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DETECTION OF BRAIN TUMOR USING THRESHOLDING AND MORPHOLOGICAL OPERATIONS

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ABSTRACT

This paper aims to locate the tumor in brain. A computer based diagnosis is suggested in order to detect the Tumor from the given Magnetic Resonance Image(MRI). Many methods are available for detection of brain tumors like watershed segmentation, gradient operators, thresholding techniques, wavelet transforms and morphological operations. In this paper for extracting the tumor region, morphological operations along with thresholding technique is applied. The proposed method is compared with existing algorithm to check the efficiency of this method. Better result is achieved by this proposed method.

KEYWORDS

benign, malignant, morphological operators, mri, thresholding.

1. INTRODUCTION

Now a days, one of the main cause for increasing mortality among children and adults is brain tumor. It has been concluded from the research of most of the developed countries that number of people suffering and dying from brain tumors has been increased to 300 per year during past few decades.

A brain tumor is an abnormal growth of cells within the brain, which can be cancerous or non-cancerous (benign). It is generally caused by abnormal and uncontrolled cell division, normally either in the brain itself, in the cranial nerves, in the brain envelopes, skull, pituitary and pineal gland, or spread from cancers primarily located in other organs (metastatic tumors). Brain tumors are of two types: primary and secondary. Primary brain tumors include any tumor that starts in the brain. Primary brain tumors can start from brain cells, the membranes around the brain, nerves, or glands. Primary brain tumors are classified as: a) benign; b) malignant.

Benign tumors can be removed, and they seldom grow back. Benign brain tumors usually have an obvious border or edge. They don't spread to other parts of the body. Malignant brain tumors are generally more serious and often are a threat to life. They are likely to grow rapidly and crowd or invade the nearby healthy brain tissue. Cancer cells may break away from malignant brain tumors and spread to other parts of the brain or to the spinal cord. They rarely spread to other parts of the body.

As brain tumor detection is a very time consuming process which is done by medical experts. So to tackle this issue many segmentation techniques are developed by the image processing experts. Many of these techniques are not properly defined rather they are ad hoc techniques. Segmentation is the process where an image is divided into the different regions on some similarity bases. Basic function of the segmentation is that we can easily extract information and different features from the images. Image segmentation plays a critical role in all advanced image analysis applications, a key purpose of segmentation into divide image into regions and objects that correspond to real world objects or areas, and the extent of subdivision depends on requirements of specific application.

There are many segmentation techniques, mostly based on similarity or discontinuity. Threshold Segmentation is a kind of similarity based segmentation. In this paper threshold segmentation along with morphological operators is used for detecting the tumor and after that area is calculated in pixels.

2. RELATED WORK

In this section, a brief review of the literature is presented. A good amount of literature related to the application of segmentation techniques for brain tumor detection is available. Tumor detection using watershed and thresholding techniques is provided in Anam Mustaqeem et al [1], Sudipta Roy et al [6] and Saptalkar et al [2]. Authors Pratibha Sharma et al [4], have presented an efficient algorithm for detecting the edges of brain tumor using watershed and morphological operators obtained through MRI scanning. The clustering technique have been comprehensively explored and used in Logeswari and Karnan [5], a clustering support come close to using a self organizing map (SOM) algorithm is projected for medical image segmentation. Segmentation using gradient operators is suggested in Nag et al [3].

3. METHODOLOGY

The proposed method uses threshold segmentation and morphological operations. The colored image is converted to gray and then using random thresholding it is converted to binary, where the tumor gets separated from other components of image due to concentration, intensity differences. Then using morphological operations like erosion and dilation, other than tumor all other components are removed. The methods imerode and imdilate of MATLAB is used for doing it and structuring element is generated using strel('disk',3). The method is divided into two algorithms one for detecting the tumor and other for calculating the area. The area is calculated in pixels.

3.1 METHODS USED

3.1.1 Threshold Segmentation: Threshold segmentation is one of the segmentation methods. Thresholding is the commonly used enhancement technique used for segmenting an image into object and background. A threshold value is computed above (or below) which pixels are considered "object" and below (or above) which "background" and eliminates unimportant shading variations. 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. Some common methods used under this segmentation include maximum entropy method and k-means clustering method for segmentation. We are using random thresholding technique.

