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Image Processing Techniques on Brain Tumour Detection

Bhuvaneshwari M, Leena Prema Kumari

Fatima college Autonomous,Madurai , India

ABSTRACT:

Brain tumor is a life-threatening problem and hampers the normal functioning of the human body. For proper diagnosis and efficient treatment planning, it is necessary to detect the brain tumor in early stages. Digital image processing plays a vital role in analysis of medical images. Segmentation of brain tumor involves separation of abnormal brain tissues from normal tissues of brain. In the past, various researchers have proposed the semi and fully automatic methods for detection and segmentation of brain tumor. In this article, the different techniques available for segmentation have been presented. This article focuses on the work done by many researchers in the past to partially or fully automate the job of segmenting the brain tumor. Simplicity and degree of human supervision decides the clinical acceptance of a particular segmentation technique.

INTRODUCTION:

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. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

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

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

Purpose of Image Processing:

The purpose of image processing is divided into 5 groups. They are:

Visualization- Observe the objects that are not visible.

Image sharpening and restoration - To create a better image.

Image retrieval- Seek for the image of interest.

Measurement of pattern – Measures various objects in an image.

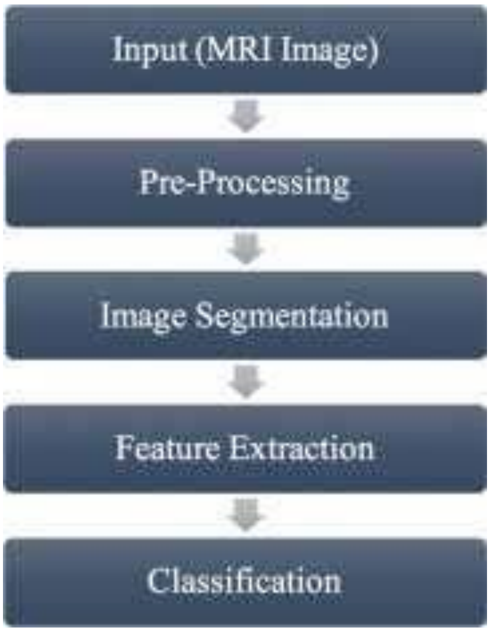
Image Recognition – Distinguish the objects in an image.

LITERATURE REVIEW:

Rasel Ahmed Anirban Sen Swisher, Md. Foisal Hossain, Md. Abdur Rafiq [4] proposed method which include stages like image pre-processing, segmentation, feature extraction, SVM classification and tumor stage classification using Artificial Neural Network (ANN). Key image processing techniques for brain MRI image segmentation is classified as SVM, FCM. Swapnil R. Telrandhe, et. al [5] Proposed tumor detection inside which Segmentation separates an image into parts of regions or objects. In this it has to segment the item from the background to browse the image properly and classify the content of the image strictly. During this framework, edge detection is a vital tool for image segmentation. In this paper their effort was made to study the performance of most commonly used edge detection techniques for image segmentation and additionally the comparison of these techniques was carried out with an experiment. Preliminary results show that our approach has achieved good segmentation results. Also, this approach was reducing a large quantity of calculation.

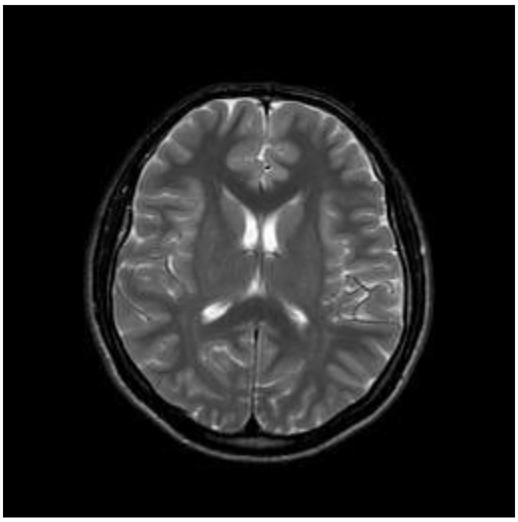
METHODOLOGY:

By using the following steps, we can detect Brain tumors using Image Processing techniques.



