Minimum Time Delay and More Efficient Image Filtering Brain Tumour Detection with the help of MATLAB

Yogesh Kumar Sahu, Chanki Pandey, Preesat Biswas, M.R.Khan and Shanti Rathore

***Abstract*—Brain tumor detection is one of the intriguing task in the medical field still now. Earlier they uses pneumoencephalography and cerebral angiography had the drawback, CT and MRI scan techniques with the help of surgeons to providing a higher quality result in image processing. It is difficulty in distinguishing between brain tumor tissue and normal tissue because it was similar in color. Hence Brain tumor must be analyzed more precisely in order to cure it. In this paper Tumor 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 Gaussian high pass filter for noise reduction In the second stage processing system for pixel enhancement we uses Median filter and in third stage is the post-processing which Entropy Filter., Standard Deviation Filter(SDF), Weiner Filter , Gradient Magnitude ,Regional Maxima for various different-different results. In this post processing which is followed by algorithm not only automatically create report but also very less delay time and get better brain tumor detection more efficient.**

***Index Terms*—Grayscale, Gaussian HPF, Entropy Filter. SDF, Weiner Filter, Gradient Magnitude, Regional Maxima.**

I. Introduction

GENERALLY tumor which is abnormal cells which are expands in our body but 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 sometime they can changes their activities like personality, ability to concentrate and problem with memory. A brain tumor is categorized primary and secondary depends upon location size and its origin.

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A. Benign

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

B. Maligant

Malignant brain tumor was rapidly expand like cancer that spreads one area to other area of the brain and spine it [3].

C. Materials and Methods

The MRI report is obtained from Government Medical College, Jagdalpur under the guidance of Rajat Kumar Pandey(MBBS, Final Part II ,Student) that includes one normal image and one abnormal image of MRI and CT report. 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 discusses the results. At last, Section V concludes the paper with the conclusion.

II. Schematics of the Study

Pre-processing: The aim of the pre-processing is improvement of Block-Diagram as shown in Fig. 1. Those image data are suppressing with undesired distribution and it was enhance some image for the future. The aim of Pre-processing is to reduction of the noise and to implement Contrast Enhancement [4,5] to improved the image quality. The working process of pre-processing is

1. Gray-scale
2. Noise reduction (with the help of Gaussian HPF).

A. Gray Scale

Gray scale image include only gray-scale values, but MRI report consist of primary colors (RGB) [6] .Gray scale is type of monochrome image where each pixel of any image posses the information of intensity of light hence it may look similar to that of conventional black and white image. By converting into grayscale image it become easier for further processing of the MRI. Here we take the help of 'rgb2gray' or 'binarize' this commands help to convert the three dimensional image into two dimensional or gray scale image.

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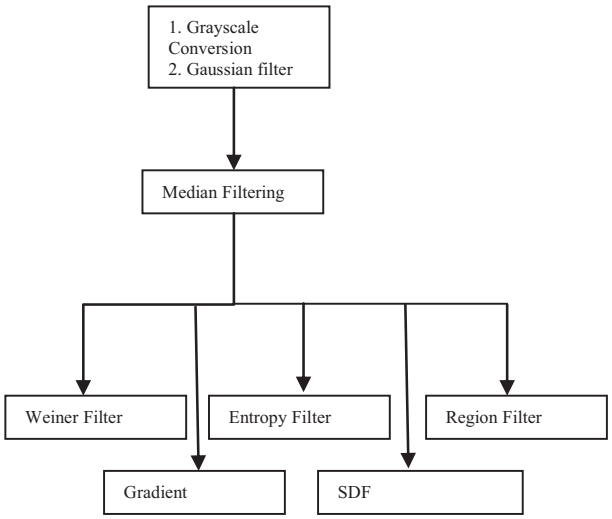

Fig. 1. Block diagram

B. *Filtering*

Filtering is a technique is type of image processing where we tries to reduce or keep as minimum as possible the effect of noise for this we assume that Gaussian noise present in source. So after the conversion into grayscale image we try to minimize the noise effect by passing it through a type of 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 the mean 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). Thus the first stage of operation that is pre-processing is done.

