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Brain Tumor Detection from MRI Image using Digital Image Processing

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***Abstract:** Tumor detection and removal is one medical issue that still remains challenging in field of biomedicine. Early imaging techniques had the drawback of being invasive and hence the CT and MRI imaging technique help the surgeons in providing a better vision. In this paper, tumor image processing involves three stages namely pre-processing, segmentation and morphological operation. After the acquisition of the source image, it is pre-processed by converting the original image to gray scale in addition high pass filter for noise removal and median filter for quality enhancement is provided which is followed by enhancement stage resulting with histogramic equivalent image. Finally segmentation is done by means of watershed algorithm. The above proposed methodology is helpful is generating the reports automatically in less span of time and advancement has resulted in extracting many inferior parameters of the tumor. The present work demonstrates that method can successfully detect the brain tumor and thereby help the doctors for analyzing tumor size and region .The algorithms have been developed by using MATLAB.*

***Keywords:** Brain Tumor, MRI Image, Segmentation, Filtering*

I. INTRODUCTION

The National Cancer Institute (NCI) estimated that 22,070 new cases of brain and other central nervous system(CNS) cancers would be diagnosed in the US in 2009. The American Brain Tumour Association(ABTA) clarifies this statistic further by estimating that 62,930 new cases of brain tumors have been diagnosed in 2010. A Brain Tumor is a collection, or mass of abnormal cells in our brain. Our skull which encloses our brain, is very rigid. Any growth inside such a restricted space can cause problems. Brain tumors can be cancerous or non-cancerous. When cancerous or non cancerous tumors grow, they can cause the pressure inside or skull to increase. This can cause brain damage, and it can be life threatening. Today, most medical institutions use the World Health Organization (WHO) classification system to identify brain tumours. The WHO classifies brain tumours by cell origin and how the cells behave, from the least aggressive (benign) to the most aggressive (malignant).

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There are three common types of tumor:
[1] Benign tumour
[2] Pre-Malignant tumour
[3] Malignant tumour

[1] Benign Tumour:-A benign (non-cancerous) brain tumour is a mass of cells that grows slowly in the brain. It usually stays in one place and does not spread.The symptoms of a benign brain tumour depend on how big it is and where it is in the brain. Some slow-growing tumours may not cause any symptoms at first. Common symptoms include severe, persistent headaches, seizures (fits), persistent nausea, vomiting and drowsiness.

[2] Pre-Malignant Tumour:- A precancerous condition or premalignant condition, sometimes called a potentially precancerous condition or potentially premalignant condition, is a state of disordered morphology of cells that is associated with an increased risk of cancer. If left untreated, these conditions may lead to cancer.

[3] Malignant Tumour:- Malignant tumours are cancerous tumours, they tend to become progressively worse, and can potentially result in death. Unlike benign tumours, malignant ones grow fast, they are ambitious, they seek out new territory, and they spread (metastasize). The abnormal cells that form a malignant tumour multiply at a faster rate.

A. MRI Image:

Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body in both health and disease. MRI scanners use strong magnetic fields, radio waves, and field gradients to generate images of the inside of the body. MRI is based upon the science of nuclear magnetic resonance (NMR). Certain atomic nuclei can absorb and emit radio frequency energy when placed in an external magnetic field. In clinical and research MRI, hydrogen atoms are most-often used to generate a detectable radio-frequency signal that is received by antennas in close proximity to the anatomy being examined. Hydrogen atoms exist naturally in people and other biological organisms in abundance, particularly in water and fat.

B. Digital Image Processing:

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. Image processing basically includes the following three steps:

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(i) Importing the image via image acquisition tools;
(ii) Analysing and manipulating the image;
(iii) Output in which result can be altered image or report that is based on image analysis.

C. Steps Acquired in Digital Image Processing:-

(1) Image Acquisition:-

Image Acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. Image acquisition inimage processing can be broadly defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through whatever processes need to occur afterward. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible.

(2) Pre-processing:-

In this phase image is enhanced in the way that finer details are improved and noise is removed from the image. The first step is to get the MRI image and application of pre-processing steps. There are various methods which come under this step; we will be dealing with only grey scale and filters. Basically pre-processing is done to remove noise and blurring as well as ringing effect in order to get the enhanced and much clear image for our purpose. The filter which we have used is median filter but as we are working on image samples that are required for the medical purpose. The median filter has to be passed with mask for better image, to achieve this we are using an operator.