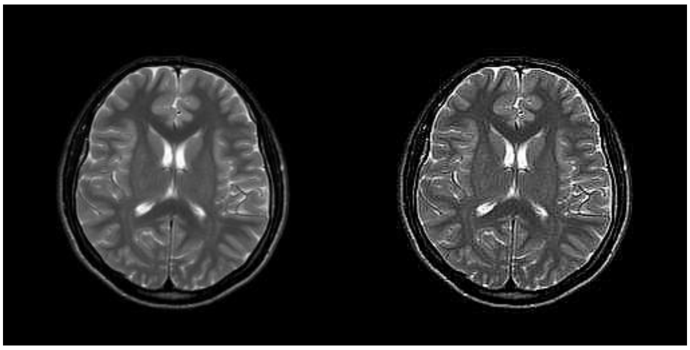
1. MRI Images Of The Brain:

This is the first step. The resulting MRI images may not be of very good quality for analysis. Images can be noisy, blurry, low-contrast. The area of interest can be difficult to extract. Here, grayscale MRI images are provided as input to the system.



2.Pre-Processing of Image:

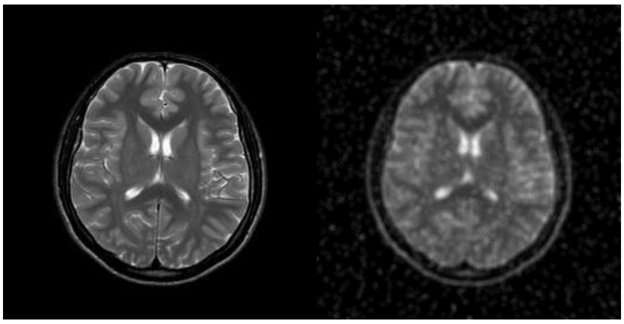
It is a bit hard to process a picture. Before any picture is handled, it is exceptionally noteworthy to evacuate pointless things it might hold. Subsequent to expelling superfluous curios, the picture can be prepared effectively. The underlying advancement of picture handling is Image Pre-Processing. Pre-Processing includes forms such as transformation to greyscale picture, commotion evacuation and picture reproduction. Change to greyscale picture is the most widely recognized pre-preparing practice (b). After the picture is changed over to greyscale, at that point overabundance commotion is expelled utilizing diverse separating techniques. [a=original image ,b=processed image]



(a) ***(b)***

FILTER: MEAN

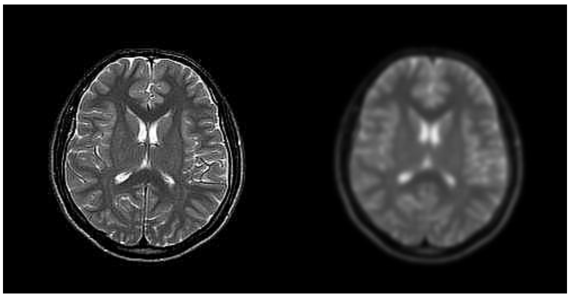
This the most widely recognized method which is utilized for commotion disposal. This is a 'non-straight' separating strategy. This is utilized to wipe out 'Salt and Pepper clamour' structure the greyscale picture. Middle channel depends on normal estimation of pixels. The upsides of middle channel are effective in decreasing Salt and Pepper commotion and Speckle clamor. Additionally, the edges and limits are saved. The fundamental hindrances are multifaceted nature and time utilization when contrasted with mean channel. [a=original image, b=processed image]



(a) (b)

FILTER: MEDIAN

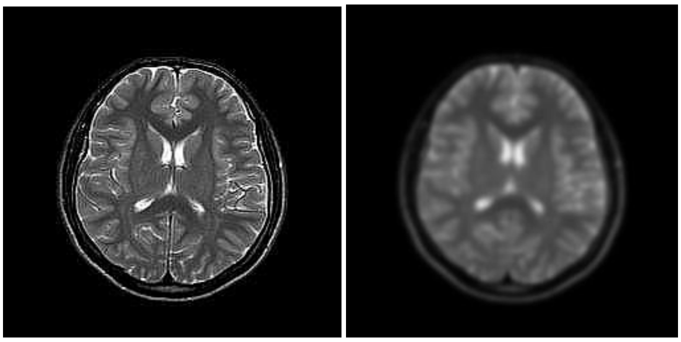
This channel is additionally a de-noising channel that depends on normal estimation of pixels. Major interest of mean channel is it lessens Gaussian clamor and the reaction time is quick. Primary burden is its contorted limits and edges. [a=original image, b=processed image]



