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BRAIN TUMOR DETECTION AND SEGMENTATION BY USING THRESHOLDING AND WATERSHED ALGORITHM

Roshan G. Selkar
PG Scholar,
Electronics and Communication,
S.D. College of Engineering,
Selukate, Wardha, India

Prof. M. N. Thakare
Assistant Professor (Sr. Gr.),
Electronics and Telecommunication Engineering,
Bapurao Deshmukh College of Engineering,
Sevagram, Wardha, India

Abstract— This Paper Present the detection and segmentation of brain tumor using watershed and thresholding algorithm. Brain tumor segmentation in magnetic resonance imaging (MRI) has become an emergent research area in the field of medical imaging system. Brain tumor detection helps in finding the exact size, shape, boundary extraction and location of tumor. The system is consist of three stages to detect and segment a brain tumor. An efficient algorithm is proposed for tumor detection based on segmentation and morphological operators. Firstly quality of scanned image is enhanced and then morphological operators is applied to detect the tumor in the scanned image. After that edge detection operator is applied for boundry extraction and to find the size of the tumor.

Keywords — Brain Tumor, Edge Detection Operator, MRI, Segmentation.

I. INTRODUCTION

Digital image processing is vast fields which can be using various applications. Which include Detection of criminal face, figure print authentification system, in medical field, object recognition etc. Brain tumor detection plays an important role in medical field. Brain tumor detection is detection of tumor affected part in the brain along with its shape size and boundary, so it useful in medical field.

Recent techniques achieved in researches for detection of brain tumor can be broadly classified as

1. Histogram based method.
2. Morphological operation is applied to MRI images of brain.
3. Edge base segmentation and color base segmentation.
4. Cohesion self merging based partition K-mean algorithm.

Brain tumor detection can be done gray as well as color image researches in the field is still going on but remarkable result is not achieved until now.

Accurate measurements in brain diagnosis are quite difficult because of diverse shapes, sizes and appearances of tumors. Tumors can grow abruptly causing defects in neighboring tissues also, which gives an overall abnormal structure for healthy tissues as well. In this paper, we will develop a technique of 3D segmentation of a brain tumor by using segmentation in conjunction with morphological operations.

1.1 Types of TUMOR

Tumor

The word tumor is a synonym for a word neoplasm which is formed by an abnormal growth of cells Tumor is something totally different from cancer.

There are three common types of tumor:

1) Benign
2) Pre-Malignant
3) Malignant

Benign Tumor

A benign tumor is a tumor is the one that does not expand in an abrupt way; it doesn't affect its neighboring healthy tissues and also does not expand to non-adjacent tissues. Moles are the common example of benign tumors.

Pre-Malignant Tumor

Premalignant Tumor is a precancerous stage, considered as a disease, if not properly treated it may lead to cancer.

Malignant Tumor

Malignancy (mal- = "bad" and -ignis = "fire") is the type of tumor, that grows worse with the passage of time and ultimately results in the death of a person. Malignant is basically a medical term that describes a severe progressing disease. Malignant tumor is a term which is typically used for the description of cancer.

1.2 Magnetic Resonance Imaging (MRI)

MRI is basically used in the biomedical to detect and visualize finer details in the internal structure of the body. This technique is basically used to detect the differences in the tissues which have a far better technique as compared to

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computed tomography. So this makes this technique a very special one for the brain tumor detection and cancer imaging. [1]

II. DESIGN ISSUE

- Segmentation of brain tumor based on Watershed and thresholding .
- Detection of brain tumor.
- Boundry Extraction of Tumor.
- Size of Tumor.

2.1 Segmentation of brain tumor based on Watershed and thresholding

The watershed and thresholding algorithm techniques are useful for segmentation of brain tumor. Image segmentation is based on the division of the image into regions. Division is done on the basis of similar attributes. Similarities are separated out into groups. Basic purpose of segmentation is the extraction of important features from the image, from which information can easily be perceived.

