A Hybrid Filtering Techniques for Noise Removal in Color Images

Monika Saini
Department of Computer Science and Engineering
KIIT College of Engineering, Gurgaon, Haryana

Sangita Yadav
Department of Computer Science and Engineering
Yadhuvanshi Institute of Technology, Narnaul, Haryana

Sharvan Rewri
Assistant Professor
KIIT College of Engineering, Gurgaon, Haryana

Abstract- Noise is an important factor that influences image quality which is mainly produced in the processes of image acquirement and transmission. Noise reduction is necessary for us to do image processing and image interpretation so as to acquire useful information that we want. Because the working status of image transmitter is influenced by varied of factors, such as the environment of image acquired, different noises can be dealt with in different ways. Through the analysis of OCT images, its difference can help us to choose different methods to do noise reduction while the information of the OCT image is reduced to be the most. This paper illustrates some methods of noise reduction and takes one test image as an example. Since this image was affected by noise, the noise reduction methods of this OCT image are mainly studied. Then, MSE and PSNR are calculated to evaluate the processed image. Results suggest that the methods used in this paper are suitable in processing this noise.

Keywords – Watermarking, Haar Wavelet, OCT, PSNR, Image enhanced factor, conventional, median filter, mean square error, salt and pepper noise

I. INTRODUCTION

Every digital image has a two-dimensional mathematical representation of an image. Digital images are composed of pixels i.e. picture element. Each pixel represents the gray level for black and white photos at a single point in the image, so a pixel can be represented by a tiny dot of a fussy color. By calculating the color of an image at a large number of points, we can generate a digital approximation of the image from which a copy of the original can be recreated. Pixels are a slight like grain particles in a conventional photographic image, which can be arranged in a regular pattern of rows and columns and store information differently to some extent. A digital image is a rectangular arrangement of pixels sometimes called a bitmap. The evinced an improved decision-based algorithm for the restoration of gray-scale and color images that are highly corrupted by Salt and Pepper noise which efficiently removes the salt and pepper noise by preserving all details [11]. The algorithm utilizes formerly processed neighboring pixel values to get better image quality than the one utilizing only the just previously applied pixel value. The projected algorithm is faster and also produces better result than a Standard Median Filter (SMF). The advantage of the proposed algorithm lies in removing only the noisy pixel either by the median value or by the mean of the previously processed neighboring pixel values. The proposed that removal of high density salt and pepper noise in noisy color images using projected median filter [12]. The presentation of improved median filter is good at lower noise density level. The mean filter prevents little noise and gets the worst results. The enhanced median filter is good at lower noise density levels. It suppresses most of the noises effectively while preserving colored image details. The performance of the algorithm is analyzed in terms of Peak signal to noise ratio (PSNR), Mean square error (MSE), Image Enhancement Factor (IEF). The suggested that images are often corrupted by noise known as salt and pepper noise [13]. This noise can corrupt the images and the corrupted pixel takes either maximum or minimum gray level. Along with these standard median filters has been established as reliable method to remove the salt and pepper noise without harming the edge features. Though, the major problem of standard Median Filter (MF) is that the filter is effective only at low noise densities.

II. BACKGROUND HISTORY

Firstly all the pixels are classified into signal pixels and noisy pixels by using the Max-Min noise detector. The noisy pixels are then separated into three classes, which are low-density, moderate-density, and high-density noises, based on the local statistic information. Finally the weighted 8-neighborhood similarity function filter, the 5×5 median filter and the 4-neighborhood mean filter are adopted to remove the noises for the low, moderate and high level cases, respectively. The validation results show that the proposed algorithm has better performance for capabilities of noise removal, adaptively, and detail preservation, especially effective for the cases when the images are extremely highly corrupted. Image filtering processes are applied on images to remove the different types of noise that are either present in the image during capturing or introduced into the image during transmission. The salt & pepper(impulse) noise is the one type of noise which is occurred during transmission of the images or due to bit errors or dead pixels in the image contents. The images are blurred due to object movement or camera displacement when we capture the image. The hybrid filter is a combination of wiener filter and median filter. [5] Used for proposed for the removal of fog using bilateral filter.

The proposed work on image enhancement using α-trimmed mean filters [8]. Image enhancement is the most important challenging pre-processing for almost all applications of Image Processing. By now, various methods such as Median filter, α-trimmed mean filter, etc. have been suggested. It was proved that the α-trimmed mean filter is the modification of median and mean filters. On the other hand, filters have shown excellent performance in suppressing noise. In spite of their simplicity, they achieve good results. In this paper, we suggested a new filter which utilizes α-trimmed mean. We argue that this new method gives better outcomes compared to previous ones and the experimental results confirmed this claim.

