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De-Noising of Retinal Image using Crafty Edge Detection (CED)

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ABSTRACT: ***In all fields Image processing doing excellent analysis to diagnosis the diseases. Especially image processing is relevant to modern ophthalmology. It is a field that heavily dependent on visual data. In medical filed ophthalmologists used retinal images for diagnostic purpose. So these images frequently need visual enhancement prior to apply a digital analysis for pathological risk or damage detection. In this work we propose a image enhancement techniques to compensate the noise in retinal images. The quality of retinal images affected by various noise and it can be denoised by proposed algorithm Crafty Edge Detection(CED). This new work helps to increase SNR (Signal-to-Noise Ratio) value. Also, Median filter, Gaussian filter, Mean filter, Average and proposed had taken for the comparative study. PSNR and MSE metrics are used to analyze the performance and quality of the retinal image for further processing. Experimental results proved that the proposed filter produce better PSNR (Peak Signal to Noise ratio) and reduces MSE (Mean Square Error) than other filter.***

Keywords: Median filter, Gaussian filter, Mean Filter, Average filter

I. INTRODUCTION

Image processing plays a vital role medical image disease diagnosis. Ophthalmologists are used retinal images in the diagnoses of eye diseases. Human's Retinal images are taken by fundus camera for analyzing by image processing to make decision of specific disease. Automatic prediction of retina blood vessels detection can be used to predict pathological risk or damage in advance. In large scale screening manual assessment is not scalable due to unavailability of higher imaging equipments. To automate and increase the speed of diagnosis in large scale we need the help of image processing. It is contains following stages to diagnosis such as preprocessing, enhancement, segmentation. Light variation shows in colour fundus. To reduce the fault and produce images suitable for extracting blood vessels, it must to recognize the belongings of fundus image then apply preprocessing. This step is used to produce high accuracy result in diagnosis. The pre-processing is used to improve the visual quality for further processing. The paper mainly consists of two parts: The first part deals with an review of enhancement techniques and discuss the various types of filters and its pros and cons. Then second part explain the proposed algorithm.

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I. REVIEW OF LITERATURE

Dr.M.Renuka Devi, V. Kavitha [6] introduced a hybrid filter to solve the problem of noises in the citrus fruit images. It combined the following two filters such as median and wiener filters.

In this paper performance of all filters were compared using metrics such as PSNR and MSE S. Shenbagavadivu et al [3] analyzed the performance of a median filter on various types of images such as still images by camera, medical image and remote sensing image. This paper made a analysis based on mean value and standard deviation of median filter with various modalities captured images and it concluded that median filter effectively removes salt and pepper noise.

Maheswari et al.[16] introduced a hybrid filter for paddy seeds to noise remove. This research focus to develop a method for identifying special variety of paddy seeds by using morphological features. These features are used to identify the paddy seeds very effectively. For acquisition of image cannon digital camera is used. These captured images are stored in the jpg format for future process.

Azadeh[11] et al to remove noise this paper compared five filtering techniques from skin cancer images. Median filter, Adaptive Median filter, Mean filter, Gaussian smoothing filter and Adaptive Wiener filters had tested to remove four kinds of noises (Speckle, Gaussian, Poisson and Salt & Pepper), which is mixed with the skin cancer images. PSNR value has calculated and concludes that Adaptive wiener works efficiently.

II. TYPES OF EXISTING FILTERS

A.Mean filter

The mean filter is also called as average linear filter. The mean filter is capable of calculating the average area of corrupted block in the original image. The calculated average value of the corrupted block will be chosen as the new value for the centre pixel of the block. The mean filter performs the task repeatedly until the average value is calculated for the entire block. Also until the corruption pixel present in the image is shifted over the image. The mean filter is helpful in smoothing the image. It also has some disadvantages. The median filter removes both the noise and the fine detail since it can't tell the difference between the two images.

B.Median Filter

The median filter is groped under the non-linear category. The median filter is used to compute the corruption block. The new median value for the corruption block is calculated and the new value is assigned as the centre pixel block of the current corruption block. The same step is repeated until the all the corruption region of the image is evaluated. But it also removes the color information of the image.