Threshold Segmentation: Threshold segmentation is one of the simplest segmentation methods. The input gray scale image is converted into a binary format. The method is based on a threshold value which will convert gray scale image into a binary image format. The main logic is the selection of a threshold value for segmentation. We choose a single threshold value from the image using histogram. An image histogram is a type of histogram that acts as a graphical representation the tonal distribution in a digital image. It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance.

Watershed segmentation is one of the best methods to group pixels of an image on the basis of their intensities. Pixels falling under similar intensities are grouped together. It is a good segmentation technique for dividing an image to separate a tumor from the image Watershed is a mathematical morphological operating tool.

2.2 Detection of Brain Tumor

After applying Watershed and thresholding segmentation we get a high intensity portion from whole image and this portion is called tumor. This portion contains only high intense pixels and its showing with totally white portion.

The stages of detection of brain tumor are shown in following figure.

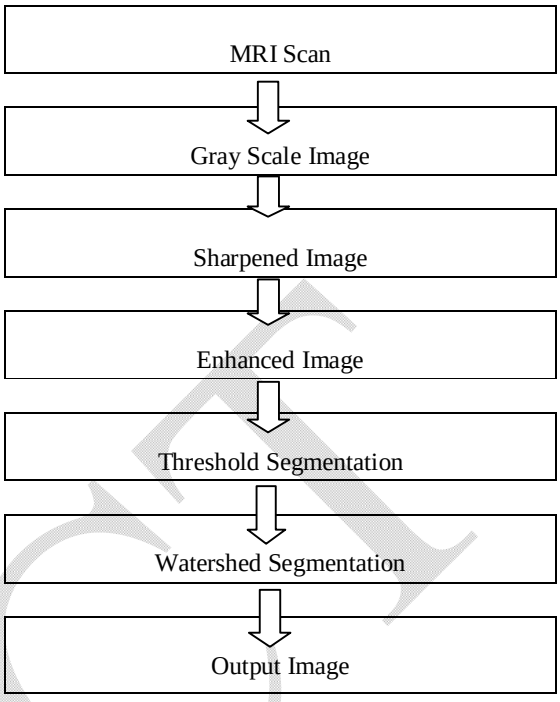

Fig 1 : Stages of Tumor Detection

In this way first we are taking MRI scan image after that we are taking Gray Scale image then sharpening and Enhancing the image for removing noise from the Image. Finally applying the Threshold Segmentation and Watershed Segmentation for tumor detection from the whole image and we get tumor detected image.

2.3 Boundry Extraction of Brain Tumor

Boundry Extraction of Brain tumor is the third part of our research, Edge based segmentation is the most common method based on detection of edges i.e. boundaries which separate distinct regions. For brain tumor boundry extraction various edge detection operators are used which are prewitt edge detection, canny edge detection operator and robert edge detection operator. In this part we are finding only boundry of tumor which we are getting from thresholding segmentation.

2.4 Shape and Size of Brain Tumor

The finding shape and size of brain tumor is the last part of our research, Once's we are getting the boundry of the tumor, from that we can easily decide the shape of the tumor. If we are getting circular boundry then its shape is circular and so on. After that we are finding the size the brain tumor, it is measured in the matrix form (m*n).

Corresponding Author: Mr. Roshan G. Selkar, S.D. College of Engineering, Selukate, Wardha, India.

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III. EXPERIMENTAL OUTCOMES

Firstly the input image is shown here, Fig 2 shows input images which has brain tumor. Threshold segmentation is applied on this image which contains brain tumor. The result is shown in the Fig 3.

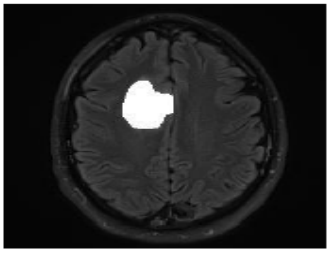

Fig 2 : Input Brain Image

In the following figure white spot is shown, which is the result of threshold segmentation applied on the images. This is basically the area with the intensity values higher than the defined threshold. High intensity areas mostly comprises of tumors. So through threshold segmentation we can specify the location of tumor.