A. Filters for Suppression of Additive Noise: Traditionally, AWGN is suppressed using linear spatial domain filters such as Mean filter [13-21], Wiener filter [13, 23, 24-26] etc. The traditional linear techniques are very simple in implementation but they suffer from disadvantage of blurring effect.

They also do not perform well in the presence of signal dependant noise. To overcome this limitation, nonlinear filters are proposed. Some well known nonlinear mean filters are harmonic mean, geometric mean, L_p mean, contra-harmonic mean proposed by Pitas Some of researcher are found to be good in both preserving edges and suppressing the noise. Another good edge preserving filter is Lee filter [27] proposed by J.S. Lee. The performance of this filter is also good in suppressing noise as well as in preserve edges. Bilateral filter works on the principle of geometric closeness and photometric similarity of gray levels or colors.

B. Filters for Suppression of Impulsive Noise: An impulsive noise of low and moderate noise densities can be removed easily by simple denoising schemes available in the literature. A simple median filter [40] works very nicely for suppressing impulsive noise of low density and is easy to implement. But the cost paid for it distorts edges and fine details of an image. The distortion increases as the filtering window size is increased to suppress high density noise. Specialized median filters such as weighted median filter [40-44], center weighted median filter [45-47, 57, 58] and Recursive Weighted Median Filter (RWMF) [46] are proposed in literature to improve the performance of the median filter by giving more weight to some selected pixel(s) in the filtering window. But they are still implemented uniformly across an image without considering whether the current pixel is noisy or not. Additionally, they are prone to edge jitter in cases where the noise density is high. As a result, their effectiveness in noise suppression is often at the expense of blurred and distorted image features.

III. METHODOLOGY AND PLANNING OF WORK

We applied lot of filter to reduce the noise and to calculate peak signal to noise ratio, mean square error etc and after that we compare the result of all filter. The main focus of digital image processing is to improve the potential information for human interpretation and processing of image data for storage, transmission, and representation for autonomous machine perception. The quality of image degrades due to contamination of various types of noise. Additive white Gaussian noise, Rayleigh noise, Impulse noise etc. corrupt an image during the processes of acquisition, transmission and reception and storage and retrieval. Image deblurring and image denoising are the two sub-areas of image restoration. In the present research work, efforts are made to propose efficient filters that suppress the noise and preserve the edges and fine details of an image as far as possible in wide range of noise density.

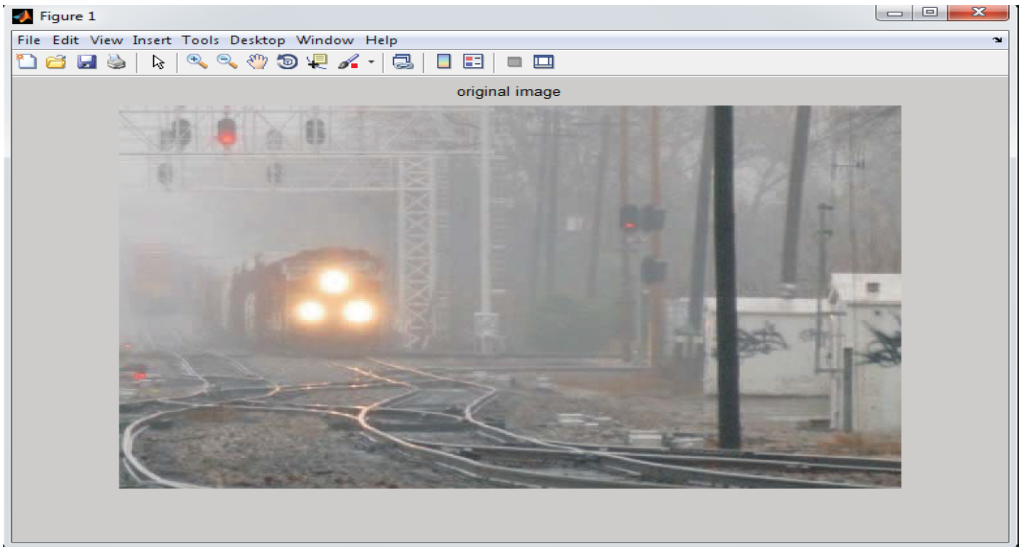

Fig.1 Original Image

Methodology Block Diagram:

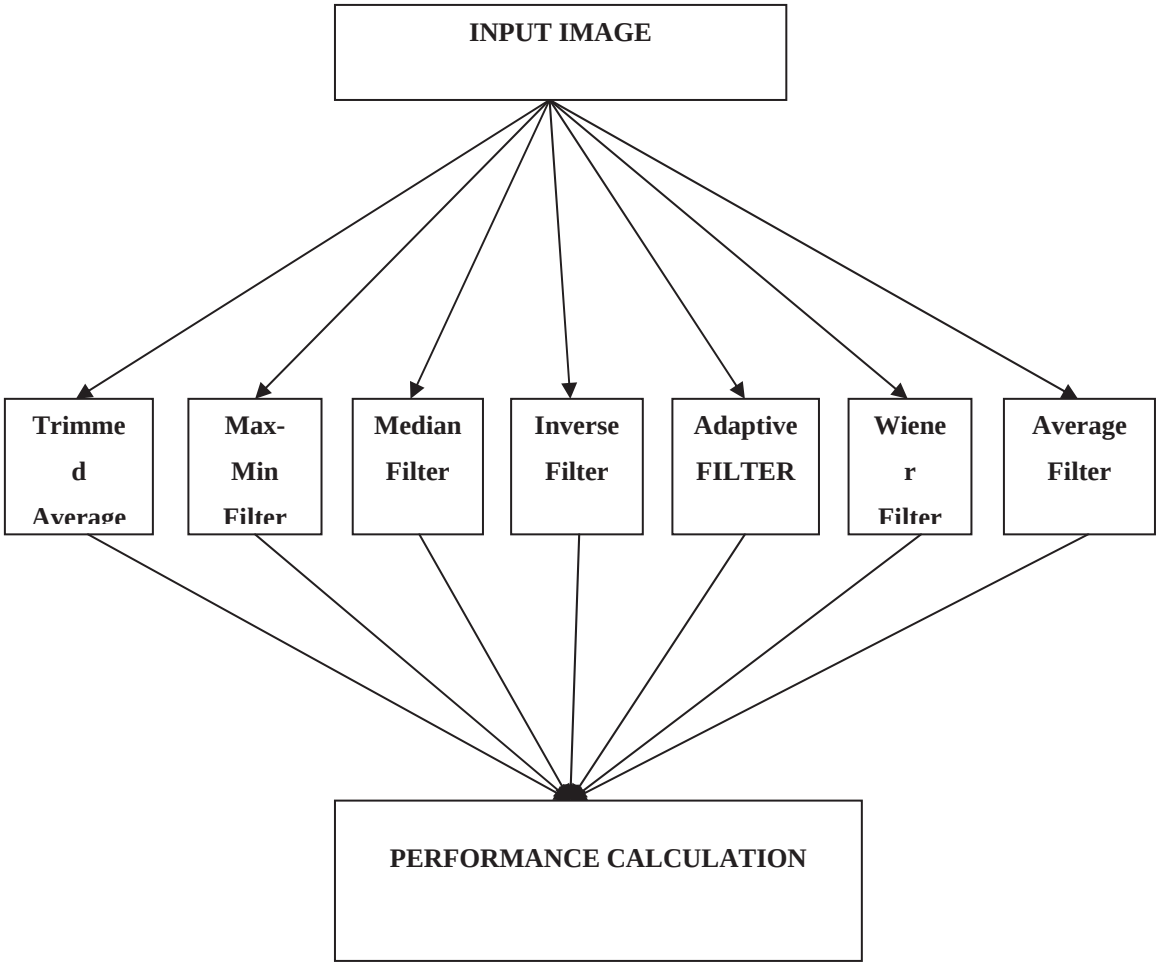

Fig.2 Methodology block model

After applying these filter we got different images and corresponding to each filter we got different peak signal to noise ratio, mean square error, normalized cross correlation and normalized absolute error. Out of these some result are depicted under.

