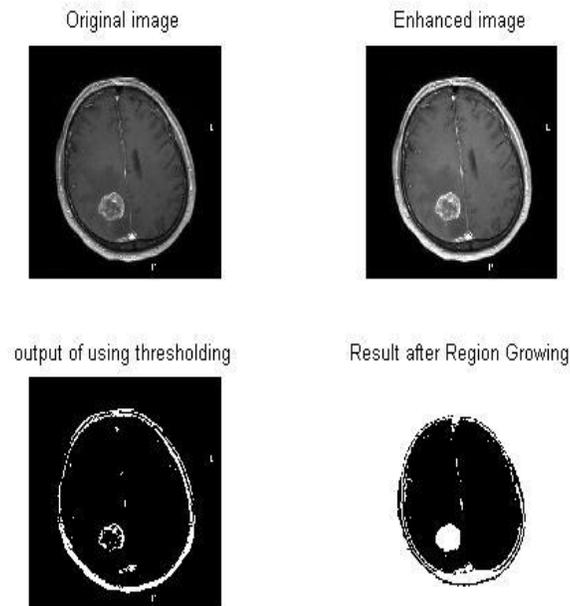


Figure 1.1 Resultant Image

The above figure shows the output images first portion shows the input 2 dimension MRI image, second part shows the output after applying enhancement filter then third portion shows the output of thresholding and the last portion shows the final output after growing the region find from thresholding.

IV. CONCLUSION

From figure 1.1 it may be concluded that the proposed algorithm provides the better output then single thresholding technique and also can be very useful in segmentation of other medical images.

V. FUTURE SCOPE

In future this algorithm may be applied in different medical images and it may be useful for other image segmentation processes.

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