RESTORATION OF DIGITAL IMAGE AFFECTED BY SALT AND PEPPER NOISE

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ABSTRACT

This paper presents an efficient approach for restoring image affected by salt and pepper noise detection and removal. Initially, the detection stage will utilize the histogram of the corrupted image to identify noise pixels. These detected "noise pixels" will then be subjected to the second stage of the filtering action, while "noise-free pixels" are retained and left unprocessed. The proposed algorithm replaces the noisy pixel by trimmed median value when other pixel values, 0'sand 255's are present in the selected window and when all the pixel values are 0's and 255's then the noise pixel is replaced by mean value of all the elements present in the selected window except the processing pixel. This proposed algorithm shows better results than the Standard Median Filter (MF), Decision Based Algorithm (DBA), Modified Decision Based Algorithm (MDBA), and Progressive Switched Median Filter (PSMF). The proposed algorithm is tested against different grayscale and color images and it gives better Peak Signal-to-Noise Ratio (PSNR)

Keywords: Restoration, Salt and Pepper Noise, Switching Median Filter, Denoising

I INTRODUCTION

The occurrence of salt-and-pepper noise can severely damage the information or data embedded in the original image during image acquisition and transmission. Attenuation of noise and preservation of details are usually two contradictory aspects of image processing. Nevertheless, both of them are important to subsequent processing stages like edge detection or segmentation. One of the simplest ways to remove salt-and-pepper noise is by windowing the noisy image with a median filter The median filter, as well as its modifications and generalizations [2],[3] has been demonstrated to offer good performance in the removal of impulse noise. However, because these approaches are typically implemented invariantly across an image, they also tend to alter noise free pixels moreover they are prone to edge jitter in cases where the noise ratio is high [4].As a result, the effectiveness in noise suppression is often at the expense of blurred and distorted image features. Many existing methods use noise detection stage to determine whether a pixel is noisy or not. Then, the filtering process is applied only to the identified noisy pixels. The corrupted pixels are replaced by median value. This switching strategy, has been shown to be simple and yet more effective than median filter [5] [6]. These methods will not consider the local features as a result of which details and edges may not be recovered when the noise level is high. To overcome this Decision Based Median Filtering

Algorithm (DBA) [7], was proposed by Jay raj to remove high density impulse noise. At higher noise densities the median may also be a noisy pixel and it is replaced by the immediate neighborhood pixel. This produces streaking effect.

II PROPOSED METHOD

The noise considered in this paper is salt and pepper noise. This method first detects the noise .If the standard deviation is greater than T, multi level median filtering is performed. Next, minimum array was found from three different arrays like red, green, blue and checked whether its elements consists of all '0''s ,255's or both. If any of these are present the pixels in the minimum array means the processing pixel are replaced by its mean value except the current pixel, else they are replaced by its median value except the processing pixel to obtain the restored image .If the standard deviation is less than or equal to T then, one neighbor array of the processing pixel is considered and checked whether its elements consists of 0's, 255's or both. If any of these are present in the pixels, replace the pixels by the mean value except the processing pixel, else they are replaced by its median value to obtain the restored image.

