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Designing of Hybrid Filter

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***Abstract*— In digital image processing, image de-noising plays a vital role and generates a high quality image. Using different techniques of filter, comparing the traditional methods of image de-noising and reduce the error rate. Comparing the error rate of different images using different filter technique such as Weiner Filter, Kuwahara Filter and Hybrid Filter, which is a combination of Mean and Median Filter. Degradation of an image is a serious problem and it happens when the camera captures an image it might get degraded and noise is transmitted through the external or internal source. The filter is used to remove the speckle so that the inner region as well as the outer region gets clearer. The final analysis of images shows the qualitative and quantitative dimensions. This filter calculating the error rate such as MSER, RMSE, PSNR, NMSE and MAE and PSNR error enhances and other error rates reduces. It gives the high PSNR values.**

***Index Terms*— MSER, RMSE, PSNR, NMSE, MAE.**

I. INTRODUCTION

effectively filtered out through different techniques. Filters can help in removing the speckle from inner region of the image and preventing the edges. Some filters are preserving the edges and smoothen the image.

Linear Filter

This filter is used for reducing random noise, sharpening the edges and correcting unequal illuminations. The main filters blur the edges and destroy the fine details of an image. They have poor performance in removing signal dependent noise. Linear filtering is a filtering in which the value of an output pixel is a linear combination of the values of the pixels in the input pixels neighbourhood, procedure is carried out by filtering the image with correlation of an appropriate filter kernel [9]. The value of output pixel is calculated as a weighted sum of neighbouring pixels called Convolution. The linear filter can be represented by the following equation

Convolution: r(j,k) = -k (3)

Weiner Filter

This filter is following the powerful linear technique which is meaningful when additive noise is present [1]. This filter is especially designed for image de-noising of motion blur removal [2].

Kuwahara Filter

The main task done by this filter is to smoothen the image and preserving its edge and corners. The best technique to smoothen the image is low pass filtering. However since it would not only remove the noise but also strongly attenuates high-frequency components and edges and corners are also smoothed out. One limitation of the Kuwahara filter is the block structure of the output, particularly evident on textured areas, that is due to the square shape of the regions [10].

Mean Filter

This filter is a Linear Filter especially designed to preserve the edges and smoothen the image. It helps in blurring the signal's boundaries. This filter effectively works in smoothing the Gaussian noise and Uniformly distributed noise.

Hybrid Filter

Hybrid Filter is a combination of Mean and Median Filter. A image of 256x256 is captured by a camera so image gets degraded by the noise which is removed by this designed Hybrid Filter and it would give the better quality of image.

II. PROPOSED WORK

The main idea of the Low Noise Rim Preserving filter is to use the hybrid filter that's built up of Mean and Median filter. When we pass an image of 256×256 across the designed filter so we start computing the image from the leftmost corner by selecting the 3×3 matrix pass through it from the designed filter and then repeat this process till the completion of whole so it reduces noise .

Algorithm

The main methodology follows the steps in the sequential order.

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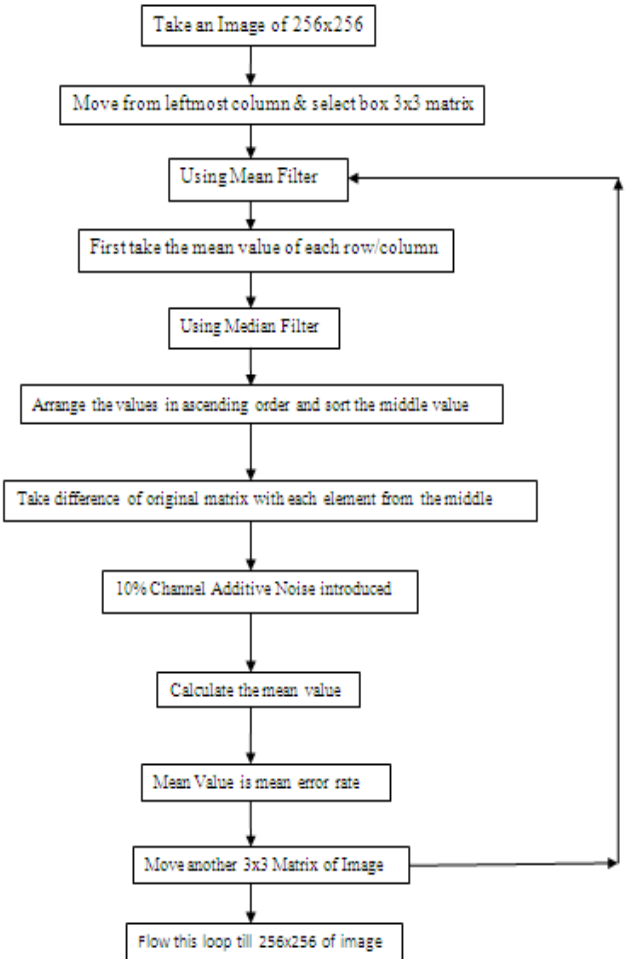
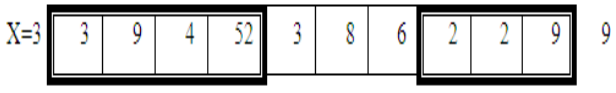


Figure 1 Algorithm

III. METHODOLOGY

1D Matrix Median Filter

Median filter is applied on the 1 D matrix to sort out the middle value. In this 1 D matrix we need to preserve the edges of the first and the last value which is taken outside the matrix region where X is Input Matrix in which values are sorted in ascending order and Y is Output.