(3) Image enhancement:-

To improve contrast the enhancement method is needed. This approach can be used on whole image or part of an image .Contrast between the brain and tumor region may be present on a MRI but not clearly visible through eyes. Thus to enhance contrast between the normal brain and tumor region, a high pass filter is applied to the digitized and smooth the MRI which results in better and enhanced image with clearly visible contrast.

(4) Filtering:-

Filtering is a technique for modifying or enhancing an image. We can filter an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing , shaping and edge enhancement. The median filter is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the result of later processing. Filtering is a neighbourhood operation in which the value of given pixel in the output image is determined by applying some algorithm to the values of the pixels in the neighbourhood of the corresponding input pixel.

(5) Thresholding:-

Threshold segmentation is one of the simplest segmentation methods. The method is based on threshold value which will convert the gray scale image into binary format. In the threshold segmentation , there are several methods where we use local methods which adapt the threshold value on each pixel to the local image characteristics for segmentation. Some methods used under this segmentation include maximum entropy method and k-means clustering method for segmentation.

(6) Morphological operation:

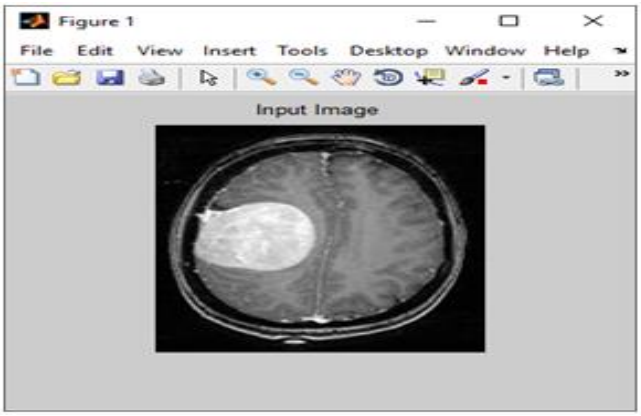
After thresholding the morphological operation is applied on the converted binary image. The purpose of morphological operation is to separate the tumor part of mage. This operation is the collection of non linear operation related to the shape or morphology of features in an image. Morphological operation on a binary image creates a new binary image in which the pixel has non-zero value only if the test is successful at that location in the input image. Only the tumor portion of image is visible. This portion has the highest intensity than other regions of the image.

II. PROPOSED ALGORITHM FOR DETECTING BRAIN TUMOR

INPUT: MRI image of human brain.
OUTPUT: Tumor portion of the image.
Step 1:- Read the input colour image of brain.
Step 2:-convert input colour image in to grayscale image.
Step 3:-Resize this image into 200*200 image matrix.
Step 4:-Filter the multidimensional array with the multidimensional filter.(pre-processing image)
Step 5:-Enhanced the filter image with median filter.
Step 6:-computes a global threshold that can be used to convert an intensity image.
Step 7:-compute the morphological operation.
Step 8:-Erode the image to get tumor portion image.

III. RESULT

In this paper the pre-processing stage performs image filtering. the median filter is used for image enhancement .it is used to remove the noise in an image .it is better than mean filter ,weiner filter, Gaussian filter. Threshold is used to convert an intensity image. on applying morphological operation erode the image to get tumor portion image. To test the effectiveness of the proposed scheme, we have tested the density based morphological brain MR image segmentation method, proposed algorithm is applied on the image.



(A) Original Image (Brain With Tumor)

