Minimum Time Delay and More Efficient Image Filtering Brain Tumor Detection with the Help Of MATLAB

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Abstract: Brain tumour detection is one of the intriguing task in the medical field still now. Earlier the technologies pneumoencephalography and cerebral angiography were used but they had drawbacks. The next technologies such as CT and MRI scan techniques with the help of surgeons came into use to provide a higher quality result in image processing. However it is difficult in distinguishing between brain tumour tissue and normal tissue because it they are similar in colour. Hence Brain tumour must be analysed more precisely in order to cure it. In this paper Tumour Detection with help of MATLAB image processing catches three stages Pre-processing, Processing and Post-processing in morphological detection. After the getting MRI report first stage is pre-processing which is converting the original RGB image to gray-scale image and then using a Gaussian high pass filter for noise reduction. In the second stage processing for pixel enhancement we use Median filter and in third stage i.e. the post-processing where different filters such as Entropy Filter., Standard Deviation Filter (SDF), Weiner Filter, Gradient Magnitude, Regional Maxima are used for various different-different results. In this post processing which is followed by algorithm not only creates the report automatically, but has very less delay time and gives the output more efficiently.

Index Terms—Gray scale, Gaussian HPF, Weiner Filter, Gradient Magnitude, Regional Maxima.

I. Introduction

GENERALLY tumors are abnormal cells which expands in our body, in brain tumor a mass of tissue in our brain cell are expanded rapidly [1].The symptoms of brain tumor depends upon tumor type, size and location of the tumor[2]. The symptoms are headache vomiting nausea some other changes are speech vision and hearing problems, ability to concentrate and memory problems. A brain tumor is categorized primary and secondary depends upon location size and its origin.

The Tumors can be of 2 types which are classified as Begin and Maligant

A. Begin:

Benign tumors are type of non-cancerous mass of cells which expands very slowly in the brain. It does not spread and stay in one place. Normally benign brain tumors can be detected by CT and MRI scans.

B. Maligant:

Malignant brain tumors are tumors which rapidly expand like cancer that spreads from one area to other area of the brain.

- Materials And Methods

The input image includes report of MRI and CT-scan. All the image processing operation are done in MATLAB. The paper organized as below. Section II describes about the detail discussion about schematics of the study. Section III gives the parameters comparison. Section IV includes results. At last, Section V concludes the paper with the conclusion.

II. Schematics of the Study

There are 3 Stages of proceedings in the detection of tumor efficiently. They are classified as **Pre-Processing, Processing and Post-Processing.**

Pre-Processing: The aim of pre-processing is to convert the RGB image into gray image using Gray-Scale conversion. The converted image is then processed to reduce noise and implement the contrast enhancement [4,5] to improve the quality of the image.

The working process of pre-processing is as follows:

1. Gray-scale conversion
2. Addition of Poisson Noise

Gray Scale Conversion: The Gray scale image includes only gray-scale values, but MRI report consist of primary colors(RGB)[6]. Gray scale is a type of monochrome image where each pixel of any image consists some information of the intensity of light hence it is similar to that of conventional black and white image. By converting the image into gray it becomes easier for further processing. Here we take the help of 'RGB2gray' or 'binarize' the commands which converts the three dimensional image into two dimensional or gray scale image.
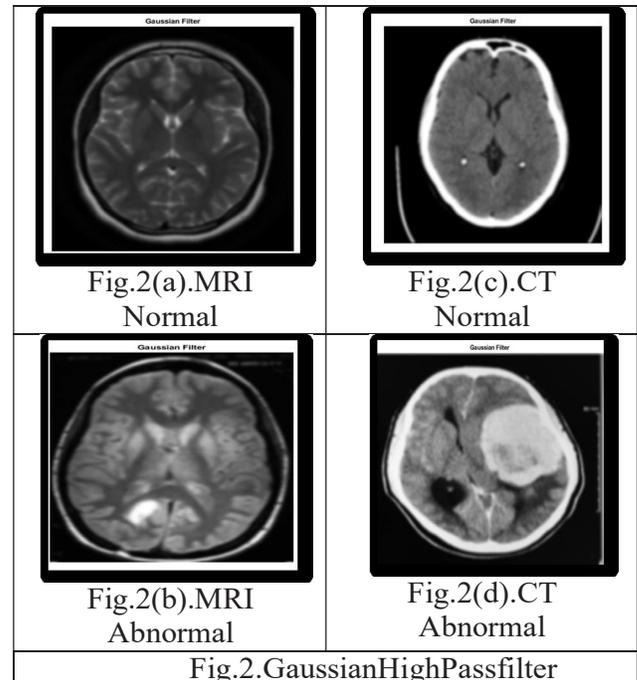
Poisson noise addition and applying a high pass filter: Filtering is a technique in image processing where we try to reduce the effect of noise as minimum as possible. Let us assume that the image consists of Gaussian noise present in it. After the conversion of image into gray, we try to minimize the noise effect by passing it through a high pass filter known as Gaussian HPF. Median filter is the type of filter provides a median value of the pixels of an image and it is used because theme an values obtained using averaging filters it makes image blur[7]. In MRI, Gaussian noise are more commonly seen or observed. Salt and Pepper noise can be reduced with the help of median filter, considering that Gaussian noise is reduced by a Gaussian high pass filter (HPF).
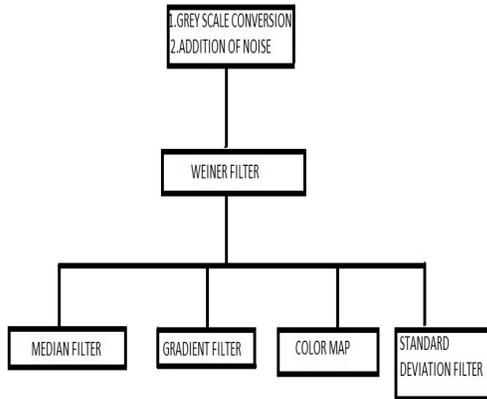
Weiner Filtering: On comparing and analyzing various filters and their capabilities we came to a conclusion that Weiner filter is the most suitable filter for further stages of processing. Hence the addition of Weiner filter completes the 1st stage i.e. pre-processing.

Processing: The 2nd stage starts with processing of the Weiner filter image. In stage 2 we applied median and gradient filters to reduce the noise at the edges and to improve the intensity of the image at the later stages. Hence Processing stage consists of Median and Gradient filtering.

1. Median Filtering.
2. Gradient Filtering.

Median Filtering: The median filter is a type of filter which is used to reduce or minimize the salt and pepper noises present in the image, which are caused by motion artifacts (movement of patient during scan). In-order to reduce these kinds of noise we used this filter in our MATLAB code following the command '**medfilt2**'. We are sub-dividing the images into 4 variants (Low-Low Image Low-High Image, High-Low image High-High Image) using **2-Dimensional Discrete Wavelet Transform**.

Fig.2(a).MRI Normal	Fig.2(c).CT Normal
Fig.2(b).MRI Abnormal	Fig.2(d).CT Abnormal

Fig.2.GaussianHighPassfilter

Block Diagram

The command 'Dwt2' subdivides the image based on its intensity values. The image obtained is combination of all the intensities.
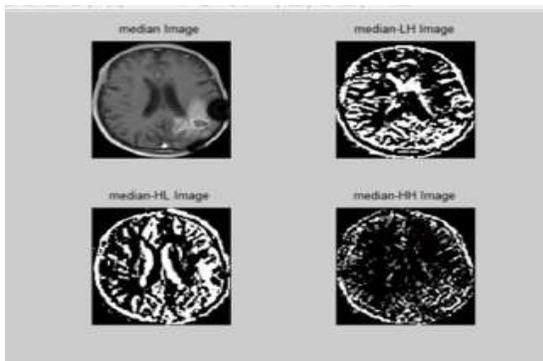

Fig.3. 2-D Dwt Median Filter

Gradient Filtering: The gradient of any vector of an image contains the information which can let us know about the change in the intensity of the image at any given point of time. By using the '**imgradient**' command present in the MATLAB and converting the matrix values (which are the intensity values) into the same components as we stated in median filtering, we can know the intensities of the image at any given point of time. For our project we've taken the combination of Low-High and High-Low intensity values lying between(90-200). These values are used to produce the combined image and is further processed to stage 3. The processing stage ends here and the following stage is post-processing.

Post-Processing

In post processing stage, the obtained gradient output images are combined together to obtain a standard output image. This is done with the help of for loop and having iterations in the program. To obtain the combination of all the pixels into single output we used four for loops and 72 iterations. These commands run and execute the code to give a single result image. For the image obtained we add some standard number of pixels to enhance the image. The addition of standard number of pixels to the image is done using "imadd()" command. The resultant output image is also resized using imresize(image_name,[256,256])' command.

