

Detection of Brain Tumor Based On Segmentation Using Region Growing Method

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Abstract – Brain tumor is a very serious and life-threatening disease. Tumors have different characteristics and types hence they have different treatments. An uncontrollable growth of tissues in any part of the body is called as tumor. This paper brings in light detection of brain tumor from efficient MRI images. Numbers of people who have brain tumors die due to inaccurate detection according to the Researches in developed countries. CT scan or MRI that is directed into intracranial cavity produces a complete image to detect the brain tumor segmentation is done i.e. region growing method. For doctors region growing is a simple and a modern method. The region growing method works relatively fast and enables accurate tumor segmentation. The efficient method for brain tumor detection is region growing method.

Keywords – Image Processing, Segmentation, Region Growing, Brain Tumor.

I. INTRODUCTION

Abnormal growth of cells inside the skull is known as brain tumor. In normal conditions the tumor grows from the cells of brain, blood vessels, nerves which emerge from the brain. Benign (non-cancerous) and malignant (cancerous) are the two types of tumors. The first one is described as slow growing tumors that will exert damaging pressure but will not spread into surrounding brain tissue. However, the second one is described as fast growing tumor and it is able to spread into surrounding brain tissue. Producing inflammation, exerting pressure on parts of brain and increasing pressure within the skull can damage normal brain cells [1].

Primary brain tumors are commonly located in the posterior cranial fossa in children and in the anterior two-thirds of the cerebral hemispheres in adults, although they can affect any part of the brain. The most common symptoms of a brain tumor are given below. However, each person may experience symptoms differently. The size and location of tumor can vary the symptoms. The symptoms are headache, vomiting, nausea, changes in personality, irritability, drowsiness, depression, decreased cardiac, and decreased respiratory function eventually, coma if not treated.

For image processing various methods and algorithms are used. Segmentation is one the image processing method. Segmentation is a process of dividing the heterogeneous image into identical regions that are homogeneous in terms of a selected criterion. This

homogeneity criterion may be as follows: intensity, its gradients, and color or characteristic textures.

Pixels with same properties are grouped together in region based segmentation. The property and type of pixels is taken into consideration. There are two types of segmentation, region growing and region merging. Pixels are examined with their neighborhoods and are grouped together. In brain tumor diagnosis region growing technique can be used. In region growing, we start with similar pixels and go on grouping with pixels having same intensity [2].

II. REGION GROWING METHOD

One of the methods for segmentation of medical images is region growing method. It is a simple method which gives good performance. This technique groups pixels which have same properties based on homogeneity criterion. It starts with a set of initial seed points that represents the criteria, and grows the region by appending to each seed's neighboring pixels that have similar properties to the seed. We can select the seeds automatically or manually. The automated selection can be based on finding pixels which are of interest [4].

Based on predefined criteria region growing is a procedure that group's pixels or sub regions into larger regions. The basic approach is to start with a set of "seed" points and from these grow regions by appending to each seed those neighboring pixels that have properties similar to the seed. The nature of the problem defines the selection of the seed. When prior information is not available, the procedure is to compute at every pixel the same set of properties that at the last will be used to assign pixels to regions during the growing process.

The selection of similarity criteria depends not only on the image data available but also on the type of the problem under consideration. For example, the analysis of land use satellite imagery depends heavily on the use of color. Grouping pixels with the same gray level to form a region without paying attention to connectivity would yield a segmentation result that is meaningless in the context of this discussion.

The formulation of a stopping rule is another problem in region growing is. Primarily, growing a region should stop when no more pixels satisfy the criteria for inclusion in that region. Gray level, texture and color are local in nature are some of the criteria which do not take into account the history of the region growth. Additional

criteria that increase the power of a region growing algorithm utilize the concept of size, likeness between a candidate pixel and the pixels grown so far and the shape of the region being grown [11].

The first aim in the region growing segmentation is to determine the initial seed points. It is known in this application that the pixel of defective welds tends to have the maximum allowable digital value. Conditions for this region growing method are as follows (a) indicates that the segmentation must be complete; that is every pixel must be in a region. Condition (b) requires that points in a region must be connected in some predefined sense. Condition(c) indicates that the region must be disjoint. Condition (d) deals with the properties that must be satisfied by the pixel in a segmented region [13].

Visual presentation of above is given in Fig. 1.