C. *Gaussian High Pass Filter*

A high pass filter is able to pass the high frequency information of image data and it tries to block the lower terms of frequency components, thus help to the transitions of the image intensities which are required. In high-pass filter processing, the high values of pixel of image is enhanced with relative to its adjacent pixels [8] by help of kernel filter. Fig. 2 shows the after applied Gaussian HP filter.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \quad (1)$$

D. *Median Filter*

The median filter has greatest advantage that it kind of filter which used to reduce or say minimize the salt and pepper kind of noises present which is cause by motion artifacts (movement of patient during scan) in the CT & MRI images[9,10]. It is done for a type of CT & MRI brain image. Since we take help of the MATLAB we use 'medfilt2' command to implement it and the results are shown in Fig. 3.

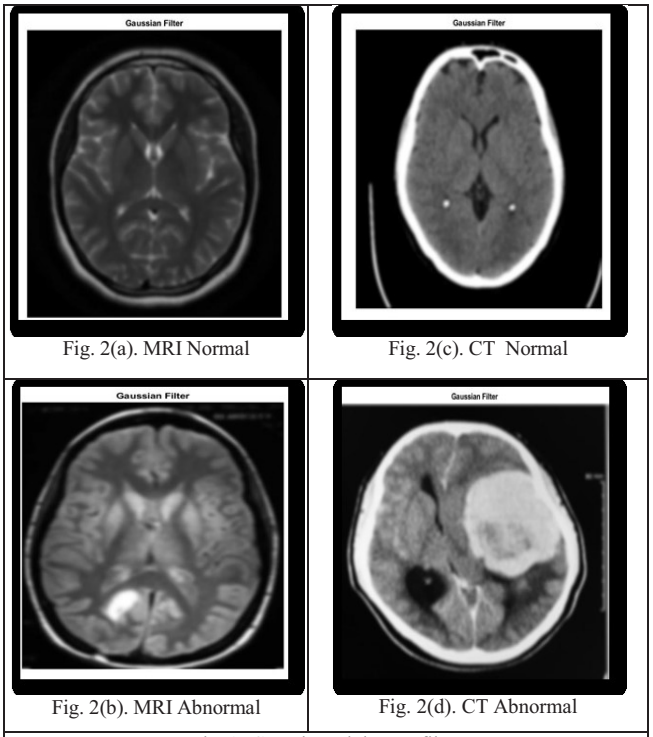

Fig. 2(a). MRI Normal
Fig. 2(c). CT Normal
Fig. 2(b). MRI Abnormal
Fig. 2(d). CT Abnormal
Fig. 2. Gaussian High Pass filter

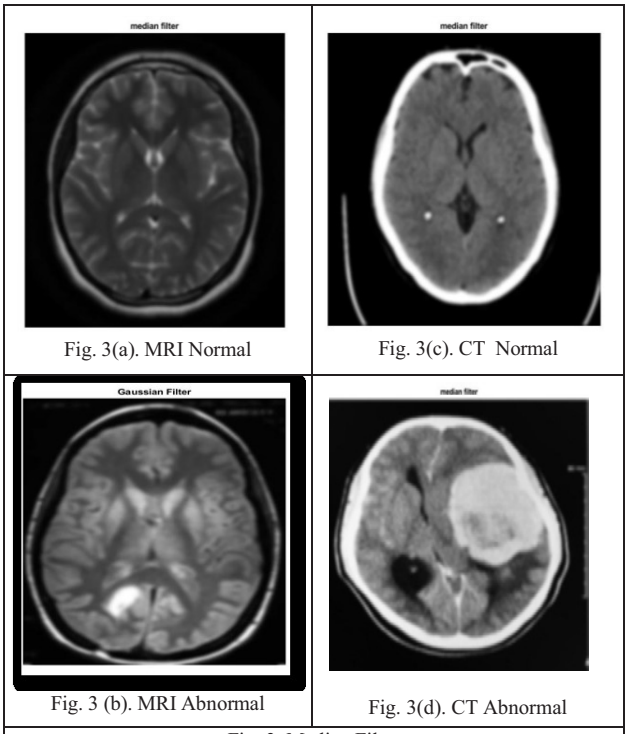

Fig. 3(a). MRI Normal
Fig. 3(c). CT Normal
Fig. 3 (b). MRI Abnormal
Fig. 3(d). CT Abnormal
Fig. 3. Median Filter

