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Noise removal technique from digital image using advance median filter algorithm

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ABSTRACT

Images are often degraded by noises. From transmission to receiver there are various situations where noise can be mix with original data. Noise removal is a crucial and tedious task in image processing. In general, the results of the noise removal have a strong influence on the quality of the image processing technique. In color image processing there is so many methods for noise removal but it depends on types of noise and filters used to remove noise. The nature of the noise removal problem depends on the type of the noise corrupting the image. In the field of image noise reduction, several linear and nonlinear filtering methods have been proposed. In our research paper salt and pepper noise removed using an advanced median trimmed filter. Noise level removed from an image having range 10% to 90% and also calculated following parameters PSNR, IEF, and MSE. In our simulation result, we found that as salt and pepper noise increases the value of PSNR decreases significantly. When a comparative analysis carried out between the base paper and proposed work, values of parameters in proposed work are better and research work significantly improved.

Keywords: *PDF, MSE, IEF, Quantization, Pixel, Denoise, PSNR.*

1. INTRODUCTION

Nowadays Image processing is a technique to execute some operations on an image, to get an enhanced image or to extract some useful data from it. Nowadays, image processing is among exponentially growing technologies. Two crucial techniques are there with help of them an image can be processed which are known as analog and digital. Analogue image processing can be utilized for the hard copies for example photographs and printouts [1-2]. Image analysts use various fundamentals of interpretation while using these visual techniques. DIP techniques help in influence the digital images by using advanced computers. Before applying proposed technique to give information there is a requirement of pre-processing of data so that the desired result can be accomplished in an effective way and these pre-processing techniques are an enhancement, and display, information extraction [3-5].

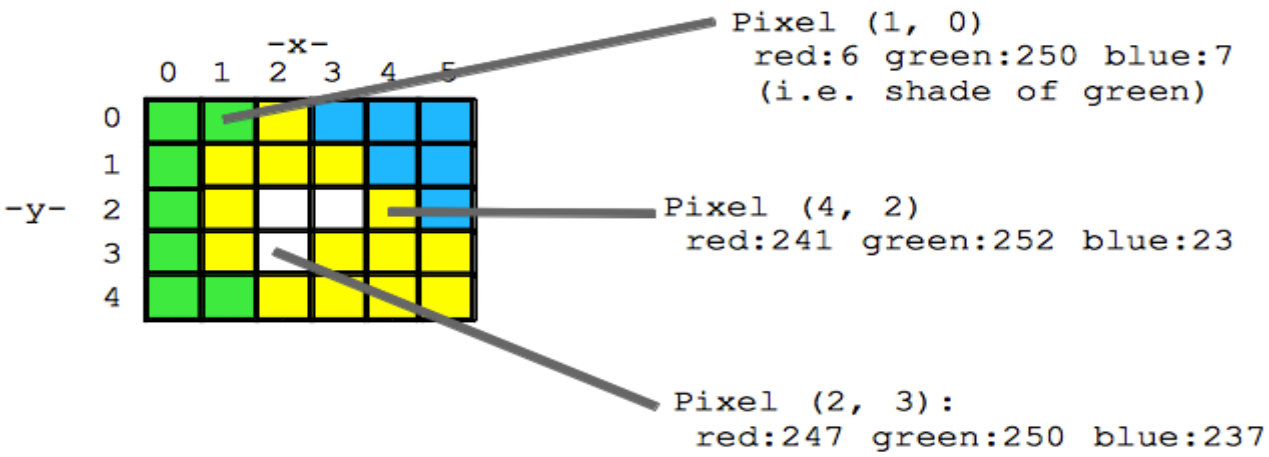

Figure1. The color image is a collection of RGB color

Noise interrupts the image at the time of acquisition, transmission, storage etc. so to get a meaningful and useful processing like image segmentation and object recognition, and also for good image display in instruments like television, mobile cameras, etc., so the image signal obtained must be without the presence of noise and also deblurred. Both, noise suppression (filtering) and the deblurring are classified under the common category of image processing which is known as image restoration. From the study of noise model and filtering techniques [7-9], in image processing, noise reduction and image restoration are predictable to recover the image qualitative assessment with the performance criteria of quantitative image analysis techniques.