(a) ***(b)***

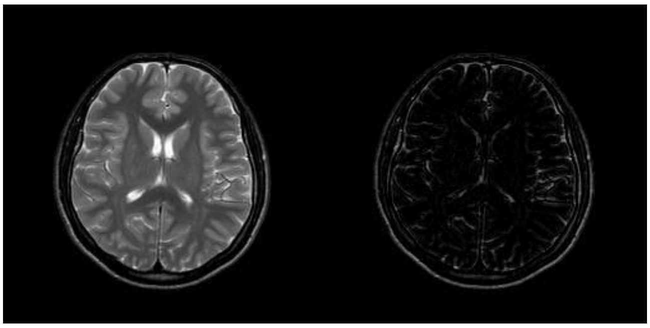
FILTER: GAUSSIAN BLUR

This plug-in filter uses convolution with a Gaussian function for smoothing. 'Radius' means the radius of decay to exp (-0.5) ~ 61%, i.e., the standard deviation sigma of the Gaussian (this is the same as in Photoshop, but different from the 'Gaussian Blur' in ImageJ versions before 1.38u, where a value 2.5 times as much had to be entered. - Like all convolution operations in ImageJ, it assumes that out-of-image pixels have a value equal to the nearest edge pixel. This gives higher weight to edge pixels than pixels inside the image, and higher weight to corner pixels than non-corner pixels at the edge. Thus, when smoothing with very high blur radius, the output will be dominated by the edge pixels and especially the corner pixels (in the extreme case, with a blur radius of e.g., 1e20, the image will be replaced by the average of the four corner pixels). - For increased speed, except for small blur radii, the lines (rows or columns of the image) are downscaled before convolution and upscaled to their original length thereafter. [a=original image, b=processed image]



FILTER: TOP HAT

Top-hat transform is an operation that extracts small elements and details from given images. There exist two types of Top-hat transform: the *white top-hat transform* is defined as the difference between the input image and its opening by some structuring element, while the *black top-hat transform* is defined dually as the difference between the closing and the input image. Top-hat transforms are used for various image processing tasks, such as feature extraction, background equalization, image enhancement, and others. [a=original image, b=processed image]

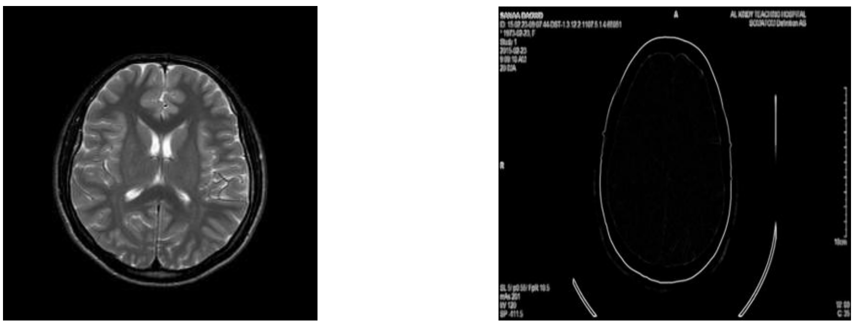


(a) (b)

FILTER: VARIANCE 3D

Highlights edges in the image by replacing each pixel with the neighbourhood variance.

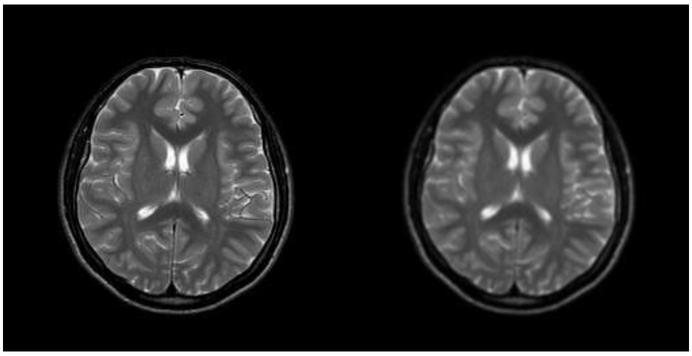
[a=original image, b=processed image]



