Region Growing Method for Detection of Brain Tumor, Affected Regions in Eye and Skin Diseases

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Abstract— **automated segmentation and detection are vastly important in medical diagnostics because they provide information related to the complex parts in human body. In surgical planning this is most important. As the appropriate segmentation of anatomical regions of the brain, eyes and skin are quite difficult in medical image analysis. The MRI image produces a high contrast image which indicates regular and irregular tissues that help to discriminate the affected and non-affected areas. But if these edges of affected regions are not sharp then the results obtained from the segmentation are not accurate. This usually happens if the disease is in its initial stage. So, in this paper a modified method of detection and segmentation is discussed to separate the irregular and the regular surrounding tissue. This is necessary to get a real identification of involved and noninvolved areas. This will assist the surgeons for the surgical planning to distinguish the involved area precisely. The method proposed here is seeded region growing method to detect the affected regions in brain tumor, eye disease and skin disease.**

Index Terms— **image processing, segmentation, region growing, brain tumor, eye disease, skin disease.**

I. INTRODUCTION

Brain, eyes and skin are the most complex and important organs of human body. Brain serves as the centre of the nervous system. Brain is a soft, delicate, non-replaceable & spongy mass of tissue. While brain tumor is a group of abnormal cells that grows inside the brain or around the brain. All healthy brain cells are directly destroyed by this brain tumor. Brain tumor is created by an abnormal and uncontrolled cell division in brain itself. Brain tumors can be located from CT or MRI scans. Through these scanning each year many people are diagnosed with primary and metastatic brain tumors [1].

Sensation of vision, color differentiation and perception of depth is given by human eyes. This is due to the presence of rods and cones in the retina of human eyes. The different diseases related to eye retina are diabetic retinopathy (DR), macular degeneration and glaucoma. These diseases may cause damage to the different parts of the retina or may even cause vision loss. In the field of ophthalmology, eye disease identification techniques are highly important. These identification techniques of conventional retinal disease are based on manual observations which are highly subjective and prone to error. Thus the implementation of automated techniques is very much necessary. This will eliminate the drawback of the conventional techniques which is significantly necessary in the medical field. The accuracy of the automated disease identification techniques should be high. Whereas, the techniques should also possess a quick convergence rate which enables them to be suitable for real-time applications. Based on these two performance measures, several automated techniques are developed and implemented successfully for retinal disease identification [2].

Various attempts have been made across the world till now to implement the traditional telemedicine. But the efforts have been facing various challenges such as high-cost of sustaining telemedicine solutions and non-availability of medical expertise. Skin color detection in a high illuminated region is a difficulty on skin-color-based segmentation. There is a very little difference between the distribution of skin color pixels and that of non-skin color pixels. To improve skin color segmentation performance, a novel skin color detection method for the high brightness region is proposed in this paper. Based on the principle of brightness and spatial continuality of the skin region, a region growing algorithm is developed to help detecting high brightness skin color pixels. Experimental results have proved the proposed algorithm can more accurately and precisely detect the high illumination skin color [3].

A forceful segmentation tool for the detection of brain tumor, eye disease and skin disease is needed to assist clinician and researchers in radiosurgery applications. Segmentation is a process of identifying an object or pattern in the given work space. There are a number of methods for segmentation, but these all methods produces unsatisfactory results due to unshaped edge boundaries and also the time to produce desire result is large.

In this paper we are proposing an automatic region growing method to segment the brain, eyes and skin. So in this method the users don't need to select the seed point manually therefore there is no need of human intervention. The region growing method allows to display easily and with precision the complex parts of brain, eyes and skin that are poorly visible in the pathological images. Region growing method is the most accurate one and enables the most efficient detection of affected regions in brain tumors, skin and eye diseases. This method only needs one seed point inside the affected region [4].

II. REGION GROWING METHOD

Region growing is one of the most popular techniques for segmentation of medical images due to its simplicity and good performance. The complex parts of human body which are

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poorly visible in the pathological images are displayed easily and with precision by using this method. The technique groups pixels or regions that have similar properties based on predefined criteria. It starts with a set of initial seed points that represent the, and grow the region.

When the seed point is selected, region growing process starts. In the beginning, the region subject to growing consists of the seed point, next pixels neighboring with the seed point are picked and the homogeneity criterion is verified. The pixels adjacent to the pixel included in the region are checked and are included in the region. The region ceases to grow when the pixels no longer comply with the homogeneity criterion and cannot be included in the region. The iterations stop when all seeds have been used for the region growth [1].

