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Brain Tumor Detection Based on Canny Edge Detection Algorithm and it's area calculation

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ABSTRACT: *In this project, a method for detecting the brain tumor is described. Generally, the structure of the brain can be seen with the help of CT or MRI scan. During the earlier few years, MRI scanning place an important role in the medical research field. Image segmentation is very important process in image processing as it helps to extract information from complex medical image. In this method the tumor is segmented based on canny edge detection algorithm. It is the only procedure capable of finding the best contours while eliminating all edges associated with the gray matter in original image. Finally thresholding is applied to the image and based on this tumor area and shape is calculated .*

Keywords: CT (Computed Tomography), MRI(Magnetic Resonance Imager),canny edge detection algorithm, thresholding.

INTRODUCTION

In this paper, the main concept of segmentation of brain tumor is described. The MRI scan is more preferable than CT scan because it has an excellent capability for soft tissue imaging. Multichannel images with variable constrast can be achieved by using different pulse sequencies, this can be further utilized for segmenting and classifying different structures, MRI machines do not emit ionizing radiation.MRI may define the precise extent and location of a tumor. The MRI scanner uses powerful magnets to polarize and excite hydrogen nuclei in human tissue, which produces a signal that can be detected and it is encoded spatially, resulting in images of the body.MRI machines can produce images in any plane. Plus,3D isotropic imaging can also produce the Multi planar Reformation .First commercial MRI was available in1981, with significant increase in MRI resolution and choice of imaging sequences over time.

A brain tumor is a collection, or mass, of abnormal cells in the brain. The skull, which encloses the brain, is very rigid .Any growth inside such a restricted space can cause problems. Brain Tumors can be cancerous i.e., malignant or non-cancerous. The tumor may be primary or secondary. In the primary stage, the tumor is in earlier stage. In the secondary stage, the tumor cells are spreading from one region to another region which causes cancer. If the tumor is in the beginning stage the lifetime of the person is increased by 1 or 2 years. It uses computer aided method .The CAD systems help to scan digital images.CAD is an interdisciplinary technology combining elements of artificial intelligence and computer vision with radiological image processing. At the end of process we are defining the operations that detect the tumor area.

EXISTING METHOD

The existing method is based on the thresholding and region growing.

In thresholding decisions are made based on pixel information. It ignores the spatial characteristics but they are important for brain tumor detection. It is having two gray values 1 or 0.Segmentation of a noisy image through thresholding is a challenging task, because noise present in the image, converts a simple thresholding into a difficult one.

The processing of grouping pixels into larger regions are called as Region Growing is one of simplest method employed in image segmentation.

- Requires large execution time.
- Seed pixel should be **selected** from the region.
- More and more pixels are included in this region.
- Prior information may be needed regarding seed points.

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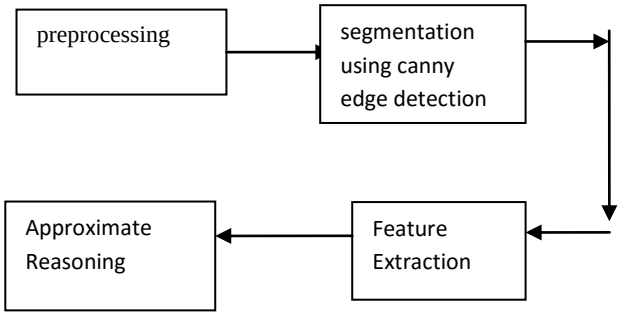
Due to this drawbacks in the existing method, we are going for the proposed method.

PROPOSED METHOD

The proposed method involves four modules. Preprocessing, Segmentation, Feature Extraction and Approximate Reasoning.



1. Preprocessing:

It is done by filtering techniques such as Gaussian and Median filters. Preprocessing is the important process in the image processing. Image acquisition involves preprocessing such as scaling, Image Enhancement filtering and noise reduction. The aim of preprocessing is an improvement of the image data that suppresses unwanted distortions or enhances some image features for further processing.

2. Segmentation:

Segmentation is done by canny algorithm.

3. Feature Extraction:

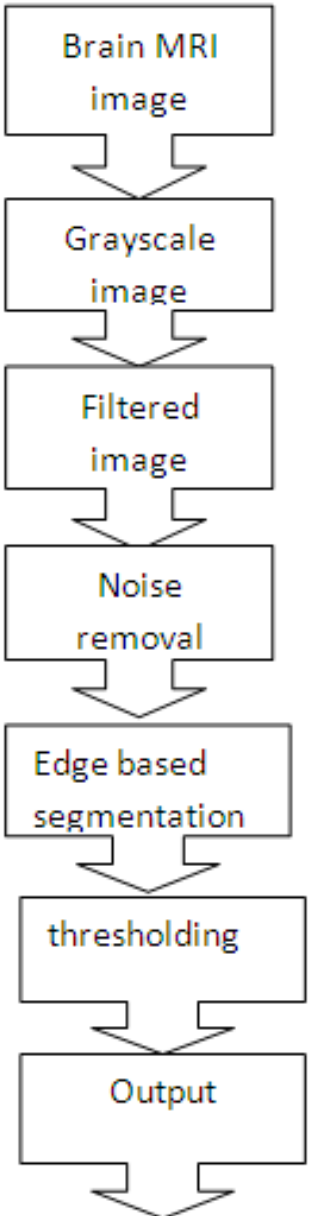
In pattern recognition and in image processing, feature extraction is to obtain the most relevant information in a lower dimensionality space. When image sizes are large and a reduce feature representation is required to quickly complete tasks.