(a) ***(b)***

SMOOTHENING

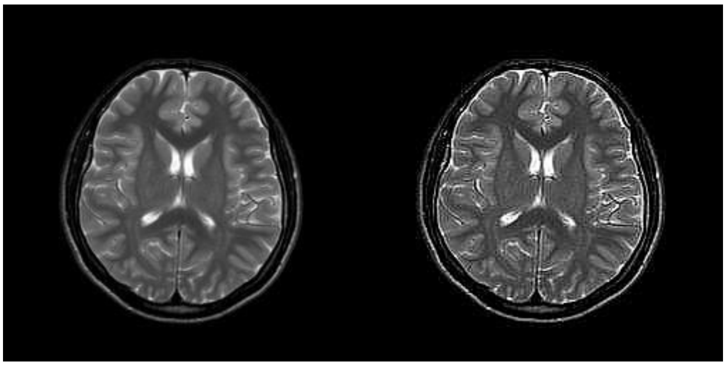
Blurs the active image or selection. This filter replaces each pixel with the average of its 3x3 neighbourhood. [a=original image, b=processed image]



(a) (b)

SHARPENING

Increases contrast and accentuates detail in the image or selection, but may also accentuate noise. This filter uses the following weighting factors to replace each pixel with a weighted average of the 3x3 neighbourhood. [a=original image, b=processed image]



(a) (b)

3.SEGMENTATION:

Segmentation is a method of breaking up an image into smaller pieces. Performed to facilitate analysis. Segmentation in this project refers to the method of dividing an image into many segments, however, the greatest difficulties in segmentation are related to the degree of the image, and images are also not inherited in a continuous area, as on X-ray film, or in a separate house, as in MRI. In 2D individual images, the placement of each action is called an element, and in 3D images it is called a voxel. When the restriction that regions connect is removed, the defining sets are called pixel classifications, and therefore the sets themselves are called classes. To address this problem, we used the foremost reliable segmentation techniques, which are helper vector machines and self-organizing maps, to see if there's a tumor on the input MRI image. The support vector machine (SVM) approach is considered a good candidate because of its high generalization performance, especially when the size of the function space is very large. SVM uses the following idea. The SVM takes operational images as input and gives the accuracy of a neural network with manual options in a purely handwriting recognition task. Those training points for which the equality of the dividing plane is satisfied, those that lie on one of the hyperplanes (H1, H2) and the removal of which will change the found solution, are called support vectors (SV).

3.1 THRESHOLD SEGMENTATION

'Segmentation' is the method that has been used to separate a computerized image into many parts that incorporate arrangements of pixels and collection of super pixels. Goals to be cultivated through the procedure of division are rearranging and changing the arrangement of portrayal of a picture such that it will turn out to be increasingly nitty gritty, significant and simple for the procedure of investigation. Putting of articles and limits in pictures, for example, lines, bends could be performed through Image division.

All through the method of picture division, each pixel in a picture is doled out a name and the pixels comprise of same mark share certain visual highlights. Every pixel in the district is comparable according to certain highlights or figured properties, for example, shading, force or surface. Bordering locales are especially unique with respect to similar highlights. Threshold strategy is the most straightforward method of picture division.

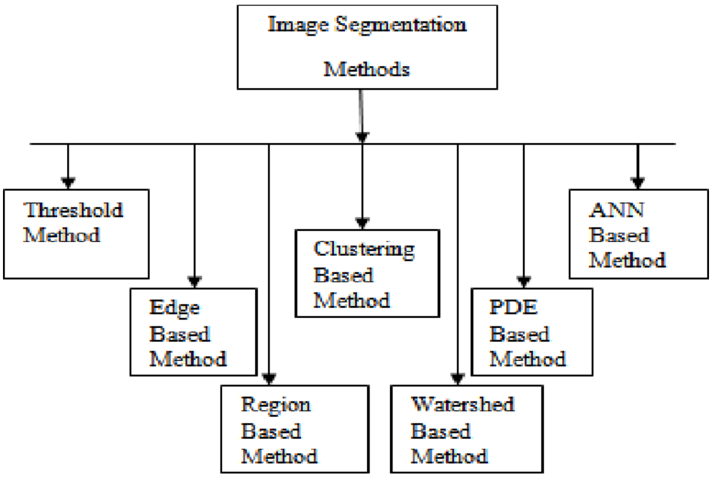
This procedure includes an edge esteem that is accustomed to changing over a dark scale highlighted picture to a paired picture. The significant bit of leeway of this technique is choosing the edge an incentive to be utilized.