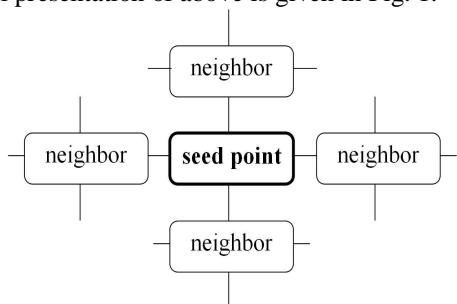


Fig. 1. Visual representation of 4-neighbourhood

III. THE PROPOSED METHOD

Image segmentation alongwith region growing method has been applied to define the boundaries of brain tumor [1]. The general algorithm is shown in Fig.2.

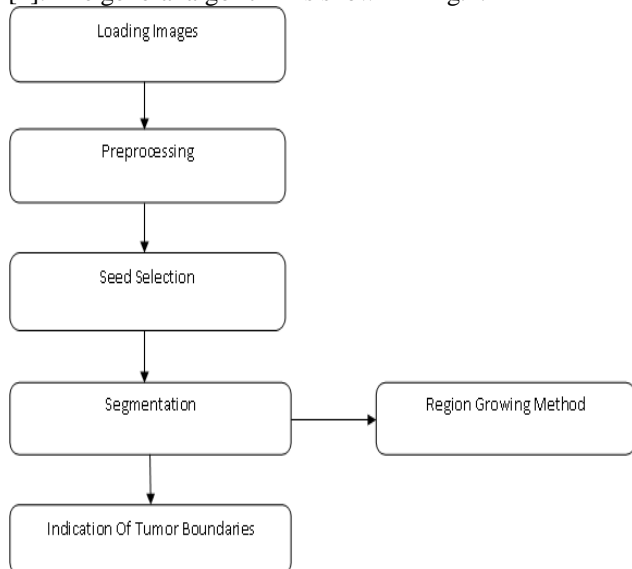


Fig. 2. General algorithm

The explanation of the above blocks are given below-

A. Loading Images

Firstly the images of different patients are collected and the database is created. Loading the images in matlab for processing.

B. Preprocessing

Various methods like gray scale, adaptive equalization and filtering can be used to remove the noise in the image.

C. Seed Selection

From the database of images and the region we want to extract from the images, we can determine the color space between RGB/HSV. The threshold can be selected to extract the particular region. The seed point is indicated by marker at the spot where the affected region is potentially present [5].

D. Segmentation

Segmentation is a process of dividing the image into identical regions that are homogeneous in terms of a selected criterion. Segmentation is used to extract the affected region using region growing algorithm.

1. Region Growing Method

The image is loaded and the homogeneity criterion is selected. The intensity difference and neighborhood type for the images are also defined. The intensity difference is selected experimentally and the user may change the parameter values of the vector. Another stage is to define the seed point and the number of images in a series to be segmented. Then identify the seed points and extreme intensity values. Pixels in algorithm are a counter of pixels in segmentation region. When all the parameters are initialized the region growing method is operated. The method checks the point that is located closest to the seed point. If the point meets the homogeneity criterion it is added to the affected region. If the point does not meet homogeneity criterion then it will not be added to the affected region [6].

E. Identification of Tumor Boundaries

The tumor boundaries are outlined more precisely by the region growing algorithm. The extracted portion is marked for ease of display.

The process of determining the homogeneity criterion and adding pixels that meet the criterion consists of several stages. Firstly the image is loaded and a single cross-section is selected. Then the seed point is selected where the affected region is potentially present and its homogeneity criterion is defined. Now the next cross-section is taken and another seed point is selected where the affected region is potentially present. Pixels with similar intensity are grouped together. If these pixels meet the homogeneity criterion they are added to the affected region and if not then they are not added to the affected region. To undergo segmentation the user can choose the type of images and cross-sections [7].

IV. RESULTS

The obtained results are shown below. The region growing method is applied on all images available in the database. The figures show the results for some selected images of different patients.

Figure 3 shows the original image of a patient that is loaded in the database. Figure 4 shows the image after undergoing preprocessing. In figure 5 it is seen that the salt and pepper noise is added to this image. Now this

noise needs to be removed from the image. This is done by filtering. The output of the median filter is shown in figure 6. Figure 7 shows the selection of seed point. The last figure 8 shows the image after segmentation which is done using region growing method. The brain tumor is located in this image. The boundaries of the tumor are indicated with green border.