C.Sobel filter

The filter is used in image processing techniques in order to support the digital image processing. The filter is used for performing edge detection in the desired image. Gradient of the image is taken into account for computation of image intensity. The Sobel filter works on the basis of discrete differentiation operator. The result acquired from the Sobel filter is either gradient or the norm of the chosen vector

D.Winner filter

The Wiener filter is to filter out noise that has corrupted a signal. It is based on a statistical approach. Typical filters are designed for a desired frequency response. The Wiener filter approaches filtering from a different angle. One is assumed to have knowledge of the spectral properties of the original signal and the noise, and one seeks the LTI filter whose output would come as close to the original signal as possible. This filter is capable of reducing the noise and degrading function.

E.Gaussian filter

It is a linear filter and general purpose filter. It removes the noise from image by remove the edge details and blurr the image. It is very effective to remove Gaussian noise. But it is not match to remove salt and pepper noise. It processes every one noisy image pixels with a Gaussian kernel, which uses Gaussian distribution function to smooth the image.

F.Average filter

This method removing noise from images by dropping the amount of amount variation between adjacent pixels. This filter is moving in the image pixel by pixel and restores each value with the average of adjacent pixels including it. But single pixel with a very misleading value can considerably influence the average value of all the pixels in its region.

III. PROPOSED METHODOLOGY

The proposed method consists of the following stages which involves Image resize, colour translation, noise reduction, gradient calculation and image enhancement. The Figure 1 shows the details of proposed method:

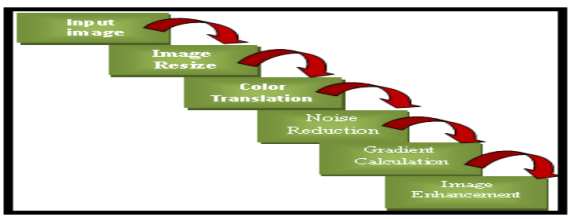

Figure 1 Proposed Method

The Retinal images may captured by microscopic camera with 10 mega pixels with dimensions 3120x4160 and also in RGB colour mode. These images are taken as input images. So the image is resized into standard format 256 x 256 dimensions. These are converted into gray scale image. Then the noise reduction is done with convolution 7*7 kernel size. Different types of noise added with gray scale image then these images are given input for proposed method. After noise reduction gradient calculation is done. After the noise reduction this step using edge detection operators to calculate the details of edge intensity and direction. Edges match to a change of pixels' intensity. To detect it, the easiest way is to apply filters that highlight this intensity change in both directions: horizontal (x) and vertical (y). After gradient calculation prediction of double threshold is done to predict weak intensity and strong intensity. This threshold value is used to predict edges.

This method is perfectly predicting the edge information and removes the noise in retinal images. It is a multi stage algorithm. It composed 5 steps as follows

Crafty Edge Detection (CED)

Step 1 : Input image is resized and transformed to gray scale

Step2 : Noise reduction with convolution 7*7 kernel size. It is done by multiplying a pixel's and its adjoining pixels color value by a matrix.

The equation for a kernel of size (2k+1)×(2*k*+1) is given by:

$$H_{ij} = \frac{1}{2\pi\sigma^2} \exp\left(-\frac{(i-(k+1))^2 + (j-(k+1))^2}{2\sigma^2}\right); 1 \le i, j \le (2k+1)$$

Step 3: Gradient Calculation

After the noise reduction this step using edge detection operators to calculate the details of edge intensity and direction.

Step 4: Identifying double Threshold values :Weak intensity and Strong intensity

Step 5: Noise reduced and edge preserved images

IV. RESULT AND DISCUSSION

The performance of proposed filter is tested with five retinal images. The Median filter and proposed filter works well on images corrupted by Salt and pepper noise. From the review of literature, Wiener filter and Gaussian filters are suitable to remove speckle noise and additive noises. But it does not appropriate to eliminate salt and pepper noise. The results shows that the proposed filter removes all types noise efficiently and preserve the edges than other filter. The quality metrics MSE,PSNR and STD values are calculated and evaluated with five images. Here, the experimental results are presented for five images in figures. The comparison of the metrics also shown in the table and the graph.The figure 2 shows the input original input image.

