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Detection of Tumor in MRI Images using Image Segmentation

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Abstract: ***Image segmentation is one of the fundamental approaches of digital image processing. During past few years, brain tumor segmentation in magnetic resonance imaging (MRI) has become a popular research area in the field of medical imaging system. MRI is used in radiology for analysing internal structures and makes easy to extract the required region. The method used in this paper is a hybrid approach i.e. combination of watershed method and edge detection method by using MATLAB as a tool to detect the tumor boundaries in MRI image for different cases of brain. The result of this method makes very clear for physician to distinguish the tumor portion for surgical planning. The efficiency and accuracy of the hybrid method is demonstrated by the experiments on the MRI brain images. Experimental results presented in this paper are obtained by using MATLAB.***

Keywords: Image segmentation; Magnetic Resonance Imaging (MRI); Watershed; Canny Edge Detection Technique.

I. INTRODUCTION

Brain is the most vital part of our body. They are made up of nerve cells and supporting cells that receive and send messages through nerves and control all the parts of our body. A brain tumour is a mass of abnormal tissue growing in any part of the brain. For some unknown reason, some brain cells grow in an uncontrolled manner and form these tumors. These tumors can arise from any part of the brain. Broadly these tumors can be divided into benign and malignant tumors. Benign tumors grow slowly and never spread to other parts. But as they slowly increase in size they can cause pressure on the normal brain and interfere with mental and bodily functions. Malignant tumors or cancers are tumors that grow fast and infiltrate the surrounding brain and sometimes spread to the other parts of the brain or spine. The task of manually segmenting brain tumors from MRI is generally time consuming and very difficult to diagnose. So an automated segmentation method is desirable because it reduces the load on the operator and generates satisfactory results for detecting tumor. The aim of this work is to provide an automated tool which locates the tumor on MRI image. There are several methods by which tumor can be detected, but there are some drawbacks of the existing methods. So a robust procedure for segmentation and edge detection of MRI images can be obtained by using a hybrid method i.e. watershed segmentation method and canny edge detection method which detects tumor accurately. This technique is selected because of its efficiency to segment out different regions and it has shown optimum results for a given MRI image.

This paper is organized as follow. In section II, Watershed Method is described. Section III presents Canny Edge Detection method. Section IV represents proposed algorithm. Section V represents Experimental Results and finally Section VI presents conclusion.

II. WATERSHED METHOD

Watershed method comes under edge based segmentation. The term watershed is the geographical one. In geography, a watershed line is defined as a line separating the two catchment's basins. The rain that falls on either side of the watershed line will flow into the same lake of water. This idea can be fruitfully cashed in the digital images. The image gradient can be viewed as terrain. The homogeneous regions in the image usually have low gradient values. Thus, they represent valleys while the

edges represent the peaks having high gradient values which relates directly as extraction of tumor from MRI Images. Watershed is an efficient morphological segmentation tool.

The aim of watershed is to search the areas having high intensity gradients (watersheds) that divide neighbored local minima (basins) [5].Watershed suffers from the problem of over segmentation (large number of segmented regions around each local minima in the image). A solution is to introduce markers [6] [7]. The markers are connected component of an image. There are internal markers and external markers where internal markers are used for the actual object to be extracted and external marker are used extracting background. This method can be used mainly for the problems where adjacent objects are there in an image and we have to separate them using image processing operations. Thus this method can be effectively used so that proper detection of the region of interest can be achieved.

III. CANNY EDGE DETECTION METHOD

The Canny Edge Detector is one of the most commonly used image processing tools, detecting edges in a very robust manner. Canny's aim is to discover the optimal edge detection algorithm. Canny edge detection method is an "optimal" edge detector means good detection, good localization, and minimal response. The Canny algorithm is adaptable with respect to environments. Its parameters allow it to be tailored to recognition of edges of differing characteristics depending on the particular requirements. The result of this edge detector produces a binary image in which the white pixels closely approximate the true edges of the original image.

IV. PROPOSED METHOD

The proposed method is as shown in Fig 1. Firstly, MRI images are taken in PNG format that is Portable Network Graphics. After that noise is eliminated because noise is the result of errors in the image acquisition process that results in pixel values that do not reflect the true intensities of the real scene. So for that wiener filter is used. If directly watershed is applied on the image then there is a problem of over segmentation, so for that foreground objects are marked by using morphological technique “opening by reconstruction” and background is marked by using grey thresholding technique so as a result a binary image is obtained. After that compute the watershed transform on the image obtained in the above step and display the resulting label matrix as an RGB image. After that foreground image, complement binary image and watershed segmented image are superimposed on each other. Apply morphological operations in which ‘strel’ i.e. structuring element of disk shaped is taken with some size and applied on the binary image for extracting the tumor from image. The tumor obtained in the above step is having not exact edge, so for that canny edge based detection method is used. Finally the watershed image is superimposed on the canny image and at last higher intensity portion is obtained as white color which is only the tumor portion of image.