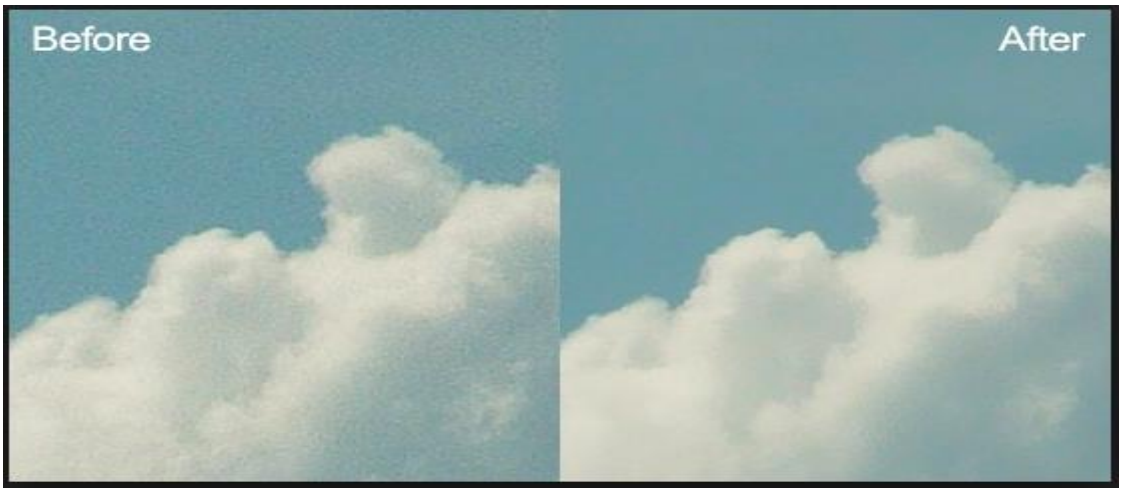

Figure2. Noise and Denoise image

2. LITERATURE SURVEY

Noise removal from images is a part of image restoration in which we try to reconstruct or recover an image that has been degraded by using a priori knowledge of the degradation phenomenon. Noises existed in images can be of a different variety with their characteristic PDF. Noise removal techniques depend on the kind of noise present in the image rather than on the image itself. Effects of applying noise diminish filters having similar characteristics on noisy images with an emphasis on SNR value estimation for comparing the results. Images are often degraded by noises [10]. There are many points at which noise can be mixed with the original signal. Noise removal is an important task in image processing. The results of the noise removal have a robust effect on the quality of the image processing technique. The nature of the noise removal problem totally depends on the type of the noise corrupting the image. In the field of image noise reduction various linear and nonlinear techniques have been proposed using various filters like a max filter, min filter, median and many more. Linear filters are not capable to remove impulse noise due to their tendency to blur the edges of an image [11]. Noise can be consistent noise, Gaussian noise, salt and pepper noise, gamma noise. The salt and pepper noise comes into existence when the pixel value is either 0 or 255. The algorithm will evaluate the center pixel's value i.e. whether or not it equals to 0 and 255. If center pixel is having value 0 or 255 then find out the alternative noise free value for the center pixel. Noise is added to an image at the time of image acquisition (or) image capturing. After capturing, images then some essential operation are performed on the image so that further classification and segmentation can be done [12]. From the literature review, different filtering techniques are available to reduce the noise from compound images. Normally the filters are used to improve the image quality, suppress the noise.

3. PLANNING OF WORK/METHODOLOGY

The median filter mainly used for removing noise from a signal or an image and this technique is nonlinear digital filtering technique. There are various procedures which can be implemented on the image to achieve the desired result but the noise reduction is a process which is carried out before edge detection to improve the results. Median filtering is very widely used in digital image processing (DIP) because, under certain conditions, it preserves edges while removing noise. Median filter has various applications in signal processing. Centre filtering is a nonlinear operation hand me down in image processing to cut "salt and pepper" noise. In median filter first of all the pixels are sorted out and then pixels having high value replaced by median value so that in neighboring pixel it does not have so much deviation. (If the convenient pixel which is to be considered contains an ultimate a number of pixels, than the decent of the two essence pixel values are used. The median filter gives enhanced result when the impulse noise percentage is less than 0.1%. When the quantity of impulse noise is increased the median filter not gives the best result.

$$L_i = \sum_{j=1}^{N} \left\| x_i - x_j \right\|_2 \; for \; i = 1, \ldots . N$$

x_i, x_j and N stand for the central pixel, is existing pixels in the window and the number of pixels which are set to be in the window, respectively.