Figure 2 Input Retinal Image

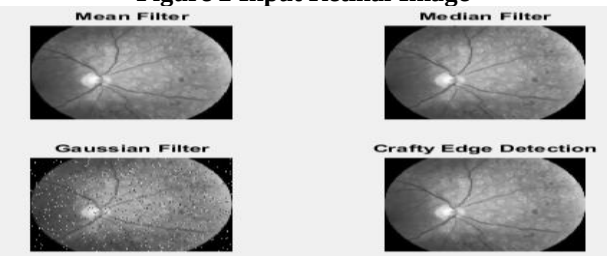

Figure 3. Image Denosing using various filters

TABLE-1: Comparison of PSNR values

Image	Median Filter	Mean Filter	Gaussian Filter	Average Filter	**CED Filter**
Image1	83.6371	75.1318	64.7350	62.4320	**89.2467**
Image2	84.0710	74.7125	58.7722	54.2358	**88.1246**
Image3	88.2183	72.5394	58.4121	51.4278	**89.2780**
Image4	89.5329	76.1820	58.3981	55.5634	**93.6724**
Image5	84.0971	73.4323	56.0212	52.3465	**87.1042**

TABLE-2: Comparison of MSE values

Image	Median Filter	Mean Filter	Gaussian Filter	Average Filter	**CED Filter**
Image1	0.042	0.022	0.220	0.212	**0.001**
Image2	0.034	0.022	0.109	0.190	**0.012**
Image3	0.041	0.012	0.094	0.145	**0.012**
Image4	0.021	0.022	0.119	0.138	**0.013**
Image5	0.023	0.023	0.259	0.263	**0.014**

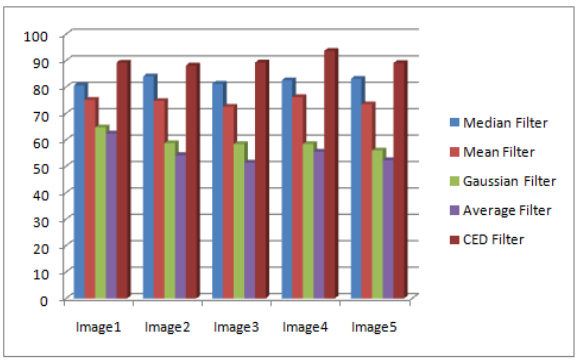

Figure 4 Comparison of PSNR Values

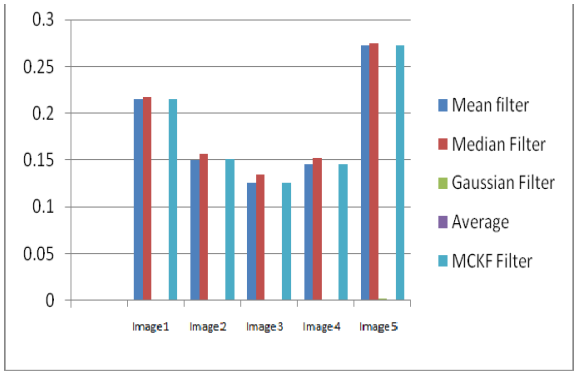

Figure 5 Comparison of STD Values

V. CONCLUSION

In this research discussed six types of filters and its drawbacks. The new filter crafty edge detector performances are testing and compared with Mean, Median, Gaussian, Average filters. The results are shown in figures. The MSE,PSNR and STD (Standard Deviation) values had measured for study, which is shown in charts and tables. The low value of MSE indicates the better enhancement approach but the high PSNR value indicates the better ones. The new method yields better results than other filters.

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Dr.M.. Renuka Devi , has nearly 18 years of post graduate teaching experience in Computer Science. She has indulged in training the post graduate students to complete real time projects and also guides research scholars in Computer Science. She has published 45 papers in various international journals and she has acted as a chair person in various international conferences. Currently she is working as Professor and Head, Department of BCA, Sri Krishna Arts And Science Coimbatore (Dt), Tamil Nadu, India

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