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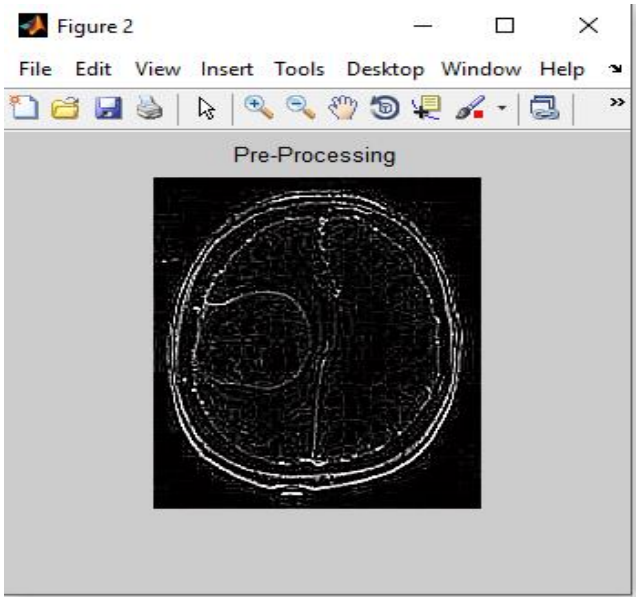
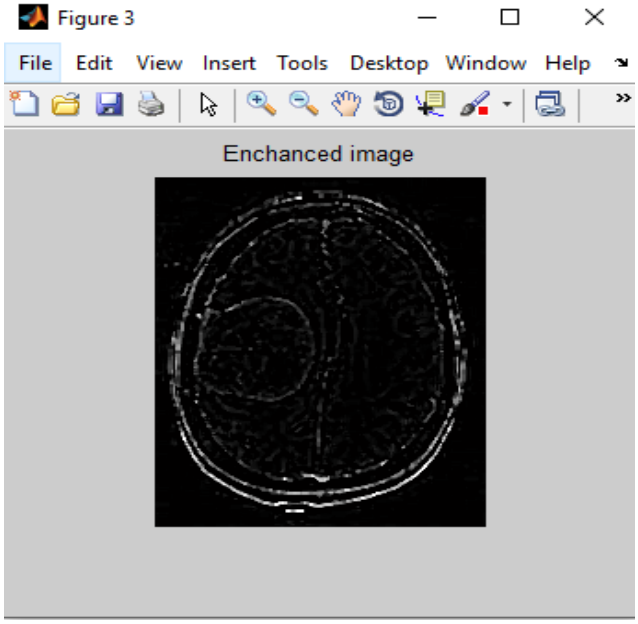
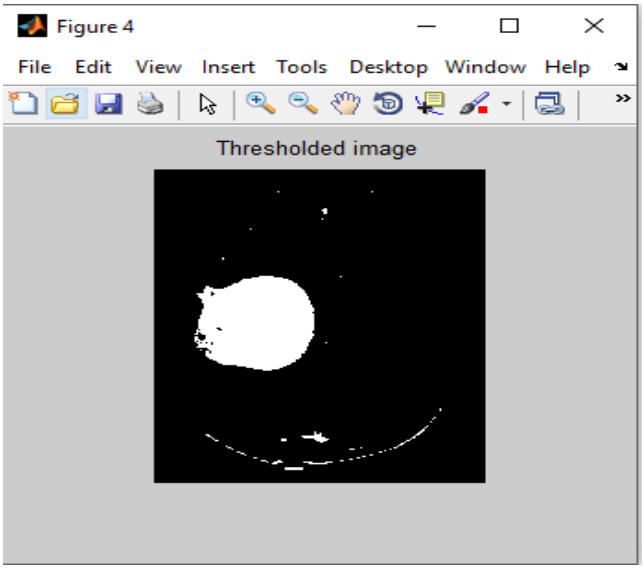


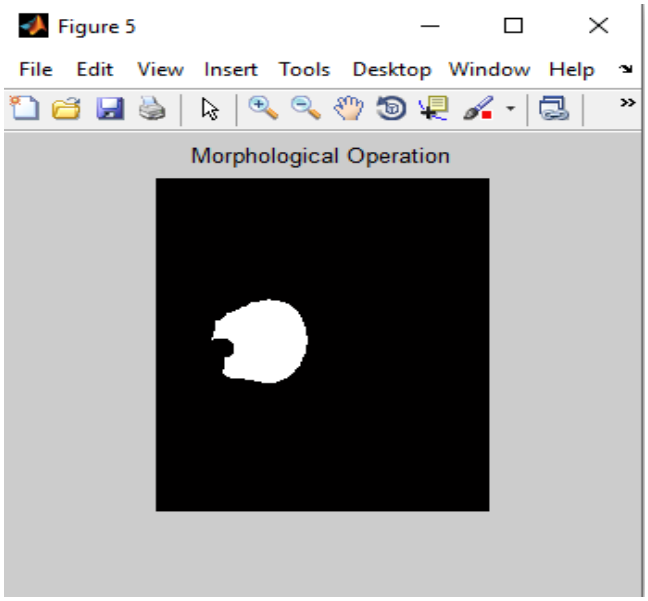
(B) Pre-Processing Image



(C) Enhanced Image



(D) Threshold Image



(E) Morphological Operation

IV. CONCLUSION

Image processing plays vital role in today's world. It has important application in biomedical field. The proposed system is developed for the diagnosing of tumour from magnetic resonance imaging pictures of the brain. This method makes the diagnosing in many phases. In the pre-processing stage filtering is performed on brain MR images. In image segmentation stage K-mean clustering method used to segment an MR image. After that texture features are extracted from gray scale MR image using GLCM method, these extracted features are given as input to artificial neural network for classifying MR image into normal and abnormal (tumorous) image.

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