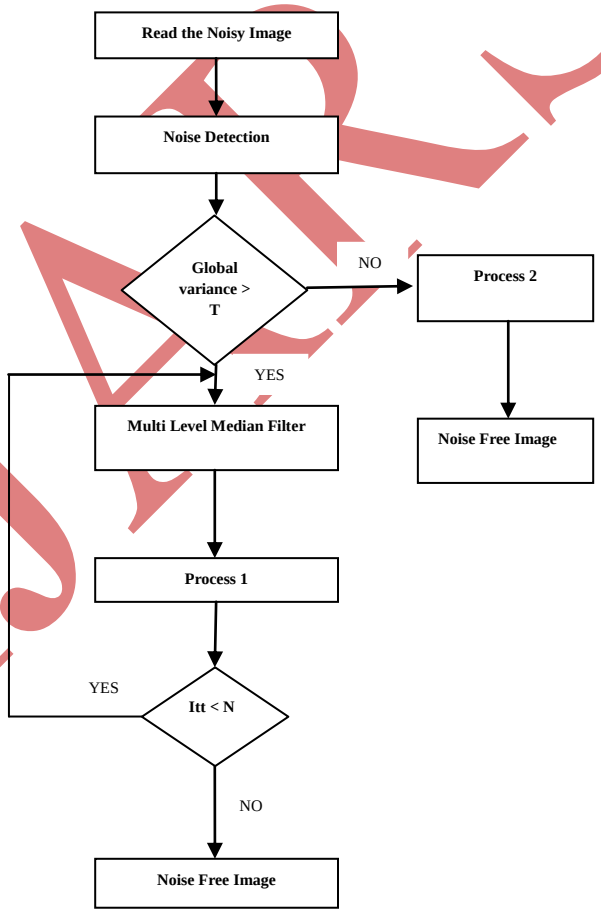

Fig: 1.1 Flow Chart Restoring Image affected by Salt and Pepper Noise

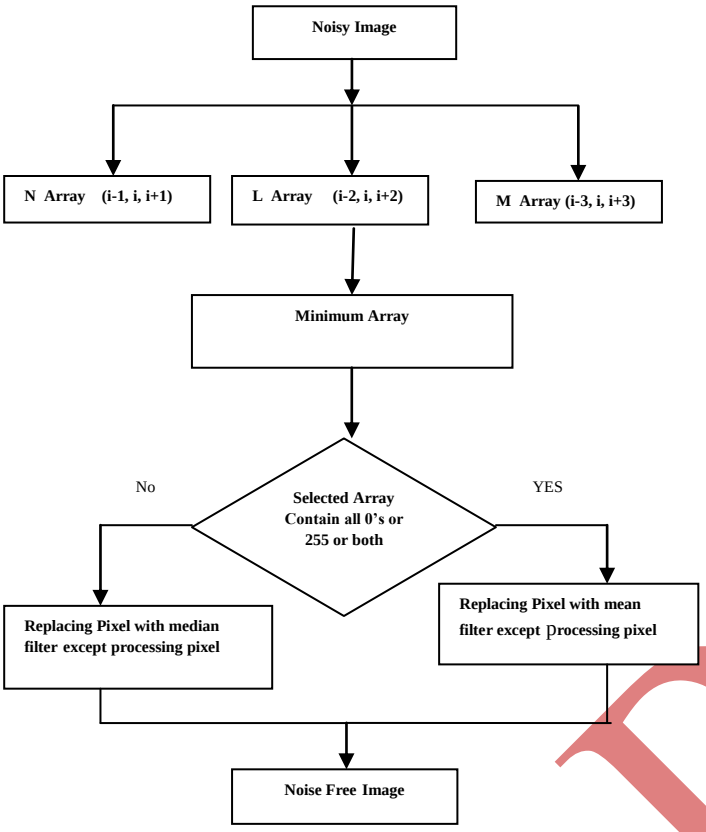

Fig: 1.2 Flow chart for Process 1

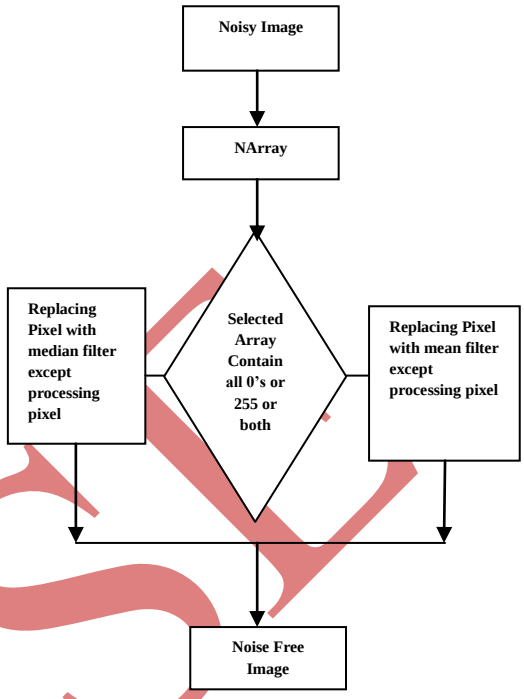

Fig: 1.3 Flow chart for Process 2

2.1 ALGORITHM

Step 1: Read the noisy image
Step 2: Perform the Noise Detection process for the Noisy Image
Step 3: If the Standard deviation of the image is greater than T means perform the Multi Level Median filtering.
Step 4: Separate the three components (red, green, blue) from the image
Step 5: Create the mask of size (3,3) to the image. The range will be different for the three images for red(i-1,i,i+1), green(i-2,i,i+2), blue(i-3,i,i+3).
Step 6: Check whether the selected window contain all 0's, 255 are both

- Replace the pixels with mean filter except the processing pixel.

Otherwise

- Replace the pixels with median filter except the processing pixel.

This process will be continued up to N times and displays the RGB Image

Step 7: If the Standard deviation of the image is less than T means
Step 8: Create the mask of size (3, 3) to the image. The range will be different for the three images for red (i-1, i, i+1).
Step 9: Check whether the selected window contain all 0's, 255 are both

- Replace the pixels with mean filter except the processing pixel.

Otherwise

- Replace the pixels with median filter except the processing pixel.

Step 10: Finally display the RGB image.

III EXPERIMENTAL RESULTS

