Integration of segmentation techniques to detect cyst in human brain using MRI sequences.

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Abstract: The main objective of this paper is to present an analytical method to detect lesions (cysts) in digitized MRI data. Segmentation techniques are applied on different sequences of MRI images (T1&T2) which helps to differentiate between malignant region from normal region in the given original image. The abnormal part is captured in the JPEG format. The segmentation of the image is then used to detect the part of the image which depicts abnormalities more accurately. The proposed algorithm helps the radiologists to take primitive measures for diagnosis. An efficient method by integrating thresholding and canny edge detector has been explained in this paper. This process requires very less time and hence the method can detect the cyst in the early stage more accurately. Time complexity of the advanced segmentations is also discussed in this paper.

Keywords: Canny edge detection, MRI, Segmentation, Thresholding.

I. INTRODUCTION

Analyzing the size of the tumor in the early stage is the emerging topic in Digital medical imaging. MRI is the effective approach to diagnose the size and shape of the tumor in the human brain by providing more contrast to the image. Highly detailed images of tissues in the body are provided by Magnetic resonance imaging (MRI). Brain tumor detecting at an early stage requires time as it is done manually by radiologists, to overcome this problem image segmentation is required. Segmentation plays an important role in digital processing to extract features from images. In general tumors are basically classified as malignant (effect neighboring cells) and non-malignant (fixed). Segmentation classified on dissimilarities in intensity and similarity of the region. Segmentation techniques are attracting great interest in detecting cancerous cells providing accurate results for the radiologists to take suitable decision for treatment depending on size and shape of the tumor. T1enhanced, T2 weighted Flair and proton density sequences of MRI images are often used for the analysis of tumor detection. Segmentation techniques like edge detection, thresholding, region based, clustering are applied to detect the tumor. Boundaries of an image are characterized by the edges which occur between various regions in an image and provide information about features of image depending on the intensity values in gray or binary digitized data. Intensity changing at different points describes an edge point which helps in segmentation analysis. Threshold segmentation is the simplest segmentation technique in which image is analyzed depending on the selected threshold with respect to abrupt changes in intensities of pixel value of the image. Thresholding technique is based on the features of the image. Edge detection identifies the discontinuities in an image. Canny edge detector is less immune to noise and detects sharp edges which makes it more efficient compared to Sobel based. In this paper by combining two different segmentation techniques using MRI images to detect the cyst (tumor) at the early stage in Matlab tool.

The paper is organized as follows: The proposed method is described in section II. Experimental results are provided in section III. Conclusion and future scope are shown in section IV and section V respectively. Also at the end Acknowledgement for the support has been included.

II. PROPOSED METHODOLOGY

. The proposed method consists of two segmentation algorithms. The sequence of operations is carried out for detection of tumour area in MRI images of brain shown in Fig. 1.

1. Firstly, a different sequence of MRI images is applied for the processing.
2. Segmentation of tumor will be tested by applying Global thresholding algorithm.
3. The threshold output will be fed to canny detector to detect the boundaries accurately.

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4. Canny edge detector detects sharp edges which help in identifying exact location of tumor in the image.

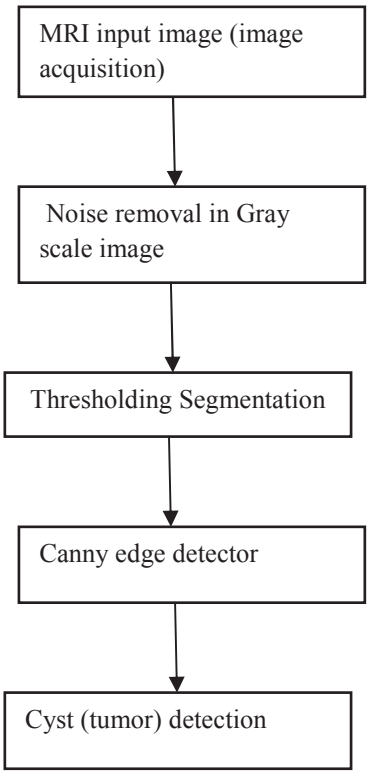


Fig. 1.Steps for tumor detection

A. Image Acquisition

Standard database for MRI images will be considered for the research. Further these images are processed to detect the tumor accurately.