After the two stages of pre-processing and processing we come to last stage that is post-processing that we have tested resulting with some uncommon filters which are as follows:

E. Watershed Transform

Watershed transform is type of a grayscale image. The name relates to metaphorically to a geological watershed. This transform divide two adjacent drainage basins. With the help of this transformation of image one can see brain tumor

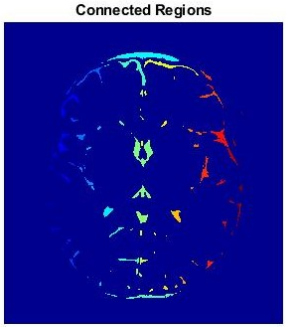

Fig. 4(a). MRI Normal

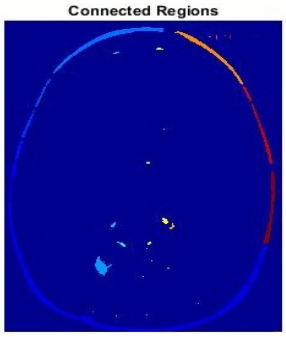

Fig. 4(b). MRI Abnormal

Fig. 4. Watershed transform

appears too clearly. We used 'watershed' command to implement image. Process is illustrated is in Fig. 4.

F. Entrophy Filter

The Entropy meaning is uncertainty of anything hence we called it measure of change so by applying entropy filter we measure or we try to locate where the maximum uncertain area is showing this area will corresponds to the tumor region if patient have any otherwise figure will show adverse image of grayscale image this is illustrated below with example in Fig. 5.

$$H(x) = -\sum_{i=0}^{N-1} p_i \log_2 p_i \qquad (2)$$

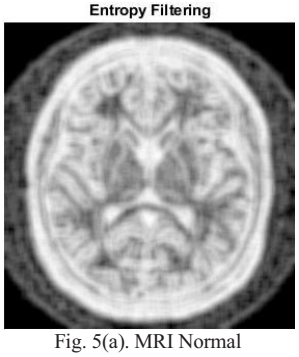

Fig. 5(a). MRI Normal

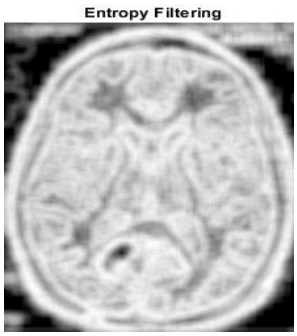

Fig. 5(b). MRI Abnormal

Fig. 5. Entropy Filter

G. Standard Deviation Filter

The implemented standard deviation filter is based on calculation two integral images and subsequent common calculation of the variance by:

$$\text{var}(x) = E[x^2] - \left(E[x]\right)^2 \qquad (3)$$

The greatest advantage of implementing the STD is that the computation time is completely unaffected by the kernel size. but coming to the disadvantage part of SDF is that an extra integral based computation is there and it doesn't allow easy variation on the kernel shape like triangle, cross circle, and as a result of all of this only rectangular kernels are supported. this implementation is shown in Fig. 6

H. Weiner Filter

This approach might produce better results than any of linear filtering used conventionally by using the process shown in Fig. 7.