In this section, the proposed method is evaluated and compared with many other existing methods. Experiments are conducted on a variety of standard gray-scale and color test images with distinctly different features and different sizes. Peak Signal-to-Noise Ratio (PSNR) and Mean Square Error (MSE) are used to represent the quantitative performance measures. The test images used for comparison are camera man image of size 512 X 512, Lena color image and Peppers color image of size 256 X 256, which is corrupted by various noise density levels. Table I and Fig.1 shows the comparison of the restoration results of different methods at different noise densities for Lena color image. Table II and Fig.2 shows the comparison of the restoration results of different methods at different noise densities for Peppers color image.

Table I

Comparison of Restoration Results in PSNR (dB) of different methods for Lena Color Image of size 256 X 256

% NOISE DENSITY	PSNR in dB				
	Mean Method	Median Method	NAFSM Method	MUBUTMF Method	Proposed Method
10	30.7	31.5	28.2	32.4	**35.6**
20	25.3	28.9	25.6	30.0	**32.3**
30	22.2	25.2	24.3	26.7	**30.1**
40	20.0	21.6	23.0	24.4	**28.1**
50	18.2	18.5	21.6	22.4	**26.3**
60	17.0	16.4	18.3	19.3	**24.5**
70	15.7	14.8	14.4	16.4	**22.5**
80	14.9	13.1	10.5	13.4	**18.1**
90	14.2	12.1	7.5	10.0	**16.0**

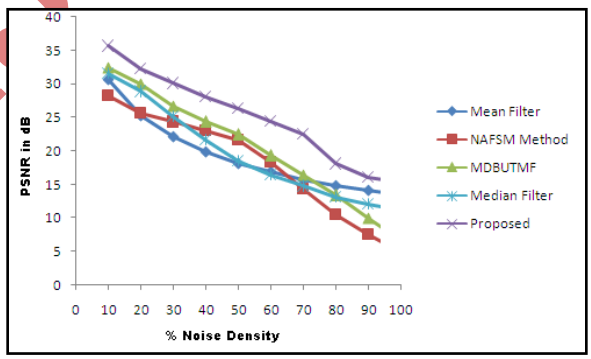

Fig.1.Comparison Graph of Restoration Results in PSNR (dB) of different methods for Lena Color Image of size 256 X 256

Table II

Comparison of Restoration Results in PSNR (dB) of different methods for Peppers Color Image of size 256 X 256

%Noise Density	PSNR in dB				
	Mean Method	Median Method	NAFSM Method	MUBUTMF Method	Proposed Method
10	29.1	30.6	27.9	34.5	**36.3**
20	24.3	27.0	26.1	30.0	**32.5**
30	21.2	23.6	25.2	27.8	**29.9**
40	18.9	20.7	23.9	25.3	**28.0**
50	17.3	18.0	22.1	22.9	**26.2**
60	16.0	15.9	18.8	20.0	**24.1**
70	14.9	14.1	15.1	16.9	**21.6**
80	14.1	12.7	10.8	14.0	**17.6**
90	13.3	11.8	7.8	10.9	**15.2**