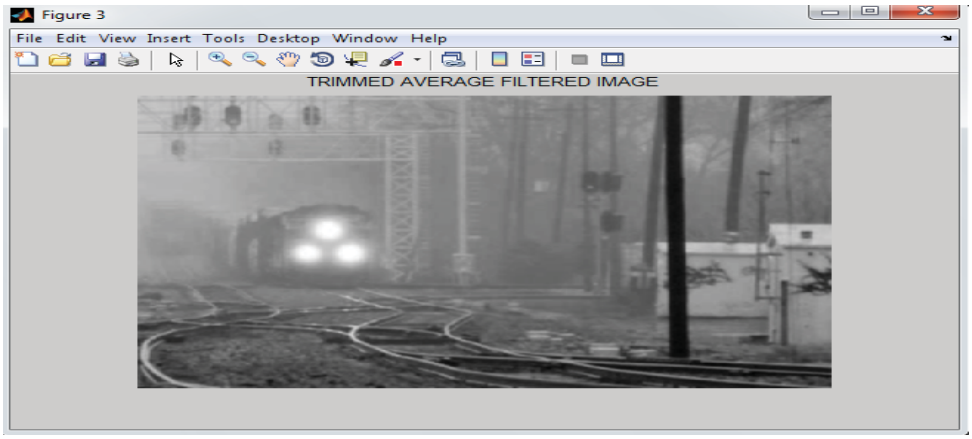

Fig.3 trimmed average filtered Image

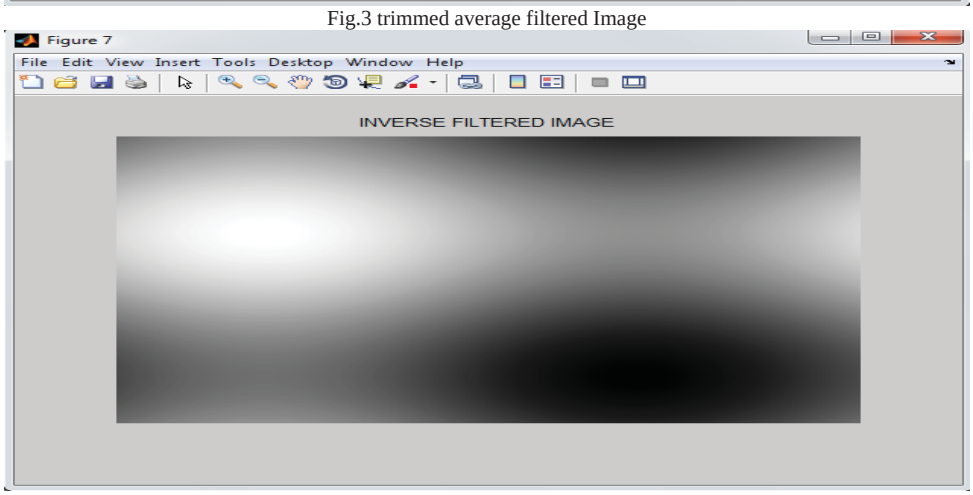

Fig.4inverse filtered Image

Fig.5 adaptive filtered Image

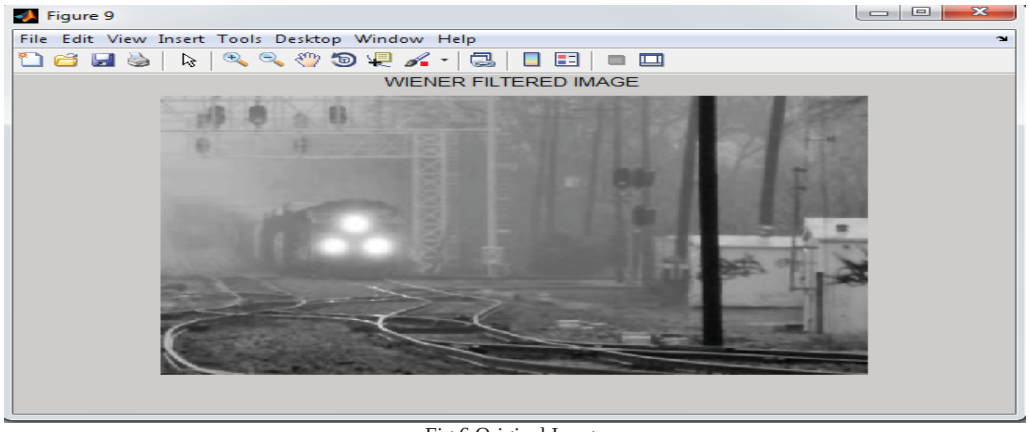

Fig.6 Original Image

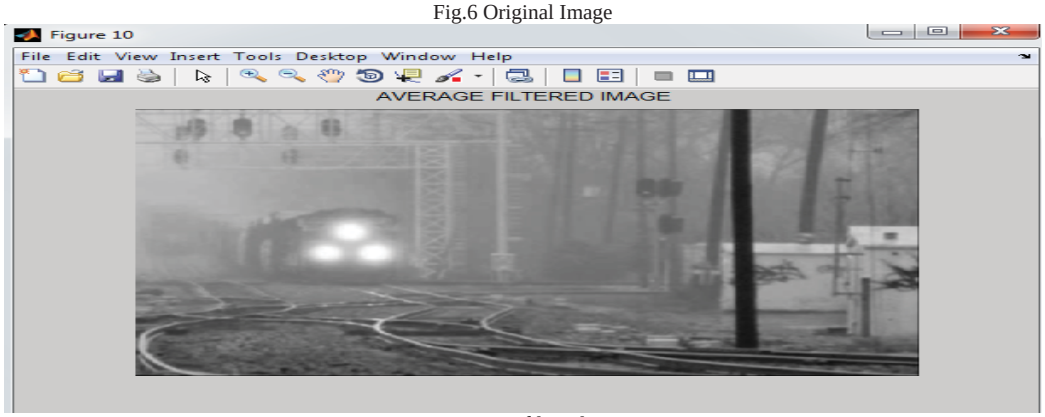

Fig.7 average filtered Image

Fig.8 Wavelet denoising filtered image

IV. RESULT

The purpose of calculating the performance of the filter and after that comparison between then, will show which filter are better for noise removing. Such method is mainly due to highly accurate noise detection experienced by the noise detection algorithm having high noise detection ratio and our method performs more desirable than the median filter and other conventional edge preserving method. The (Peak signal to noise ratio) PSNR, (Signal to noise ratio) SNR is high; (mean squared error) MSE is low. This advised method is a fast method for removing salt and pepper noise.

MEAN SQUARE ERROR	PEAK SIGNAL TO NOISE RATIO	NORMALIZED CROSS CORRELATION	NORMALIZED ABSOLUTE ERROR	FILTER
0.0113	67.5741	0.8162	0.1825	Trimmed Average Filtered Image
0.0033	72.8746	1.0313	0.0441	Min Filtered Image
0.0079	69.1511	0.9484	0.0523	Min Filtered Image
0.00024	84.2325	0.9972	0.0064	Median Filtered Image
0.0436	61.7357	0.8688	0.3114	Inverse Filtered Image
11.2375	37.6240	-1.10573	5.00047	Adaptive Filtered Image
0.00005	90.79926	0.9992	0.00667	Wiener Filtered Image
0.00089	78.6151	0.9929	0.01429	Average Filtered Image
0.1783	55.6185	0.2827	0.7602	Wavelet Denoising Filtered Image

V. CONCLUSION

By conducting the review of some high quality papers it is found that the hybrid median filter has quite more benefits over existing image filters. It is also found that hybrid median filter is only best for salt and pepper noise. To remove other kind of noises like Gaussian and random noise some other filters are required. So to make the filtering more better a new filter will be proposed in near future which has ability to remove more than one type of