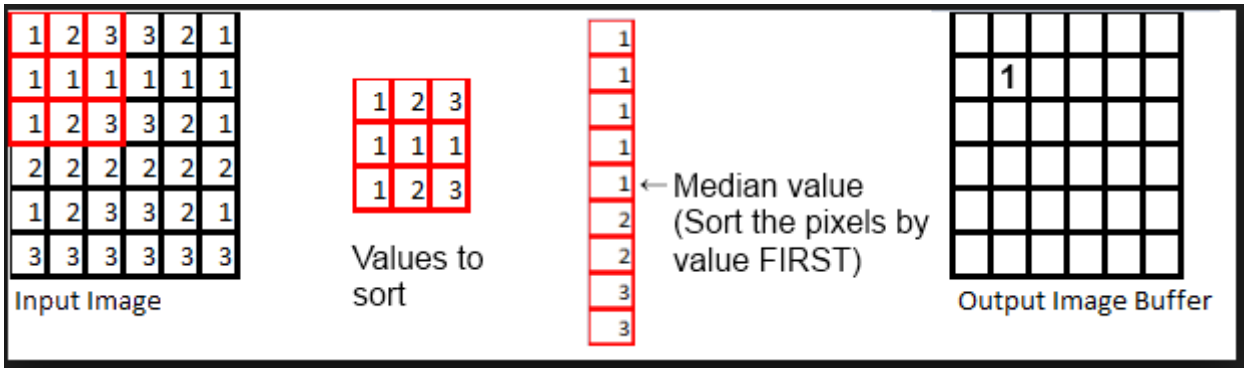

Figure 3 Median Filter processing

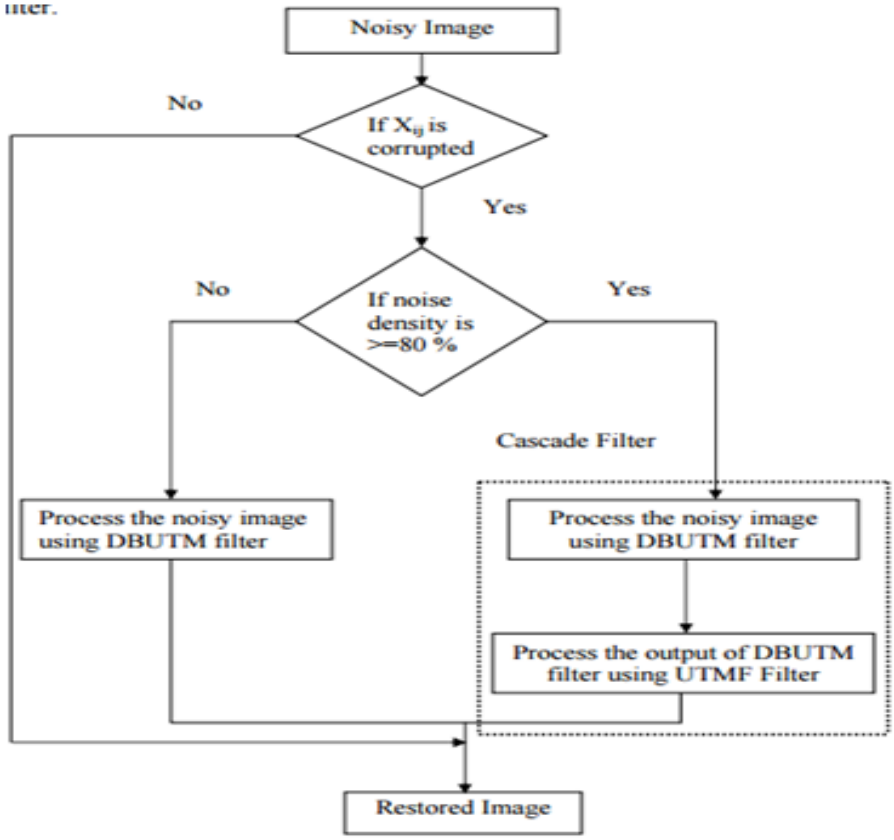

Figure4. Proposed work flow chart

4. SOFTWARE USED AND SIMULATION RESULT

There are various tools which are used to carry research work for executing the desired task. I used MATLAB R2015a tool for my research work. MATLAB is powerful software in which different environments are available through which research work can be carried out in effective.

