

Detection of Brain Tumor from MRI Images Using MATLAB

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Abstract – cancer which results from a breakdown of regulatory mechanism that govern normal cell behaviour which ultimately leads to death. Cell division is a highly regulated process, with a balance being maintained between production of new cells and cell death in most of the tissues and organs. cancer cells however proliferate in an unregulated manner and give rise to clones of cells that can expand to a considerable size and are called **Tumor**. Medical image processing is a technique which gives visual representation of any part of the body and processing of images which are scanned through the magnetic resonance imaging are the part of it. Nowadays, for processing of image, Segmentation is widely used. In the same way Magnetic Resonance Imaging gives the analysis of brain tumor images. Detection and removal of tumor is one of the medical issue that still remains challenging in the field of medicine. Early imaging techniques like pneumoencephalography and cerebral angiography had the drawback of invasive and hence these days, the CT and MRI imaging techniques help the surgeons to provide a better vision. In this paper, tumor image processing having mainly three stages namely pre-processing, segmentation and morphological operation. In these days to extract the abnormal tissues from the normal tissues image segmentation is used in bio-medical images. A Tumor may lead to cancer, which leads to death. By using watershed segmentation with the help of gray scale image on MRI images followed by thresholding and morphological operations for detecting tumor. The affected part of the brain, tumor from MRI image is identified with the help of MatLab 2019a.

Key Words: Brain Tumor, MRI, Watershed, Threshold, Morphological Operator, MATLAB

1. INTRODUCTION

Brain is a vital organ of the body. Brain is responsible for controlling all over functioning such as memory, learning, emotions, and blood vessels. Identifying tumor affected part within brain is called brain tumor detection. Abnormal cells in brain called tumor. Unneeded cell which grows in brain may lead to death of human beings.

There are three stages of tumor:-

1. Benign.
2. Pre-Malignant
3. Malignant

Benign tumour is non-cancerous or non-malignant tumor which remains vasive to the original position of its formation. These tumor stop increasing in size after certain growth and get encapsulated in connective tissue sheath, for example warts, malignant tumors are also called neoplasms and grow rapidly, with infinite life span of the proliferating cells, and become progressively invasive. These tumours are not encapsulated and spread to other locations through blood, lymph, peritoneal cavity by phenomenon called **metastasis**. They prove fatal when they disrupt the function of some vital organs. So that, to find the tumor MRI are most commonly used. MRI is very much popular among people because, it is non-invasive. MRI helps to show the internal structure of the body which shows the comparison of normal tissues and abnormal tissues in any part of the body. In this paper MRI images are used to find the moved region in brain. It is not so much harmful for human body because there is no harmful radiation. To elite the brims which are affected in any part of human body, segmentation is widely used for better diagnosis. Doctors can identify the tumor with the help of image segmentation which helps in detection of tumor. To improve the quality of the image, extract information from image which is acquired, for this Image processing technique is widely used. In human beings, the dangerous disease which is commonly found is Brain tumor. So to find out the tumor at early stage is the goal of this, which reduces the death of patient.

1.2 Types of cancer

Cancer are categorized on the basis of the tissue of origin from where they arose. Most of the cancers tumble into one of the following categories:

- a. **carcinomas:** these types of cancers arise from epithelial tissues, such as skin or the epithelial

lining of internal organs or glands. About 85 percent of all tumors are such.

- b. **Melanomas:** these are cancerous growths of melanocytes.
- c. **Sarcomas:** these are derived from tissues of mesodermal origin, e.g., bone, fat and cartilage. They are rare in humans.
- d. **Leukemias and lymphomas:** these are tumors of hematopoietic cells.

2. Methodology: For the detection of tumor, MRI images of the brain are processed using MATLAB.

- Image Acquisition
- Pre-Processing
- Post - processing
- Tumor detection

2.1 Pre-processing: To meliorate data which is present in the image, pre-process the image by suppressing the unwanted distortions which enhances the image features which will be helpful for further processing. Pre-processing aims to remove the noise from the image and to provide Contrast Enhancement which improves quality of the image the image quality.

The functions performed by pre-processing process is:

- Gray scale conversion
- Noise removal
- Contrast Enhancement

2.2 Conversion to Gray Scale: A grayscale image only consists of gray scale values, but MRI images consist of primary colours (RGB) content. In Gray colour, the red, green and blue components all have equal. To specify the single intensity value for each pixels, Apply gray scale intensity in RGB space.

2.3 Filtering: this is the method which is used for eliminating the noise present in an image. The median filter that provides median values of the pixels are used because the mean values obtained using averaging filters results in blurring of the image.