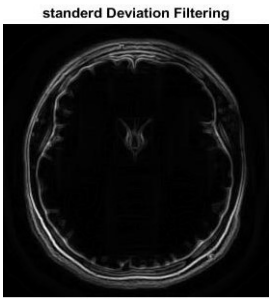

Fig. 6(a). MRI Normal

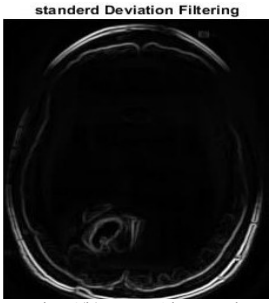

Fig. 6(b). MRI Abnormal

Fig. 6. Standard Deviation Filter

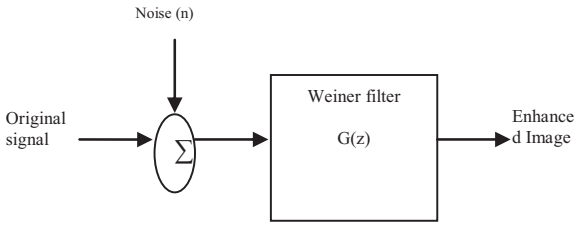

Fig. 7. Block Diagram of Weiner Filter

This filter uses adaptive filtering technique that it tries to reduce the error as minimal as possible hence we can say adaptive filter haves the more selectivity than a compared to linear type of filter, it passes edges and other high-frequency parts of an image[11]. We have seen of its advantage that there is no design task to perform; we take the help of the 'wiener2' function which performs all preliminary computations and implements for the filter for an input image. But it has one drawback that need more time of computation than linear filtering. Result are shown in Fig. 8.

$$G(z) = \sum_{a=i}^{N} a_i \, z^{-i} \qquad (4)$$

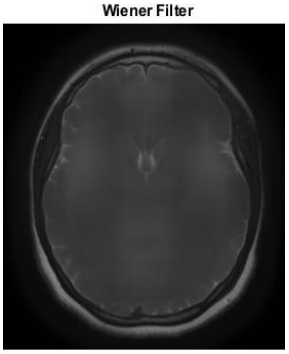

Fig. 8 (a). MRI Normal

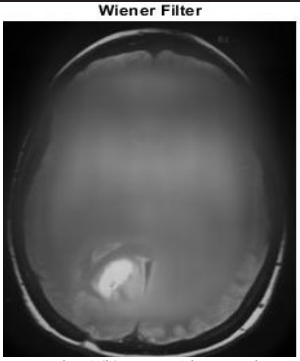

Fig. 8(b). MRI Abnormal

Fig. 8. Weiner Filter

I. *Colormap*

Colormap is set to be the color map for current figure map set is predefined colormaps. In this Fig. 9, shown axes and charts use the same colormaping. The new colormap is the same length (number of colors) as the previous colormap. we follow this syntax

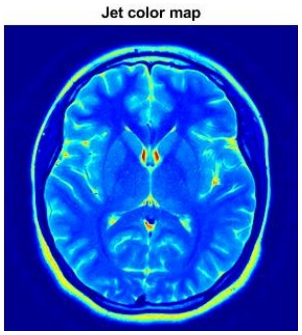

Fig. 9(a). MRI Normal

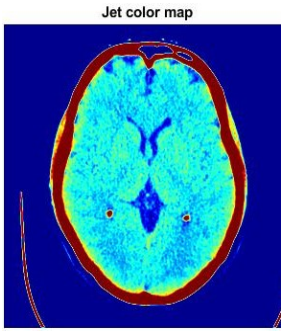

Fig. 9(c). CT Normal

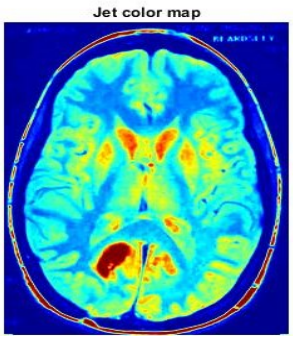

Fig. 9(b). MRI Abnormal

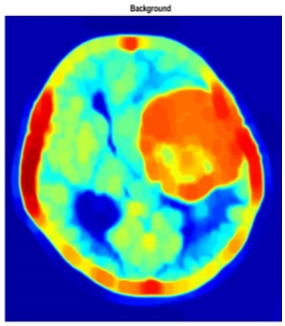

Fig. 9(d). CT Abnormal

Fig. 9. Colormap

J. *Gradient Magnitude*

The gradient of any vector image contains information of variation that means we can tell whether or not or where or when any image is changing so by this method we have seen that the tumor region or the abnormal region can see and it is more efficient compare to previous technique that we proposed. The result obtained is as shown in the Fig. 10

K. *Regional Maxima*

Regional maxima compare the two neighboring pixels of any image and the resultant image show us where the image maxima has occurred but quality of image has reduced so we proposed this technique can implied only if location of tumor is important. The process is shown in Fig. 11.