A. Image: Different
Format: JPEG
Salt and pepper Noise: 30%

Figure4. Original Image used for S&P Noise

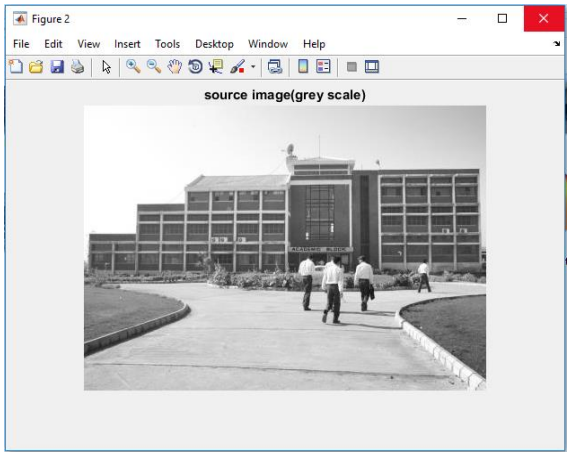

Figure5. Original Image transformed into Gray Image

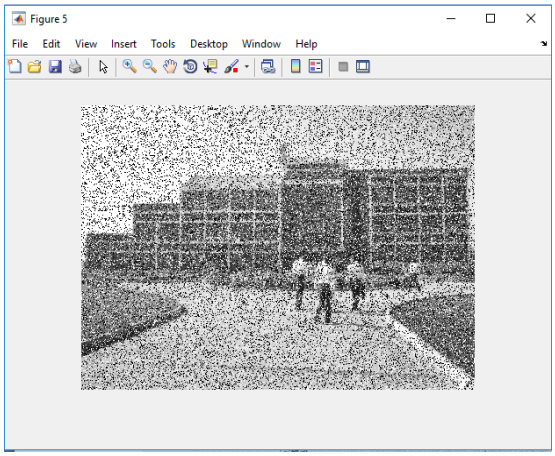

Figure6. Original Image after adding 30% S&P Noise

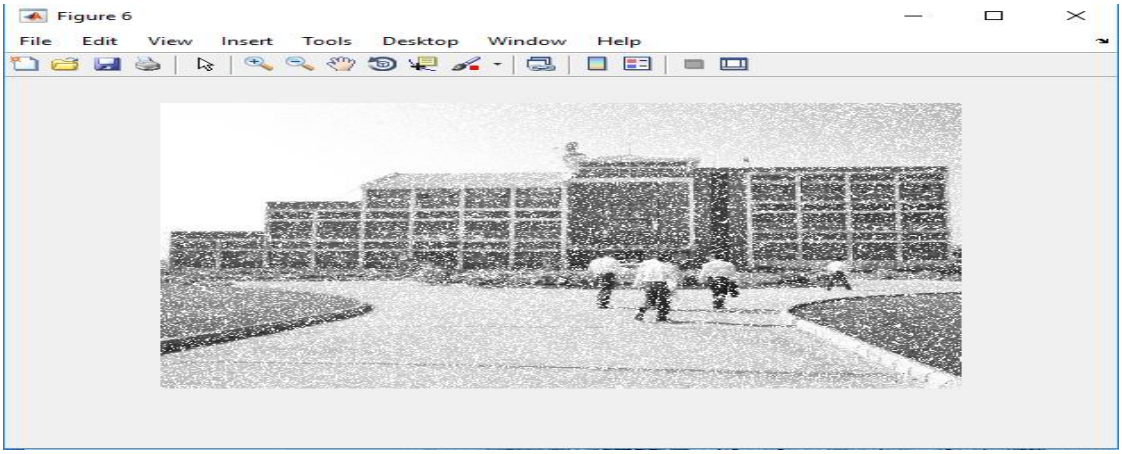

Figure7.Original Image after adding 30% S&P Noise and Pepper noise removed

Figure8. De-noised Image after using trimmed median filter

Table I: PSNR, MSE, and IEF at 30% salt and Pepper Noise for Different Image

PSNR, MSE and IEF at 30% Salt and Pepper Noise				
Sr. No	Input Image	PSNR	MSE	IEF
1	Front View	74.8151	0.0319	3.2307
2	Top View	68.928	0.0418	2.2994
3	Boys hostel	63.4016	0.0539	1.7919
4	Girls Hostel	63.7552	0.0531	1.808

B. Image: Same
Formats: Different