2.4 Compute Threshold Segmentation: Nowadays threshold segmentation is the flexible and easiest method which is normally used which is based on obtaining the binary image from the gray scale image. Segmentation of abnormal tissue from the normal

tissues can be done by using threshold segmentation algorithm. For initial segmentation select a threshold value. Various methods are using for this method such as K-means clustering, Otsu's method. Representation of an image is somewhat easier to analyse the results by using K-means clustering which basically used to locate boundaries of an object.

2.5 Compute Watershed Segmentation: In this method, image is considered as a topographic surface, in which the gray level represents the altitudes. In that image region with a constant gray level constitute flat area and region edges represent high watersheds and low rise region represent catchment basis. Watershed lines represent the boundaries of the object in the image.

2.6 Post-Processing Stage: Morphological Operators like erosion and dilation. After changing the image in binary format, morphological operations like erosion and dilation methods are applied on the image i.e. binary image. The motivation of the morphological operation is to discrete the tumor in the image. Now just the tumor segment of the image is visible, which is shown with white color. Tumor region has the highest intensity in that image than the other regions of the image. Always morphological operations are applied after the watershed segmentation. In this paper, erosion which is one of the morphological operation which is applied to detect the tumor

3. Algorithm Used for Detection for Tumor:

Step 1: Input the image

Step 2: Convert the RGB image to grey

Step 3: Use the filters for removing noise for Contrast enhancement.

Step 4: Apply Watershed Segmentation for tumor detection.

Step 5: Perform morphological operations to find the tumor.

4. Implementation: the implementation of this system is as shown in Fig-1. In this method to implement the algorithm use MRI brain image as input, which gives the complete information of the tissues in the brain images other than scanned images of the brain. Firstly, we have to check this image as image with tumor region or the image without tumor region.

So that, the tumor region can be extracted from the brain image, for this, calculate the number of pixel in the tumor region. If the number of pixels are equal to zero in the tumor region, the system will displays the brain image without tumor, else it will displays the brain image with tumor region. If the image has tumor region, then this image is need to do the following steps. In the next step, the noise is removed from the image is removed using filter. Several filters are used to remove the noise. But the MRI images does not contain a lot of noise. So that average filters are used to remove the noise from those images. After the preprocessing, the image which is obtained was smoothed image which is ready to use in further step. So that this smoothed image is used to operate in the next coming step quickly. In brain image, skull stripping is needed to avoid misclassification which can be done by various methods. In this paper, to extract the skull tissues, threshold value is used for skull stripping. In the same way, firstly the brain tissues are extracted from the image and the holes will fill that image and then, the skull tissues are extracted from the filled image and the name given as skull image. After that, segmentation process is done. In the segmentation step, the brain image obtained from the skull stripping image is segmented Using watershed segmentation which uses the sobel operation to find gradient image. Using which the watershed transform is estimated. So that, the finally the segmentation map will obtained and then the tumor region is detected using morphological operation like erosion and dilation. In post-process, we will get eroded image from the segmentation map and then, the gray matter in the brain image and white matter in the brain image are extracted. At the end, the tumor region is efficiently detected from the brain image.

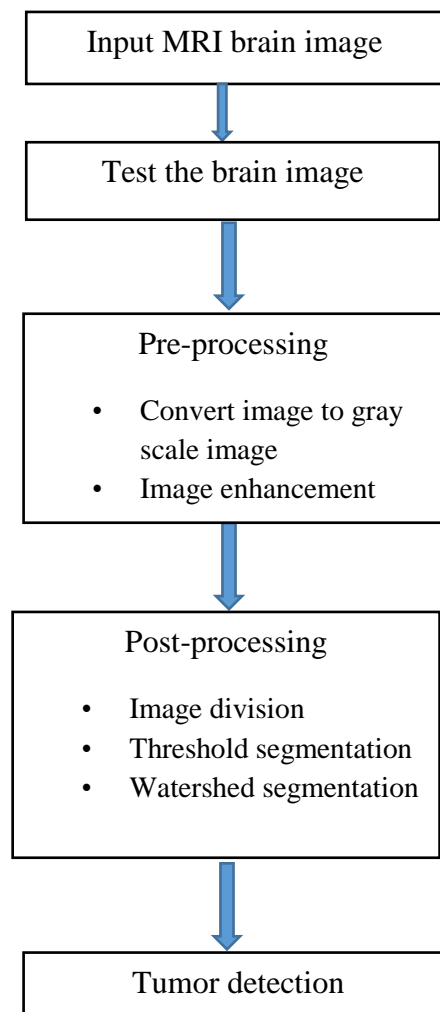


Fig-1

Sample images of Data set:

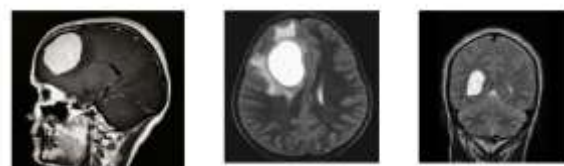


Fig. a

Fig. b

Fig. c

Results and Discussions:

Next figures show the images as an output i.e. input image, filtered image, bounding box image, threshold image, tumor outline. Finally extracted tumor from MRI image and image with tumor. For this system 3 images the intensity more than its background so it become very easy to locate tumor and Results are as follows:-

Fig.a

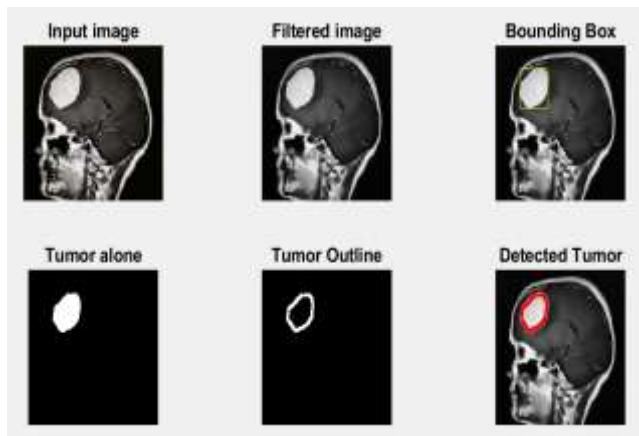


Fig.b

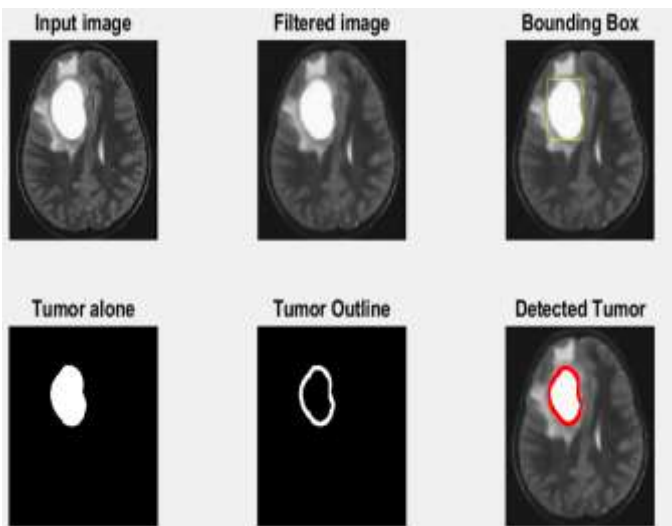
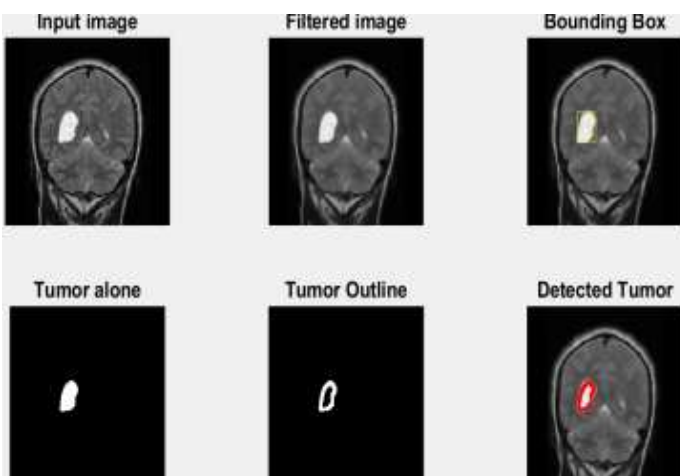

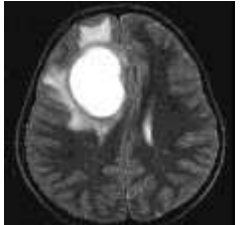



Fig.c



Results in inference Tab:

| MRI image in .jpg Format | Remarks |
|---|-------------|
|  | Tumor found |
|  | Tumor found |
|  | Tumor found |

Conclusion:

The research was done for detection and extraction of tumor from the MRI image. Manual segmentation of the abnormal tissue from the scanned images using MRI is little tricky and takes lot of time. That's why we are using automated segmentation technique which gives suitable results with less work for manual operator. So, in this paper, brain tumor is detected by the use of threshold segmentation and watershed segmentation with the help of some morphological operations. This method gives very good segmentation results and improving the accuracy, exactness and computational speed of segmentation approaches, as well as minimizing the amount of time taken for the process.

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