Removal Of Salt And Pepper Noise Using Adaptive Median Filter

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***Abstract*-- A median filter is proposed for the restoration of gray scale images that are highly corrupted by salt and pepper noise. In this filter at first the noisy pixel is identified and then it is replaced by a suitable value .**
In this paper, we proposed a method, Median Filter (MF), to remove salt and pepper (SAP) noise at all densities. We then explained some basic notions of it..
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***Index Terms*— Median Filter (MF) , digital image processing – salt and pepper noise , noise, filter, removal .**

I. Introduction

Noise is basically an undesired information that affects the quality of signals and data. In image processing noise appears from different sources like variation in the detector sensitivity ,environmental variation, transmission, quantization. The salt and pepper noise is caused by faulty memory location ,error in data transmission, camera sensor etc. The pixels which are corrupted by salt and pepper noise takes only maximum (255) and minimum (0) value of a gray scale image. The area of digital image processing refers to dealing with digital images by means of a digital computer. Digital image processing involves the modification of digital data for improving the image qualities with the aid of computer which helps maximize the clarity, sharpness of image and details of features of interest towards extraction of information for further analysis .

The median filter (MF) is the most popular non linear filter used for removing salt and pepper noise in image processing applications [1]. The main idea of the median filter is to run the filter window pixel by pixel, replacing each pixel with the median of pixels in the window. Here the window must have odd number of pixels. There are different types of median filter developed till now such as weighted median filter [2,3], switching median filter [4], adaptive median filter (AMF), adaptive weighted mean filter .

II. Median filter

The median filter is a nonlinear signal processing technology based on statistics. The noisy value of the digital image or the sequence is replaced by the median value of the neighborhood (mask). The pixels of the mask are ranked in the order of their gray levels, and the median value of the group is stored to replace the noisy value. The median filtering output is g(x, y) med{ f (x - i, y - j),i, j -W} , where f (x, y), g(x, y) are the original image and the output image respectively, W is the two-dimensional mask: the mask size is n*n (where n is commonly odd) such as 3* 3, 5* 5, and etc.; the mask shape may be linear, square, circular, cross, and etc.

Because the median filter is a nonlinear filter, its mathematical analysis is relatively complex for the image with random noise. For an image with zero mean noise under normal distribution, the noise variance of the median filtering is approximately [5].

$$\sigma_{med}^2 = \frac{1}{4n\, f^2(\overline{n})} \approx \frac{{\sigma_i}^2}{n + \frac{\pi}{2} - 1} \cdot \frac{\pi}{2}.$$

Fig.1.

where σ^2_i is input noise power (the variance), n is the size of the median filtering mask, f (n) is the function of the noise density. And the noise variance of the average filtering is :

$$\sigma_0^2 = \frac{1}{n}\sigma_i^2.$$

Fig.2.

Comparing of (1) and (2), the median filtering effects depend on two things: the size of the mask, and the distribution of the noise. The median filtering performance of random noise reduction is better than the average filtering performance, but to the impulse noise, especially narrow pulses are farther apart and the pulse width is less than n / 2 , the median filter is very effective. The median filtering performance should be improved if the median filtering algorithm, combined with the average filtering algorithm, can adaptively resize the mask according to the noise density.

III. Simulation Experiments

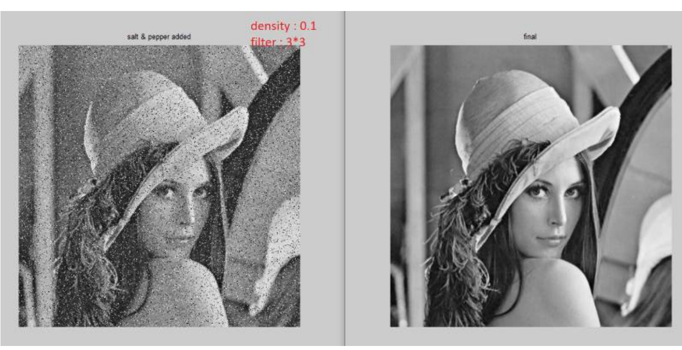
First we have corrupted The original picture then applied the filters , the original photo that had been used is shown in fig.3 :

Fig.3.

a. Experiment 1:

the experiment of the standard median filtering algorithm,.