This completes the 3rd stage which is post-processing. The obtained image is then compared with the noise image and gives us the Peak Signal to Noise Ratio, and Mean Square Error. Hence the margin or error and the value of noise reduced can be known.

III. COMPARISON

The following table consists of the comparison between the normal CT and MRI scanned images in tally with the abnormal CT and MRI scanned images. The parameters such as mean. standard deviation, area, entropy, median, moment fifth are been showed. This table gives us the range of values where one can know if the scanned image consists of the tumor or is the person normal.
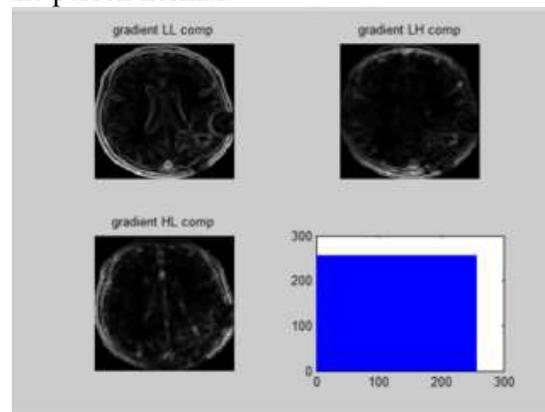

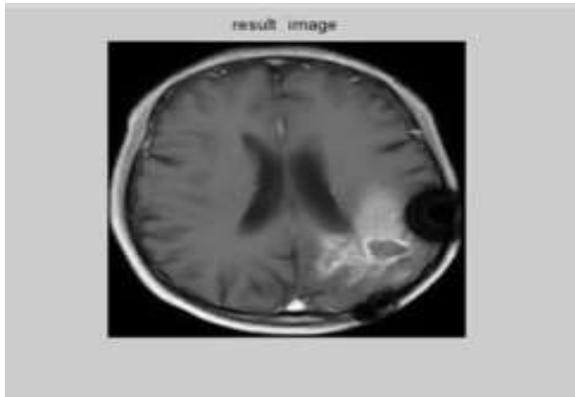Fig 4 Gradient Filter Output
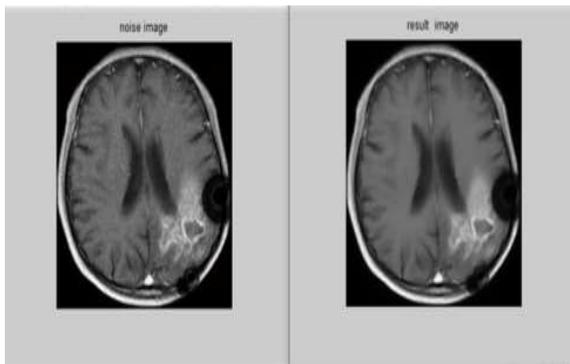
Fig 5 Result Image

Fig 6 Comparison of the result and noise image

The comparison of the result and noise image in the above figure lets us in calculating the PSNR and MSE values so that the robustness of the image obtained can be known when some external disturbances occur.

Table 1: Comparison of Statistical properties of MRI and CT-Scan

S. N O .	Parameters	MRI		CT	
		Normal	Abnorm al	Normal	Abnorm al
1	Mean	63.008	75.916	482.22	78.1154
2	Standard deviation	440.57 8	227.134	8.033	477.339 2
3	Median	8	7	3	2
4	Moment fifth	21.068	35.882	21.536	21.765
5	Area	113	36	18	156
6	Entropy	5.987	6.9627	4.3295	6.9948

IV. DISCUSSION OF RESULTS

From the result obtained in the end, we can conclude that apart from all the filters available, Weiner filter is the best suitable filter as it gives the output with minimum time delay and more efficient and enhanced image in comparison with the input image

V. CONCLUSION

All the discussions made in the paper are aiming to detect the brain Tumor more efficiently through CT and MRI brain images. The brain tumor is detected more accurately and efficiently using image processing and various type of the morphological operations, image filtering is performed for analysis and to obtain the various parameters like Peak Signal to Noise Ration, Mean Square Error.

Fig 7 PSNR and MSE values

VI. REFERENCES

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