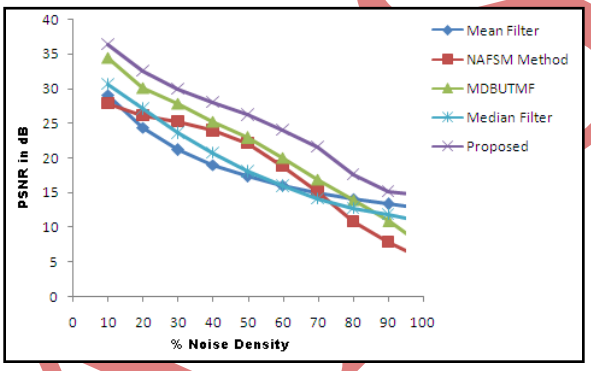

Fig.2.Comparison Graph of Restoration Results in PSNR (dB) of different methods for Peppers Color Image of size 256 X 256

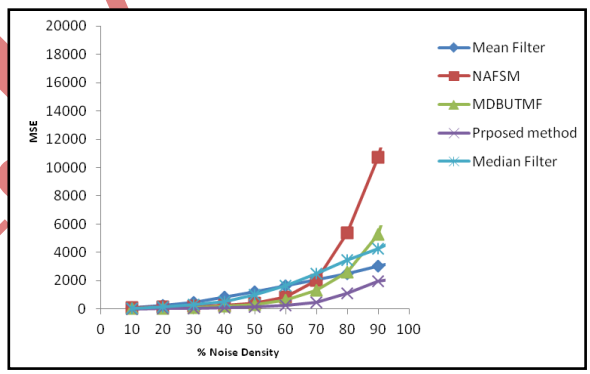

Fig.3.Comparison Graph of Restoration results in MSE of different methods for Peppers Color Image of size 256 X 256

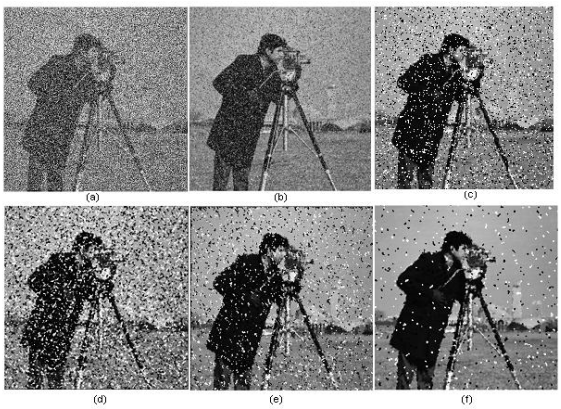

Fig.4. Restoration Results of Cameraman gray Image of size 512 X 512.
(a) Original Cameraman gray Image contaminated by 80% Noise Density (b) Output by Mean Filter (c) Output by Median Filter (d) Output by NAFSM Method (e) Output by MDBUTMF Method (f) Output by Proposed Method

Fig.5 shows the restored results of Lena Color image which shows that the proposed method yields superior subjective quality with respect to salt and pepper noise suppression and image detail preservation.

Fig.5. Restoration Results of Lena Color Image of size 256 X 256.
(a) Lena Color Image contaminated by 50% Noise Density (b) Output by Mean Filter (c) Output by Median Filter (d) Output by NAFSM Method (e) Output by MDBUTMF Method (f) Output by Proposed Method

IV CONCLUSION

A new hybrid method is proposed for the removal of salt-and-pepper noise in this work. It can detect the impulse noise efficiently while preserving the details. The simulation results demonstrate that our approach outperforms than other existing techniques in terms of both quantitative evaluation and visual quality. Particularly, it removes the noise from corrupted images efficiently without affecting the details even at higher noise densities.

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