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A Review on Detection of Brain Tumor with MRI Images

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Abstract

This paper includes brain tumor detection using image processing techniques. Since brain tumor affect the many people all round the world. Not only to old age persons, it will be detected in young people at the early stage as well. Brain tumor is nothing but an abnormal development of cells observed inside brain cranium which reduces the functioning of brain. Early prediction of brain tumor is successful with vast advancements in technology. Today's medical imaging facing challenges on detecting of brain tumor with Magnetic Resonance Imaging (MRI). Generally MRI images were utilized by experts to find the images of soft tissues inside human body. MRI produces rich information about soft tissue structure of human body. There were various brain tumor recognition and segmentation methods available now a days to find brain tumor with the help of the MRI Images.

Keywords: Brain Cranium, MRI

1. Introduction

The work includes detection of brain tumor. As we are having various image processing techniques to detect the tumor, since there were finite algorithms and methods available, yet there is a need to detect the tumor with the simple and efficient methods.

2. Literature Survey

Automatic segmentation method of detecting brain tumor based on CNN is discussed in (1). Preprocessing and enhancement techniques which were helpful to improve the findings of the suspicious region from Magnetic Resonance Image (MRI) is in (2). Three common approaches to segmentation commonly represented as, Boundary approach also called as thresholding technique, Edge-based approach, Region-based approach is discussed in (3). Image enhancement, clustering and Classification to detect brain tumor and different stages of detecting brain tumor includes filtering operations, edge detection algorithms, morphological operations and clustering were discussed in(4). MRI Images were extracted from MICCAI BraTS dataset and tumor is segmented with the help of image processing techniques and by using feature extraction, then fed to any algorithms is discussed in paper (5).

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3. Methodology

This work includes detection of tumor by using Thresholding technique and also by using watershed algorithm. The detected tumor is compared on the two methods. The first method, Thresholding technique which converts every pixel into black or white or no change which in-turn depends on the original color value is in the threshold range or not. Moreover, thresholding technique is a natural way to separate an image into some regions. The general steps followed in order to extract various features were, Input MRI Image, Pre-Processing and Enhancement, Image segmentation and Feature extraction.

Image Pre-Processing is used to improve the detecting region well. Noise image can be de-noised by using gray scaling. rgb2gray converts RedGreenBlue values into Gray scale. Enhancement of the image to a particular size can be viewed to look better.

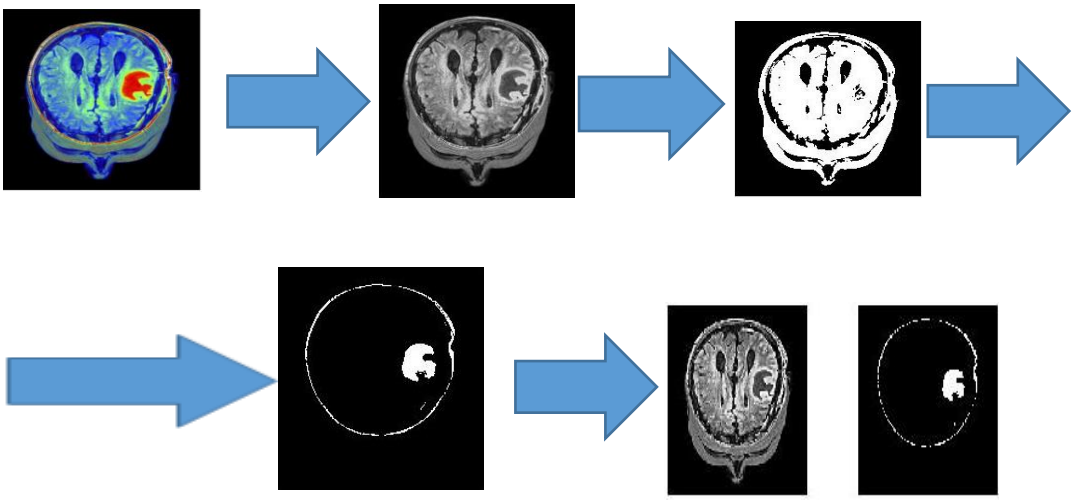
After Preprocessing, the image need to verify to differentiate tumor. Keeping the threshold value between 0 and 1 as it is a segmentation method. Its Gray Value remapping method, if R is assumed as an operation and represented as