III. COMPARISON

So coming to the comparison part we have calculated some parameters values of abnormal CT and MRI image, which is tally with the normal CT and MRI image and tabulated the results in Table I.

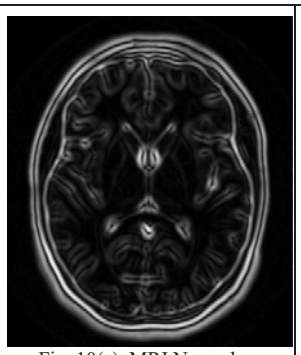

Fig. 10(a). MRI Normal

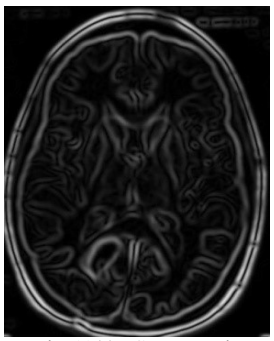

Fig. 10(c). CT Normal

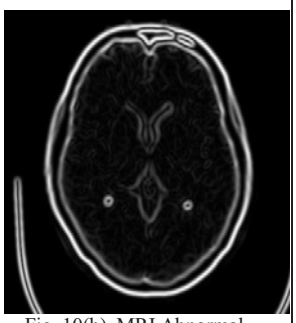

Fig. 10(b). MRI Abnormal

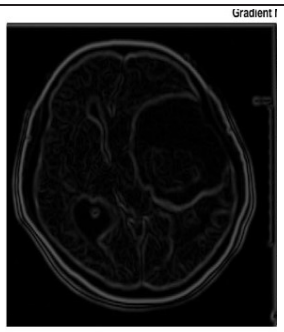

Fig. 10(d). CT Abnormal

Fig. 10. Gradient Magnitude

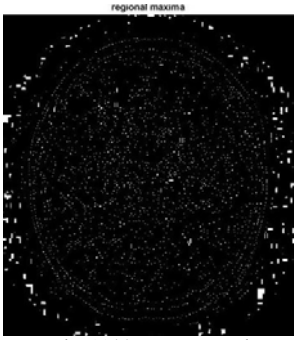

Fig. 11(a). MRI Normal

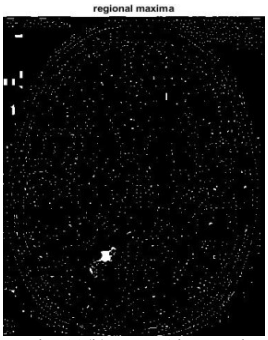

Fig. 11(b). MRI Abnormal

Fig. 11. Regional Maxima

TABLE I
COMPARISON OF STATICALLY PROPERTIES OF MRI AND CT.

S. NO.	Parameters	MRI		CT	
		Normal	Abnormal	Normal	Abnormal
01	Mean	63.008	75.916	482.22	78.1154
02	Standard deviation	440.578	227.134	8.033	477.3392
03	Median	8	7	3	2
04	Moment fifth	21.068	35.882	21.536	21.765
05	Area	113	36	18	156
06	Entropy	5.987	6.9627	4.3295	6.9948

IV. Discussion of Results

Now in this paper we proposed some new types of filtering method which may perform the tumor detection more efficiently than others and also more area of researches can be finding through our paper.

V. Conclusion

All the discussion is aiming to detect the brain Tumor from or the abnormal behavior of the any one's brain through CT and MRI brain images. The brain tumor is detected more accurately using image processing and various type of the morphological operations, image filtering are performed for analysis or to observe and to obtain the various parameters like Mean, Standard deviation, Third moment, Area, Entropy of the image.

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