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Performance Analysis of Different Filters using Digital Image Restoration

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ABSTRACT: In this paper, a method to restore the image degraded by white noise has been introduced. This method uses different filters to regain restore the quality of degraded image. The median filter is one of the well-established linear filtering methods and is well known for its excellent performance in denoising the white noise. However the estimation of the original image from the degraded image characterization is very difficult task as in most of time only a degraded version of image in available in many image processing application. Performance comparison of the denoising methods as Average filter, Gaussian filter, Median filter, Wiener filter in frequency domain. Wiener filter in frequency domain have the lowest value of PSNR with the Gaussian noise and average filter have the highest PSNR value. Again performance comparison of the denoising methods as Average filter, Gaussian filter, Median filter, Wiener filter in frequency domain (in PSNR). Median filter have the highest value of PSNR with the salt & pepper noise.

It has been observed that the median filter is having overall performance for images corrupted by white noise better compared to other nonlinear filters. Thus, the median filter is a solution to the restoration problem based upon the use of linear filter.

1 Introduction

We may define noise to be any degradation in the image signals, caused by external disturbance. If an image signal is being sent electronically from one place to another place, via satellite or wireless transmission, or through the networked cable, we may be expect errors to occur in the image signals. These errors will appear on the image output in different ways depending on the type of disturbance in the signal. We know what types of error to expected, and hence the type of noise/echo on the image; hence we can choose the most appropriate method for reducing the effects. Cleaning an images corrupted by noise/echo signal is thus an important area of image restoration. [2]

The main Applicationsare : Medicine, Agriculture, Industry, Law enforcement and Digital camera images.

Mean / Average Filter

If the Gaussian noise has mean 0, then we would expect that an average filter would average the noise to 0. The larger size of the filter mask, the closer to zero. Unfortunately, averaging tends to blur an image. However, if we are preparing to trade off blurring for noise reduction, then we can reduce noise significantly by this method.

Fig.1 original image

Fig.2 noised image

Fig.3 Filtering mask 3x3

Fig.4Filtering mask 5x5

Fig.5 Filtering mask 7x7

Fig. 6Filtering mask 9x9

S.No	Filter's Name	MSE	PSNR
1	Average with 3x3 mask	0.0036649	78.5448
2	Average with 5x5 mask	0.0054606	76.813
3	Average with 7x7 mask	0.0070869	75.6808
4	Average with 9x9 mask	0.0084112	74.9368

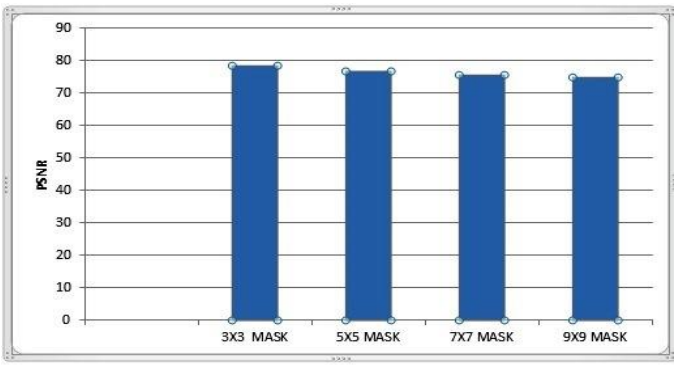

Fig.7 Comparison of average filter with different masking

Gaussian Filter

Gaussian filters are a class of low-pass filters; all based on the Gaussian probability distribution Function .it uses a different kernel that represents the shape of a Gaussian (`bell-shaped') hump. [7]:

$$G(x) = \frac{1}{\sqrt{2\Pi\sigma}}\, e^{\left(-\frac{x^2}{2\sigma^2}\right)}$$ Gaussian function in one dimensional

σ = standard deviation

Fig.7 Original image

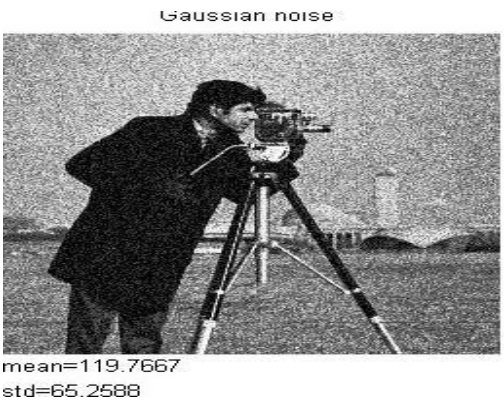

Fig. 8 noised image

Fig. 9 filtering 3x3

Fig.10 filtering 5x5

Fig. 11 filtering7x7

Fig. 12 filtering 9x9

S.No	Filter's Name	MSE	PSNR
1	Gaussian with 3x3 mask	0.0042761	77.8749
2	Gaussian with 5x5 mask	0.0042544	77.897
3	Gaussian with 7x7 mask	0.0004251	77.9005
4	Gaussian with 9x9 mask	0.0042021	77.9507

Table 2Comparison of Gaussian filter with different masking

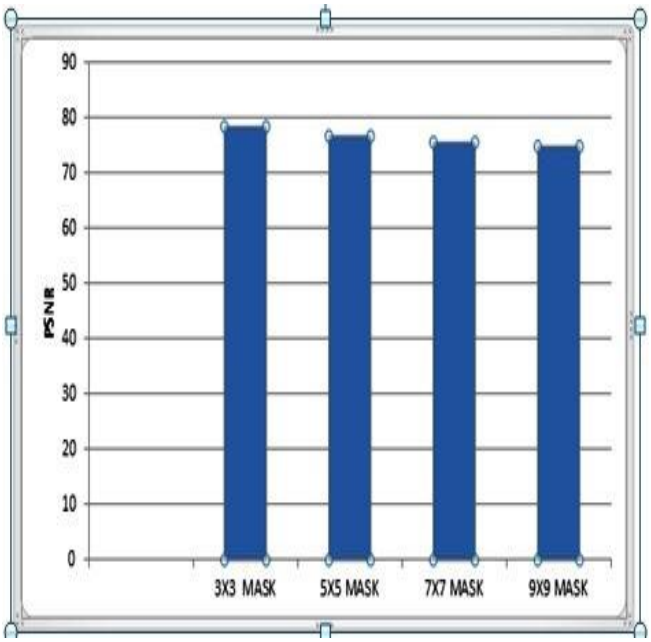

Fig.13 Comparison of different filters with 'Gaussian' noise

2 Results

Table 3 comparision of average and gaussian filter PSNR

S. No	Filter's Name	Mean	Std	MSE	PSNR
1	Average	119.8033	58.392	0.0036649	78.5448
2	Gaussian	119.5358	61.3188	0.0042761	77.8749

3. Conclusions

For this specific comparison, the Gaussian filter is better noise immunity and generates a lower error than any of the other procedures that are examined here. An image is degraded by white noise; the gaussian filter is more suitable for restoration than a variety of smoothing filters such as the Gaussian, mean/average. In an ideal case where both the original and noise images are known, it has been found that the gaussian filter is more effective. This comparison can be seen in table and filtered image.

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