A novel approach for automatic segmentation and classification of skin lesions is proposed. Initially, skin images are filtered to remove unwanted hairs and noise and then the segmentation process is carried out to extract lesion areas. For segmentation, a region growing method is applied by automatic initialization of seed points. The segmentation performance is measured with different well known measures and the results are appreciable. Subsequently the extracted lesion areas are represented by color and texture features [2].

A method of automatic optic disk segmentation based on region growing technique with automatic seed selection. In this method centre of optic disk is considered as a seed to apply region growing technique to segment the optic disk from the preprocessed retinal image. Automatic detection of centre of optic disk is done by double windowing method. The algorithm uses image processing techniques like contrast adjustment, morphological operations & filtering to process the retinal image and to remove the blood vessels from the retinal image. The performance of optic disk segmentation by proposed method is compared with Optic disk segmentation by ophthalmologists and results are found convincing and efficient. The experimental results indicate this method of segmentation of the OD has good accuracy and also is computationally cheap [3].

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.

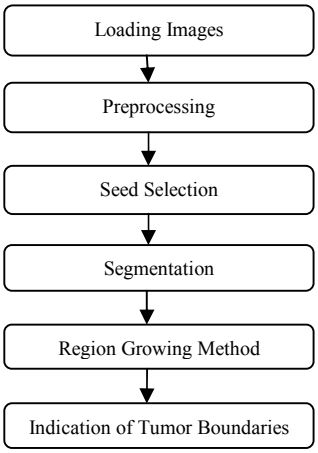

Fig 1.General algorithm

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.

E. 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 [4].

F. 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 [5].

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 2 shows the results of selected image of a brain tumor patient. In this result the first block shows the original image of a patient that is loaded in the database. Second block shows the image after undergoing preprocessing. In the third block it is seen that the salt and pepper noise is added. Now this noise needs to be removed and this is done by filtering. The output of the median filter is shown in fourth block. The fifth shows the selection of seed point. The last sixth block shows the image after segmentation which is done using region growing method. The brain tumor is located in this block. The boundaries of the tumor are indicated with green border.

The result for the selected image of an eye patient from the database is shown in figure 3. While the result for the selected image of a skin patient from the database is shown in figure 4.

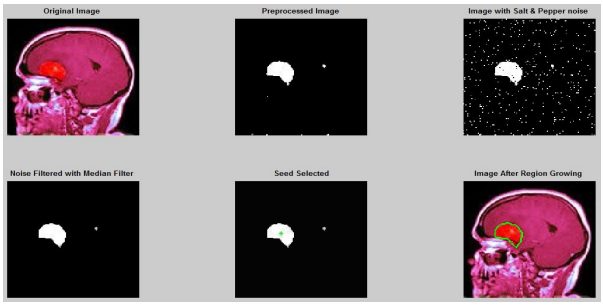

Fig. 2. Result of the selected image of a brain tumor patient from the database

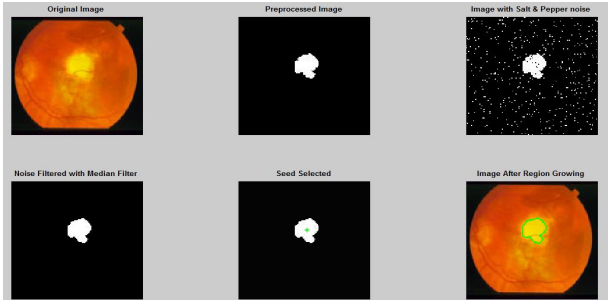

Fig. 3. Result of the selected image of an eye patient from the database

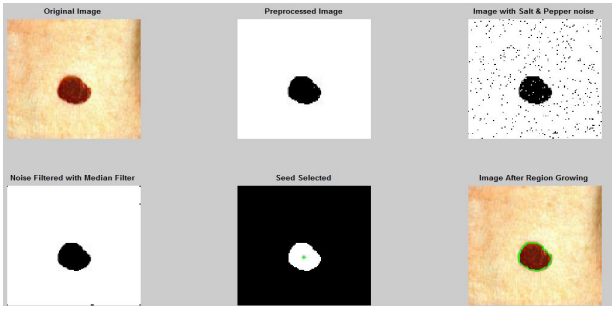

Fig. 4. Result of the selected image of an skin patient from the database

CONCLUSION

The Region Growing Method provides us with much improved results as compared to other methods. This is a faster method of detection of brain tumor, eye and skin diseases. It is also an accurate method which allows no human interference. The region growing algorithm is a simple but modern method for the physicians. This method is innovative and novel because the seed point does not have to be placed inside the centre of affected region. The seed point can be chosen inside the edge of the affected region.

The region growing method gives accurate tumor segmentation. 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.

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