3.1.2 Morphological Operations: Morphology is a technique of image processing based on shapes. The value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbors. By choosing the size and shape of the neighborhood, you can construct a morphological operation that is sensitive to specific shapes in the input image. Morphologic operations are especially suited to the processing of binary images and grayscale images.

Dilation and erosion are two fundamental morphological operations. Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. Dilation is the process in which the value of the output pixel is the maximum value of all the pixels in the input pixel's neighborhood. In a binary image, if any of the pixels is set to the value 1, the output pixel is set to 1. Erosion is the process in which the value of the output pixel is the minimum value of all the pixels in the input pixel's neighborhood. In a binary image, if any of the pixels is set to 0, the output pixel is set to 0.

3.2 ALGORITHM FOR TUMOR DETECTION

- Step 1: Read the image.
- Step 2: Convert image to gray.
- Step 3: Resize the image .
- Step 4: Take a random threshold value.
- Step 5: Apply random thresholding on the image.
- Step 6: Generate a structuring element using strel('disk',3).
- Step 7: Using the structuring element first perform erosion using imerode() on the image.
- Step 8: Next perform dilation using imdilate() on the image.
- Step 9: Resultant image displays only the tumor.

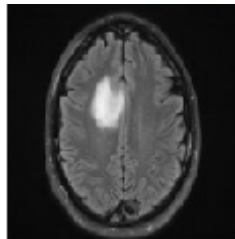
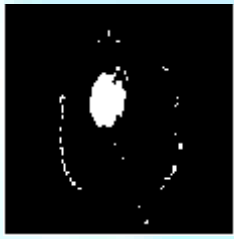

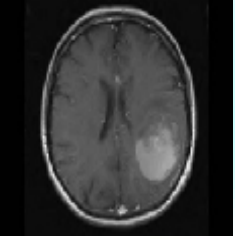
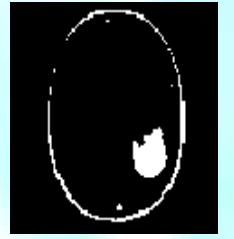

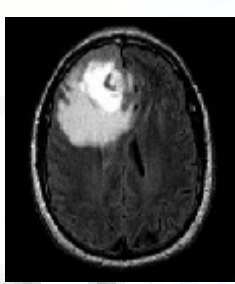

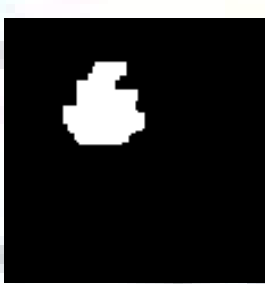



3.3 ALGORITHM FOR CALCULATION OF AREA(INPUT - THE TUMOR DETECTED IN THE ABOVE ALGORITHM)

- Step 1: Read the image
 - Step 2: area=0
 - Step 3: Compare current pixel if equal to 255 then area=area+1
 - Step 4: Repeat Step 3 till last pixel of the image.
 - Step 5: Print area
- This gives the area of the tumor.

4. RESULTS

The method is applied on many images and some of them are shown in the form of a table here. The name of the image, original image, image after thresholding, the effect of morphological operation and the area in pixels is being displayed. For uniformity all images are resized to 100x100 and then area of the tumor is calculated.

TABLE 4.1 SHOWING IMAGES OF BRAIN WITH TUMOR ALONG WITH AREA IN PIXELS

IMAGE NAME	ORIGINAL IMAGE	AFTER THRESHOLD	MORPHOLOGICAL OUTPUT	AREA IN PIXELS
IM1				250
IM2				228
IM3				670
IM4				120

5. CONCLUSION

This work was done to detect brain tumor using medical imaging techniques. The technique used was segmentation, which is done using a method based on threshold segmentation and morphological operations. The proposed method was experimented with MRI scanned images of human brains for locating tumor in the images. Human brains MRI images were taken, converted to gray images and then using thresholding converted to binary, highlighting the tumor. After this morphological operations were applied to get the tumor separated from rest of the components of the image, then area of the tumor in pixels was calculated. The proposed method has given efficient end results.

Future work is to extend the proposed method for color based segmentation and 3D images.

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