The results for other patients are shown in figure 9. Here two more results for the selected images of two different patients from the database are shown.

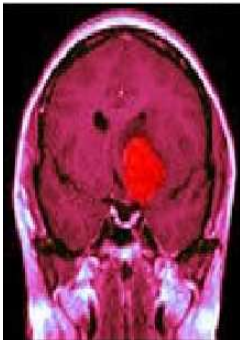


Fig. 3. Original image

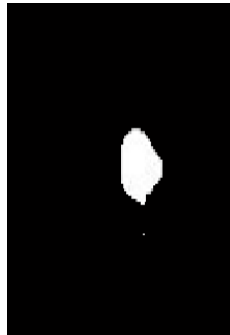


Fig. 4. Preprocessed image

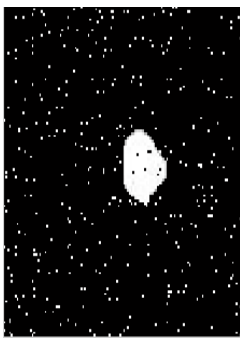


Fig. 5. Image with salt and pepper

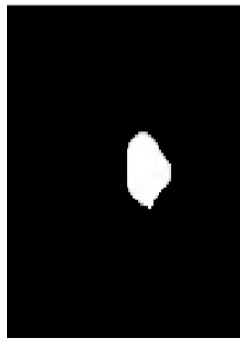


Fig. 6. Noise filtered with median filter

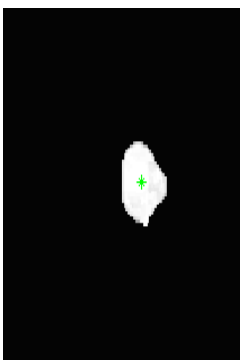


Fig. 7. Seed selection



Fig. 8. Image after Region Growing

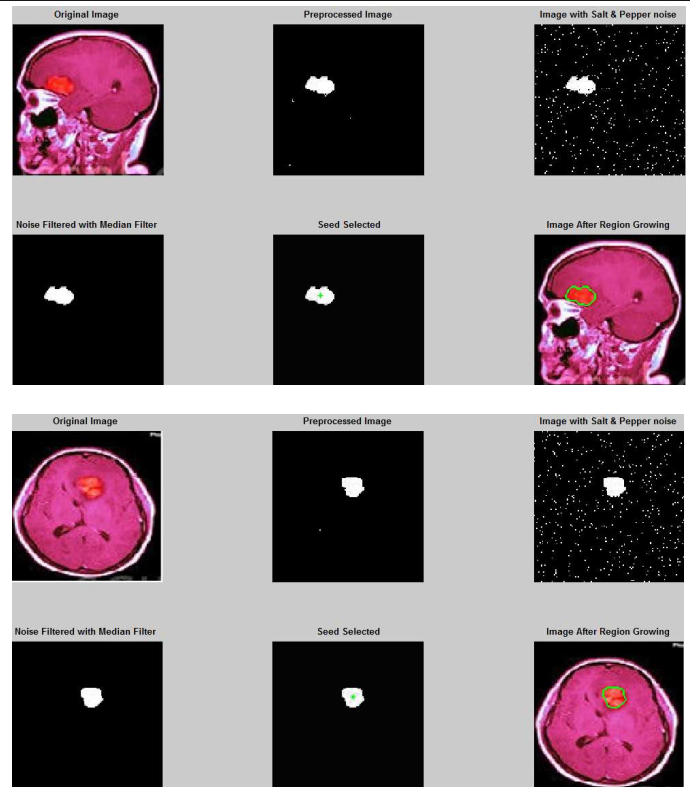


Fig. 9. Results of two selected images of different patients from the database

V. CONCLUSION

The region growing method provides precise segmentation and faster brain tumor identification. As compared to other methods the region growing method provides improved output segmented image. This method is innovative and novel because the seed point can be chosen inside the edge of the affected region; it does not have to be placed inside the centre of affected region.

The region growing method gives accurate tumor segmentation and needs no human interference. But the selection of homogeneity criterion needs to be appropriate. The results are satisfactory, still further study needs to be conducted to increase the precision in the results of the algorithm. This method is very useful and quite modern for doctors and physicians for brain tumor identification.

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