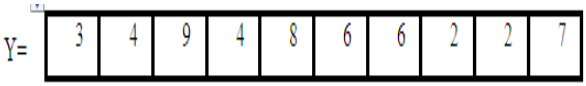
Y [1] = round [3 3 9] = 3 Y [6] = round [3 8 6] = 6

Y [2] = round [3 9 4] = 4 Y [7] = round [8 6 2] = 6

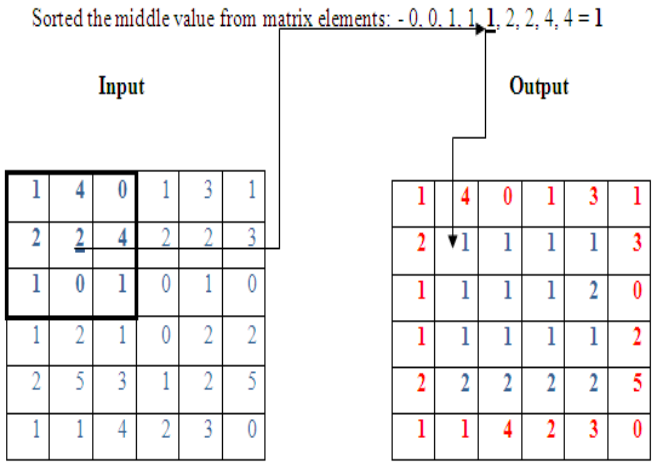
Y [3] = round [9 4 52] = 9 Y [8] = round [6 2 2] = 2

Y [4] = round [4 52 3] = 4 Y [9] = round [2 2 9] = 2

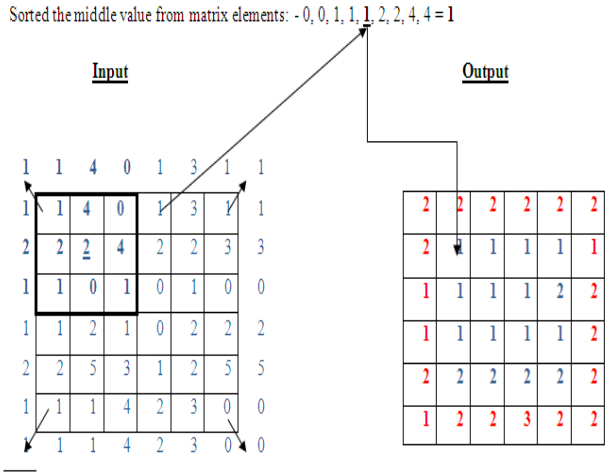
Y [5] = round [52 3 8] = 8 Y [10] = round [2 9 9] = 7

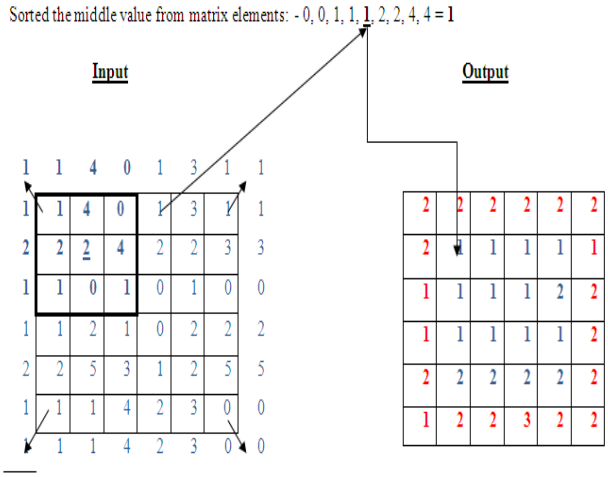


This Y is the output of the matrix in which the middle value is selected from three elements.



2 D Matrix using Median Filter : Example of sorting





IV. RESULT AND ANALYSIS

These images show the comparative analysis of different images using different filters. When these images are passed through the Kuwahara Filter, Weiner Filter and Hybrid Filter, so we find better results of Hybrid filter and the error rate also reduces to the minimum level.