$$R(X)=0 \quad \text{if } X<t$$
$$1 \quad \text{if } X>t$$

Where X is the gray value and t is threshold value. Here in this thresholding method, the gray image converted in to a binary image and the image is at last segmented in to two values 0 and 1. The processed image is compared to input sample and if the tumor persists, that is highlighted with a white color.

The general Thresholding technique includes reading of an image from a particular folder. After that we need to resize it to get a better quality of the MRI Image. Then converting into gray scale image to remove the unwanted part. After conversion, we need to evaluate the binarized image in between 0 and 1. With the help of sharpening function, make it to noise free. Apply some functions available in MATLAB as per the required operation and at last we detected the portion of tumor. Some of the special functions and its functions used in this thresholding technique. imread()- reads a gray scale image or color image, imshow()- displays the image in figure, imresize()-

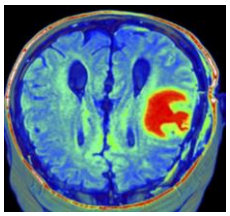
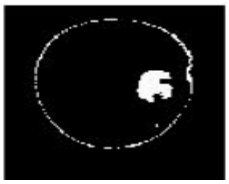
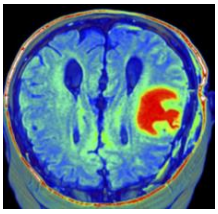
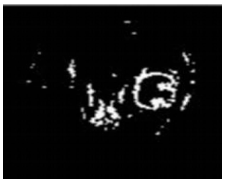
returns image that has no.of rows and columns specified by two element vector, rgb2gray()- returns a gray image with reducing hue and saturation of rgb image, imbinarize()-creates a binary image from gray scale, bwareaopen(), imsharpen()-control the aspects of unsharp masking, im2bw()-comparision of input file in the range specified, logical(bw)-converts a numeric value to a logical in array, regionprops(,'solidity','area')-returns measurments, Density=[stats.solidity]- solidity area fraction of the region as compared to convex hull, Area('vector')-plots each column in matrix vector as seperate curve and stacks the curve, max()-returns the max elements of the array, ismember()-returns an array containing logical 1 where data in lable is found in tumor lable, strel()- creates a structure element with the specified distance from the origin, imdilate()-returns the dilated image, boundaries



The second method to detect portion of a tumor will be watershed algorithm. In this method, at first we need to read the image from the desired folder and then we need to do gray-scaling and applying pre-processing techniques. After that we need to apply HPF and median filter to improve the image quality. Segmentation is done with the help of watershed algorithm and atlast we need to apply morphological operations. Then atlast we will find the portion of tumor. The high pass filter used here enhances edges, differentiate neighborhood digital numbers.

4. Comparison Results

Thresholding Technique	Watershed Algorithm
1. Operation is simple yet powerful	1. It's a morphological gradient dependent technique.
2. Main logic is the selection of a threshold value.	2. Morphological operations targets the dimensions of image in order to determine the output figure.
3. The basic step is to convert the image to binary which reduces the complexity of data and simplifies the process of recognition.	3. Pixels falling under similar intensities are grouped together.

4. Best Results: Tumor is absolutely detected. Edges resemble to the portion of the tumor	4. Average results: good localization in the brain tumor. But here, edges are not fully matched.
Input Image  Output Image 	Input-Image  Output Image 

5. Conclusion and Future Scope:

In this work, two methodologies are examined and analyzed using individual segmentation approach with the help of matlab coding. Extraction of tumor location is achieved with the developed MATLAB code. There may be many types of algorithm codes for brain tumor detection, but thresholding gives the best output results comparatively. In future many novel algorithms for segmentation and classification of brain tumours were implemented by including additional features information which makes the system more sensitive.

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