4.Approximate Reasoning:

In this step thresholding is applied to the image. Finally tumor shape and area is obtained.

DESIGN AND IMPLEMENTATION

The following shows the steps for implementation of the proposed method.



First brain MRI image is taken and it is converted RGB to grayscale image.

- **High pass filters:**

In order to remove the blur image we can use high pass filter which results in sharper image. The purpose of sharpening is to highlight fine details in an image. As edges along with other rapid changes in gray levels are concerned with high frequency components. Sharpening is generally achieved by high pass filter is used to enhance the boundaries of the object . The advantage of

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Gaussian filter is that filtering of smaller objects and thin bars is cleaner.

- **Median filter:**

Median filter is a non linear digital filtering techniques used to remove noise. It filters the noise without effecting the edges in an image. The gray level of each pixel is replaced by the median of the gray levels in a neighbourhood of the pixel. It is used to remove salt and pepper noise.

- **Segmentation:**

Segmentation subdivides an image in to its constituent regions or objects. Most of the segmentation algorithms are based on one of the two basic properties of intensity values: discontinuity and similarity. Segmentation is an important process to extract information from complex medical image. Image segmentation plays a major role in tumor detection.

- **Canny edge detection algorithm:**

Edge detection is the approach used most frequently for segmenting images based on abrupt changes in intensity. The canny edge operator works in a multi stage process. canny's approach is based on three objectives i.e low error rate, edge points should be well localised and single edge point response.

1.Smooth the input image with a gaussian filter.

2.Compute the gradient magnitude and angle image.

3.Apply non maxima suppression to the gradient magnitude image.

4.Use double thresholding and connectivity analysis to detect and link edges.

Canny algorithm was the only procedure capable of yielding a totally unbroken edge for the posterior boundary of the brain.

- **Thresholding:**

Thresholding techniques having two gray values black or white. In this the object get assigned to white and the background get assigned to black.

f(x,y)>T is called an object point.

otherwise background object.

Peak signal to noise ratio(PSNR) and Mean Square Error (MSE)

PSNR is the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation It is expressed in terms of the logarithmic scale. PSNR is most easily defined via the mean squared error (*MSE*). Given a noise-free *m*×*n* monochrome image *I* and its noisy approximation *K*, *MSE* is defined as:

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

The PSNR (in dB) is defined as:

$$\begin{aligned} PSNR &= 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right) \\ &= 20 \cdot \log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right) \\ &= 20 \cdot \log_{10}(MAX_I) - 10 \cdot \log_{10}(MSE) \end{aligned}$$

Here, MAX_I is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is 255.

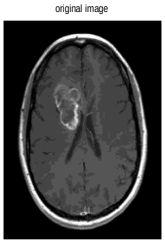
It is most commonly used to measure the quality of reconstruction of lossy compression codecs. The peak signal-to-noise ratio, in decibels, between two images. This ratio is often used as a quality measurement between the original and a compressed image. The higher the PSNR, the better the quality of the compressed or reconstructed image.

The *Mean Square Error (MSE)* and the *Peak Signal to Noise Ratio (PSNR)* are the two error metrics used to compare image compression quality. The MSE represents the cumulative squared error between the compressed and the original image, whereas PSNR represents a measure of the peak error. The lower the value of MSE, the lower the error.

The MSE for our practical purposes allows us to compare “true” pixel values of our original image to our degraded image.

The signal to noise ratio is the ratio of signal power to the noise power. Its shows how original is affected by the noise.

Original image:



Gaussian filter:

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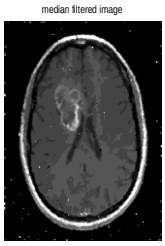
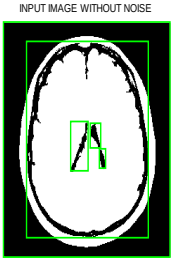
Medianfilter:



Edge based segmentation:



Thresholding:

RESULT:

Finally brain tumor is detected and area is calculated.

Area calculated = 1027

PSNR=30.13

MSE=2.23

CONCLUSION:

Brain MRI image is taken and preprocessing is performed using filters. Segmentation is performed based on canny edge detection algorithm. The performance of the canny edge detector is superior in general to the edge detectors. Thresholding is applied to the image in approximate reasoning. The proposal is that the higher the PSNR, the better degraded image has been reconstructed to match the original image. Finally tumor is detected and area is calculated.

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