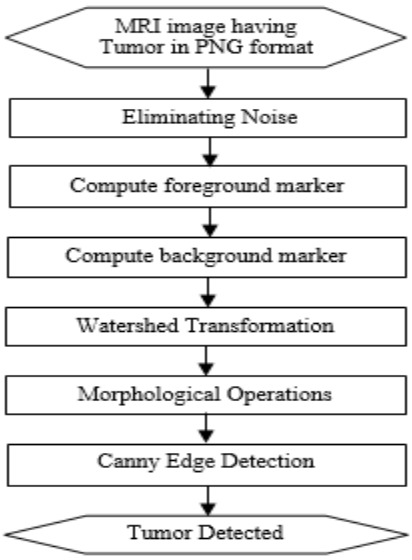
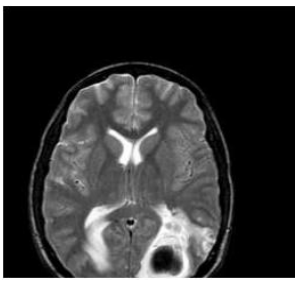
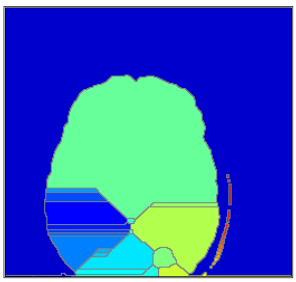
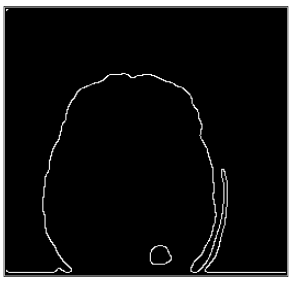
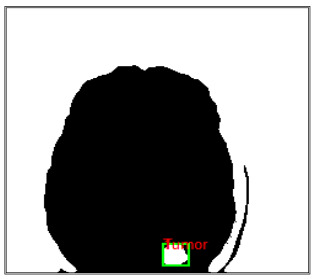
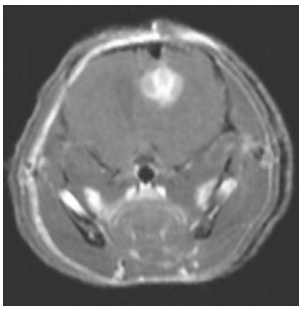
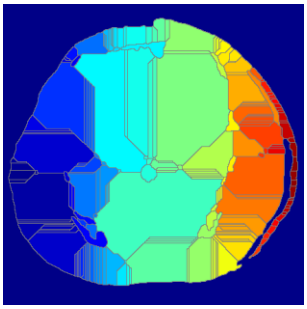
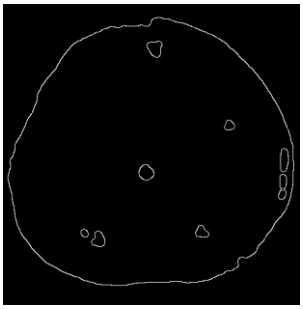
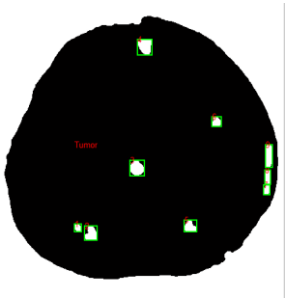
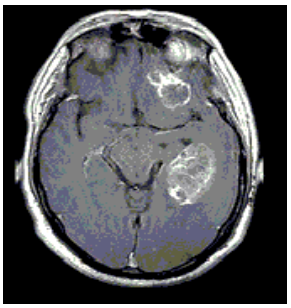
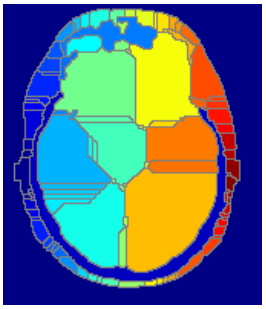
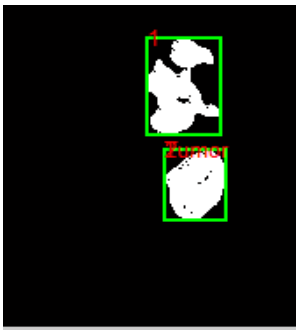


Fig. 1 Proposed Method

V. EXPERIMENTAL RESULTS

Several images were taken and the above proposed method was applied on those images and results were obtained which are shown as in TABLE I. Results show that the tumor portion obtained was accurate and the edges were clear.

TABLE I
Experimental Results of Proposed Method

Original Image	Segmented Region by Watershed method	Canny Edge Detection Image	Watershed Segmented Image and Canny Edge Detection Image Superimposed
			
			
			

VI. CONCLUSION

Traditionally, segmentation is performed manually in clinical environment that is operator dependent and very tedious and time consuming labor intensive work. However, automated tumor segmentation in MRI images poses many challenges with regard to the characteristics of image. There are several methods by which tumor can be detected, but there are some drawbacks of the existing methods. They all have their related limitations which are described throughout the literature survey. These all are the research aspects to be further explored. Here this work overcomes the problems held in detection of tumor. For this a hybrid approach i.e. combination of watershed segmentation and canny edge detection method can be used which provide effective extraction of tumor in MRI images and also enhance the performance.

Future enhancement includes carrying out work on different MRI images.

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