noises. In this paper, a recent adaptive noise reduction scheme for removing salt and pepper noise is proposed which categorizes impulse noise and will remove the noise from the corrupted image that is followed by image enhancement scheme to retain the details and image quality. As per the new results, the future algorithm yields good filtering result. This is recorded by numerical measurements like PSNR and visual observations through the experiments performed. So, we recommend an algorithm for eliminate salt and pepper noise removal. The suggested method is actually an adaptive median filter. The benefits of this proposed method are the fuzzy initialization of filtering window size and the precision of median value. Comprehensive method results expose that our filter consistently outperforms the existing filters by attaining much higher PSNR across a wide range of noise densities, from 10% to 90%. The purpose of such method is mainly due to highly accurate noise detection experienced by the noise detection algorithm having high noise detection ratio and our method performs more desirable than the median

filter and other conventional edge preserving method. The PSNR, SNR is high; MSE is low. This advised method is a fast method for removing salt and pepper noise.

The MSE is 0.00005 the image having a very less noise because the MSE is low. The wiener filtered image having a very less noise, the peak signal to noise ratio is 90.79926, this is very high and normalized error is 0.0066. The wiener filter is the best filter for removing the noise according to the performance table. The MSE for the restored image is 11.2375 and peak signal to noise ratio 37.6240 for adaptive filter. The Wiener filter is the best filter and adaptive filter is the worse filter for noise removable process. We having some more filters which one also having the good performance as compares to adaptive filter, we can use those filter as well for noise removal.

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