Fig 3 : Threshold Segmentation

Then there is a technique called watershed segmentation which is applied on the resulted image obtained after threshold segmentation. After applying watershed algorithm we detecting tumor from the image and showing in below, but resultant image give small size of tumor as compared to the input image and the threshold algorithm give an efficient result of tumor detection, so we are considering result which is getting from thresholding algorithm for further part of our research.

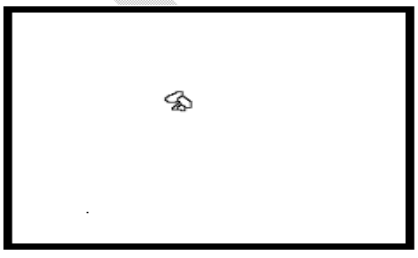

Fig 4 : Watershed Segmentation

One's we are getting tumor from thresholding algorithm then we are going to boundry extraction of brain tumor. Basically we are applying edge detection operator such as prewitt, canny and sobel operator are used and result from this three operator are shown in below. As seen these three result, canny edge detection operator gives an efficient of boundry extraction of brain tumor.

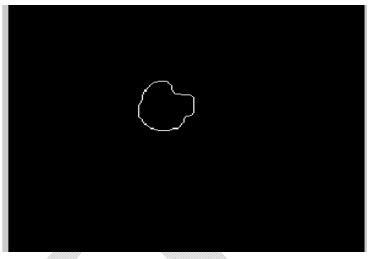

Fig 5 : Prewitt Operator

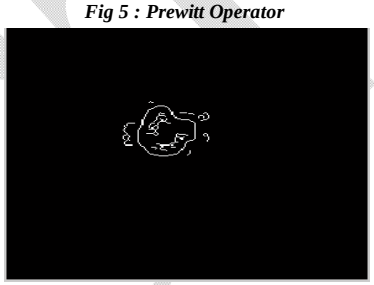

Fig 6 : Canny Operator

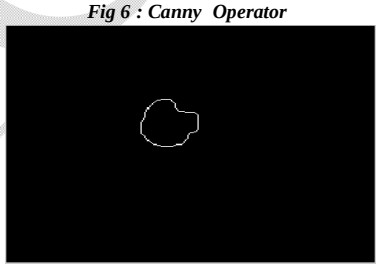

Fig 7 : Robert Operator

Now, for findinding the shape and size of brain tumor we are taking the result of boundry extraction which is given from canny edge operator, from this boundry we can decide the shape of tumor. After finding shape we are finding size of brain tumor in the matrix form (m*n), the result is showing in below along with size of the tumor.

Fig 8 : Shape and Size of tumor

Name	Size	Bytes	Class
aa	64x56	3584	uint8

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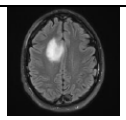
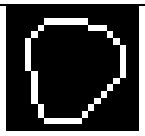
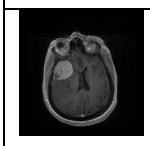
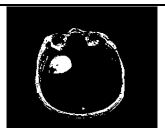
Table 1 : Result from Different Images

Input Image	Tumor Detection	Boundry Extraction	Size (m*n)
			Name aa Size 64x56 Class uint8 Bytes 3584
			Name bb Size 116x87 Class uint8 Bytes 10092
			Name cc Size 21x22 Class uint8 Bytes 462
			Name dd Size 47x44 Class uint8 Bytes 2068

IV. CONCLUSION

This paper describes Brain tumor detection, Segmentation by Using Watershed and thresholding algorithm and describes the comparative study about the tumor detection. Achieved results are shown in upper section which shows the efficient tumor detection by using thresholding algorithm rather than watershed algorithm and also finding the boundry extraction of tumor by using canny edge detection operator. Shape and Size of tumor is described.

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