3.2 SEGMENTATIONS BASED ON MORPHOLOGY

'Morphology' allows to identify the properties of the structure and shape of any element. Paired pictures may contain numerous deformities. Especially, the parallel locales developed by basic thresholding are distorted by surface and commotion. Morphological picture preparing looks to accomplish the objectives of dispensing with these imperfections by representing picture shape and structure. For the most part, this signifies perceiving items or limits inside the picture. Morphological tasks are intelligent transformations dependent on correlation of neighbouring pixel. Typically, morphological tasks are actualized on parallel pictures under the pixel esteems; 0 or 1. A significant number of the morphological activities focus on twofold pictures.

3.3K-MEANS ALGORITHM

Majority of picture handling procedures use K-Means calculation for picture division. It is extremely valuable for enormous pictures with helpless complexity. In any case, it has been understood that K-Means is vulnerable to determination of tests and foundations of fluffy sets.



4.FEATURE EXTRACTION

It is the strategy of dispersing a picture into minor bits. It makes a few arrangements of pixels inside same picture. Doles out a tag to each pixel in a picture and the pixels with the comparable mark share specific highlights [12]. Fragmenting makes it simpler to additionally break down and perceive significant data structure an advanced picture.

4.1 DETECTION OF EDGE

an edge detection happens when there is an abrupt and surprising force adjustment of the picture. At whatever point it is identified a sudden alteration or a change in the power of a specific picture, the related pixel would be treated as an edge pixel. The calculation that has been advanced for the discovery of edge pixel underpins in distinguishing the nature of the edge. Be that as it may, some of the time these edges are not shown in the conclusive outcome. Henceforth the calculations are acclimated to decide the edges [16].

4.1.1Edge Detection: 'Prewitt'

The "Prewitt Mask" is one of the unmistakable separation activities. As needs be, approximated subsidiary qualities in both the headings, with the end goal that even and vertical, are determined utilizing two 3 × 3 veils [16]. Prewitt veils provide an approximation to both flat subsidiary and the vertical subordinate.

4.1.2 Edge detection:

'Robert' By using the "Roberts edge" location activity, the picture inclination is evaluated by means of unmistakable separation. Likewise, "Robert Mask" is a network and the districts of high spatial recurrence are featured, that are frequently compared to edges in the image [16].

4.1.3 Edge detection: 'Sobel'

The "Sobel Mask" generally function as the "Prewitt veil". It must be taken into account as the Sobel administrator has values; '2' and '- 2' which are assigned to the focal point of first and the third segments of the flat veil and first and third columns of the vertical cover. Henceforth it gives high edge intensity.

4.1.4 Feature Extraction Using Histogram of Oriented Gradient

The extraction technique of the "Histogram of Oriented Gradient" (HOG) will take the calculations given below in consideration. In the first place, the pre-arranged cell picture shall be coursed as "32 × 32" pixels. The power of each pixel is '1' or '0'. By then the result will be added to "Crowd".

5.CONCLUSION

You have seen a few of the features of a good introductory image processing program. There are many more complex modifications you can make to the images. For example, you can apply a variety of filters to the image. The filters use mathematical algorithms to modify the image. Some filters are easy to use, while others require a great deal of technical knowledge. The software also will calculate the ra, dec, and magnitude of all objects in the field if you have a star catalog such as the Hubble Guide Star Catalog (although this feature requires the purchase of an additional CD-ROM).

The standard tricolour images produced by the SDSS are very good images. If you are looking for something specific, you can frequently make a picture that brings out other details. The "best" picture is a very relative term. A picture that is processed to show faint asteroids may be useless to study the bright core of a galaxy in the same field.

There are different Image enhancement techniques which are used to make the image a sharpen one and it makes the diagnostics a perfect and accurate for the radiologist. The different types of techniques in image processing were compare with each other to get the better accuracy for diagnosis.

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