B. Image pre-processing

Image is enhanced by removing the noise using median filter which helps in extracting the necessary information about the image. Median filter works by moving through the image pixel by pixel, replacing each value with the median value of neighbouring pixels.

The pixel is calculated by first sorting all the pixel values from the pattern of neighbours into numerical order, and then replacing the pixel being considered with median pixel value. Median filter is better able to remove noise without reducing the sharpness of the image. Fig. 2 shows the original image containing noise and Fig. 3 is the result of the noise removal using median filter. Among various types of filter about 80% of noise is because of Gaussian noise and salt and pepper noise. To remove noise in the image, median filter is best suitable. Thus noise removal is made with the help of median filter. Median filter removes the outlier without reducing the sharpness of the image. Hence provides better result in MRI brain for noise removal.

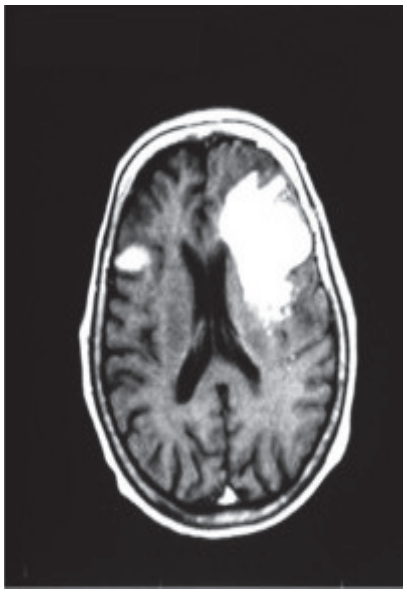


Fig. 2.Original MRI image

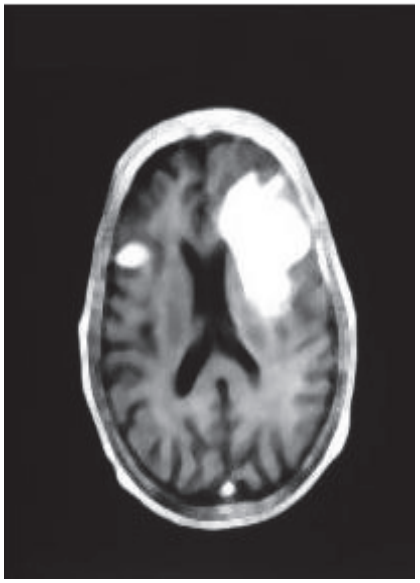


Fig. 3.Image after median filter

C. Thresholding

The simplest approach for segmenting an image is by using thresholding. If intensity of the pixel is above the threshold value is considered as white part and intensity of the pixel is below the threshold value is treated as black part. Each pixel in the image is compared with the threshold value. The pixels are partitioned depending on their intensity value.

D. Canny Edge

The binary image is applied for the canny edge detector for further processing to detect the tumor edges. Sobel masks is incorporated to detect the edges of image which is obtained by calculating gradient magnitude and suppression is performed to suppress the less amplitude below constant value using hysteresis and finally double thresholding is used to get the edges of an image by improving signal to noise ratio and detects image well even in noisy conditions. Canny edge detector detects sharp edges which help to detect the area of tumor.

III. SIMULATION AND RESULTS

The proposed method is simulated in MATLAB. The noise in an image is removed by using Gaussian filter as shown in Fig. 3. Noisy image is given to the thresholding segmentation and results are shown in Fig. 6 concerned to the region of interest and the output is fed as the input to the canny edge detection and results are shown in Fig. 9. The area of tumor is clearly visible from the images which help the radiologists to visualize the detected part for performing surgery. Integrating two segmentation techniques provides better results. The proposed method can be used to detect any tumor present in the body or can detect any carcinogenic diseases. The proposed algorithm is tested for 10 different images.