Figure 1.1(a) Original color Image

Figure 1.1 (b) Red Channel Image

Figure 1.1 (c) Green Channel Image

Figure 1.1(d) Blue Channel Image

Figure1.1 (e) Image with salt and pepper noise

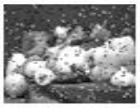


Figure1.1 (f) Noisy Red Channel

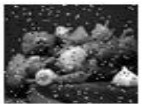


Figure1.1 (g) Noisy Green Channel

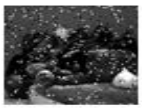


Figure1.1 (h) Noisy Blue Channel

Figure1.1 (i) Restored Image

Figure 1.1 Pepper's Image with salt and pepper noise and finally restores the original image with Median Filter

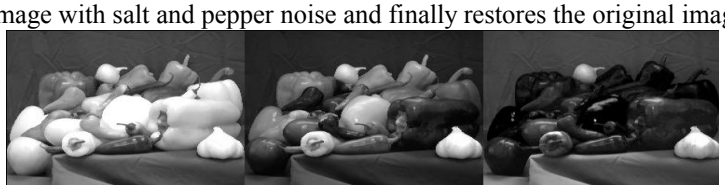


Figure 1.2 Pepper (a) Image of Kuwahara Filter (b) Image of Hybrid Filter (c) Image of Weiner Filter

Figure 2.1(a) Original color Image

Figure 2.1 (b) Red Channel Image

Figure 2.1 (c) Green Channel Image

Figure 2.1(d) Blue Channel Image

Figure2.1 (e) Image with salt and pepper noise

Figure2.1 (f) Noisy Red Channel

Figure2.1 (g) Noisy Green Channel

Figure2.1 (h) Noisy Blue Channel

Figure2.1 (i) Restored Image

Figure 2.1 Lena's Image with salt and pepper noise and finally restores the original image with Median Filter

Figure 2.2 Lena (a) Image of Kuwahara Filter (b) Image of Hybrid Filter (c) Image of Weiner Filter

Figure 3.1(a) Original color Image

Figure 3.1 (b) Red Channel Image

Figure 3.1 (c) Green Channel Image

Figure 3.1(d) Blue Channel Image

Figure3.1 (e) Image with salt and pepper noise

Figure3.1 (f) Noisy Red Channel

Figure3.1 (g) Noisy Green Channel

Figure3.1 (h) Noisy Blue Channel

Figure3.1 (j) Restored Image

Figure 3.1 House Image with salt and pepper noise and finally restores the original image with Median Filter

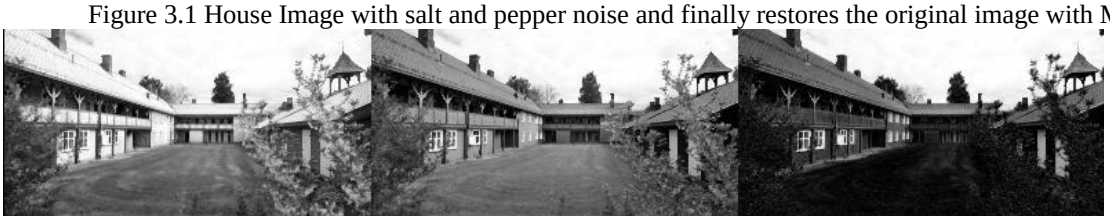


Figure 3.2 Lena (a) Image of Kuwahara Filter (b) Image of Hybrid Filter (c) Image of Weiner Filter

V. TABLE

The table given below is showing the comparative analysis of different parameters such as MSER, RMSE, PSNR, NSME and MAE. As the Fig.1.2 in which as we pass the images through these filter so we get the error rate at minimum level. In the same way Fig. 2.2 and 3.2 the error rate is reduced as compare to the previous image. The error rate of Hybrid Filter is quite low as compare to the Weiner and Kuwahara Filter. The PSNR value is enhanced at good level in Fig. 3.2 through Hybrid Filter.

Table 1 Comparing the Results of Weiner, Kuwahara and Hybrid Filter

Figure	Parameters	MSER	RMSE	PSNR	NMSE	MAE
Pepper Figure 1	Kuwahara Filter	656.6118	25.6244	19.9577	0.1177	14.9821
	Weiner Filter	178.7156	13.3685	25.6092	-0.0010	7.5407
	Hybrid Filter	96.0030	9.6798	28.3080	5.1561e-005	5.5299
Lena Figure 2	Kuwahara Filter	653.0457	25.5548	19.9814	0.1231	15.3587
	Weiner Filter	228.1697	15.1053	24.5482	-0.0020	8.6827
	Hybrid Filter	88.6155	9.4136	28.6557	3.6816e-005	5.6596
House Figure 3	Kuwahara Filter	169.1204	13.0046	25.8488	0.0818	6.6564
	Weiner Filter	73.8688	8.5947	29.4462	0.0013	4.0221
	Hybrid Filter	15.9228	3.9908	36.1106	5.2389e-006	2.0848

VI. CONCLUSION

Finally, we analyzed the result of Hybrid Filter is much better as compare to the Kuwahara and Weiner filter. Error rate is improved by 10% through the Hybrid Filter. It is better than other filters. The future aspects of this filter is we can use it in Medical field, Sattelite Images and for many purposes.

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