10% , 30%, and 50% density impulse noises are respectively added to the original image of Lena. With 3*3 filter , results are shown as Fig. 4.



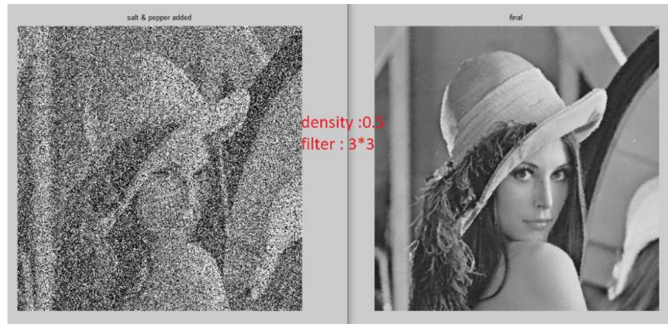


Fig.4.

✓ Conclusion

We could observe that as the density increases , our filter cannot improve all of the noises and the final photo is still noisy . on the other hand we saw that the original photo and the final photo are different from each other so when we applied the median filter we lost some details in the original photo .

b. Experiment 2:

changing the filter size to 5*5 .

and 40%, and 60% density impulse noises are respectively added to the original image of Lena. Results are shown as Fig.5.

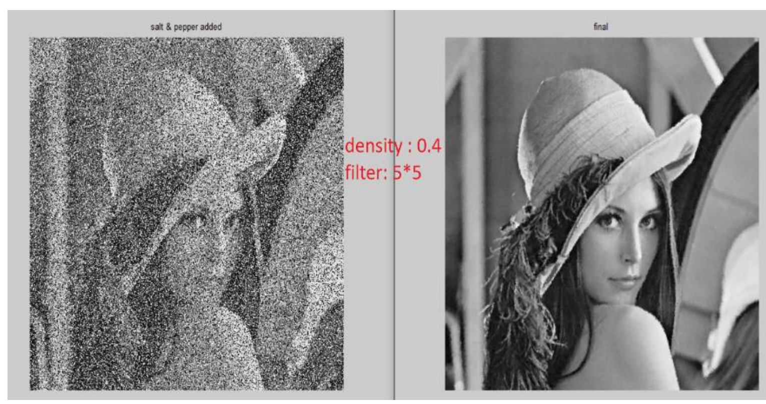


Fig.5.

c. Experiment 3:

changing the filter size to 7*7 .

and 60% density impulse noises are respectively added to the original image of Lena. Results are shown as Fig.6.

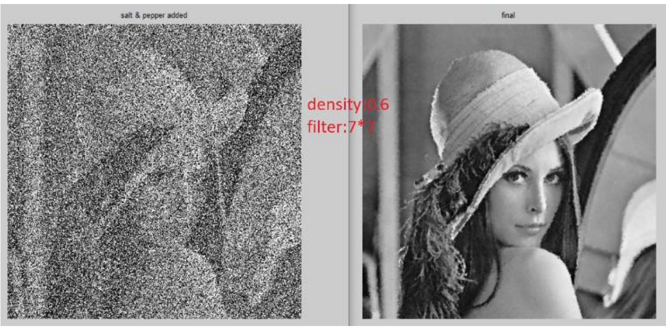


Fig.6.

✓ Conclusion

We could observe that as we increase the size of filter , our filter can improve the more noises but as the same old experiments the final photo is still noisy and got smoother.

IV. Conclusion

In this paper we implemented an adaptive median filtering algorithm for image noise reduction . It can adaptively resize the mask according to noise levels of the mask.

V. References

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