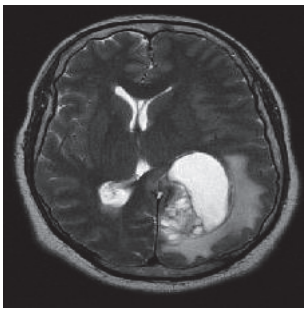


Fig. 4.MRI T2 sequence

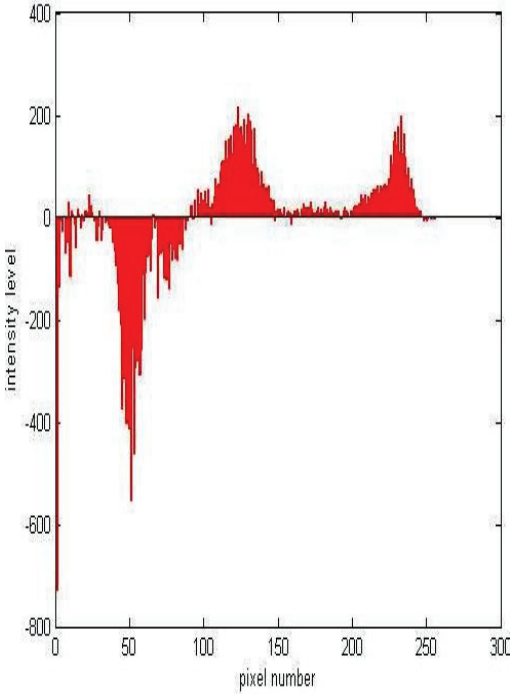


Fig. 5.Histogram thresholding

Fig. 6.Image after thresholding

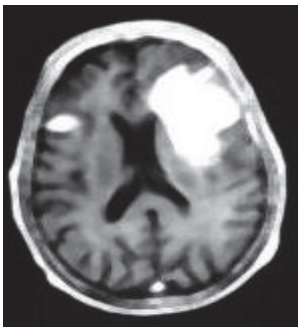
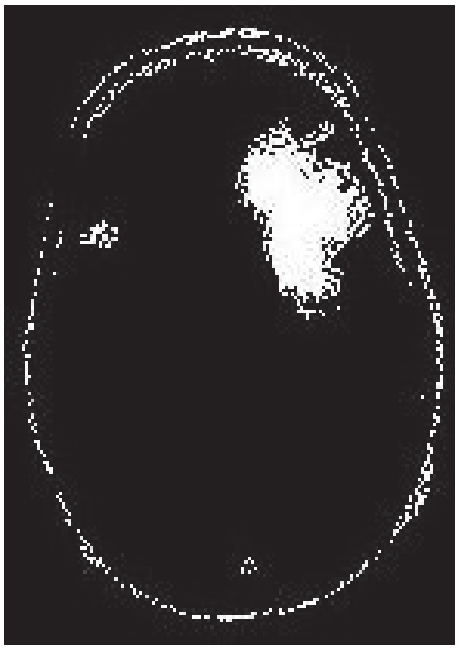


Fig. 7.MRI T1 sequence



. Fig. 8.Image after Global thresholding

IV. CONCLUSION

The proposed method would be able to detect the tumors at an early stage considering the effects of computational techniques for segmentation and analysis. Tumor information is extracted from MRI image which helps in integrating two algorithms to provide good results in terms of time complexity and code complexity which will help radiologists to take primitive measures for diagnosis and treatment. In this work an attempt has been made to integrate two different segmentation algorithms namely threshold segmentation and canny edge detection to yield accurate results using different sequences of MRI images.

V. FUTURE WORK

The proposed technique can be modified for integration of other segmentation techniques which would provide efficient results and would be helpful for diagnosing other cysts in other parts of the body at the early stage with accurate results.

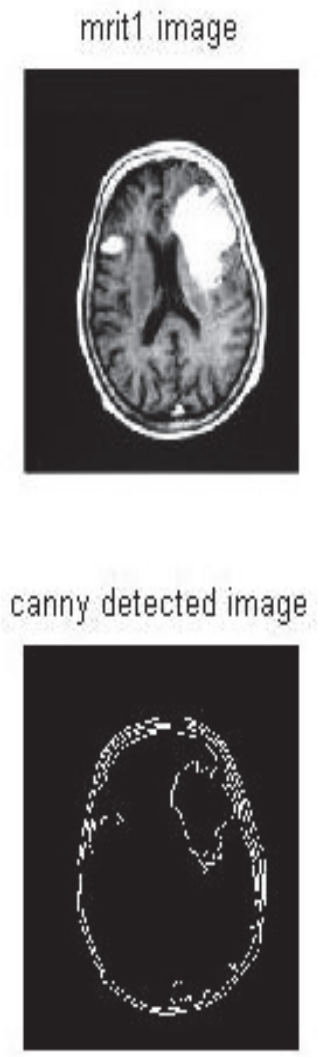


Fig. 9.Tumor detected image

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