Salt and Pepper Noise: 30 %

Figure9. Original Image (PNG)

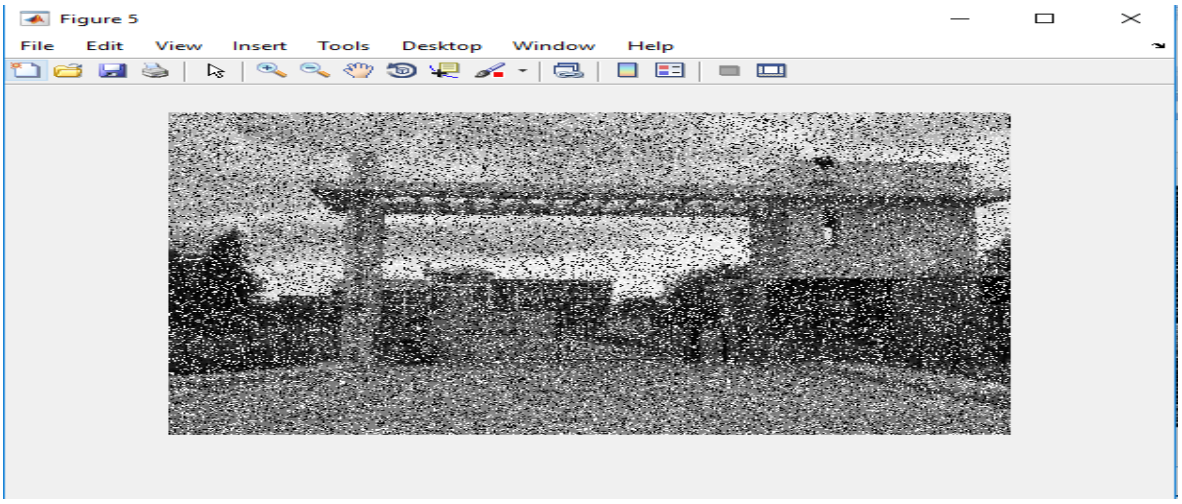

Figure10. Original Image (PNG) after adding 30% S&P Noise

Figure11. De-noised Image after using trimmed median filter

Table II PSNR, MSE and IEF at 30% S&P Noise for Different Format of the Same Image: Front View

PSNR, MSE and IEF at 30% Salt and Pepper Noise for different format of Same image				
Sr. No	Input Image	PSNR	MSE	IEF
1	PNG	62.1863	0.0571	1.6213
2	TIF	62.1839	0.572	1.6308
3	BMP	61.7961	0.0581	1.6107
4	JPG	62.27	0.0568	1.6308

Noise=50%

PSNR, MSE and IEF at 50% Salt and Pepper Noise for different format of Same image				
Sr. No	Input Image	PSNR	MSE	IEF
1	PNG	48.0123	0.1096	1.4314
2	TIF	47.9512	0.1099	1.4037
3	BMP	47.9157	0.1101	1.4056
4	JPG	47.9019	0.1101	1.4128

Noise=75 %

PSNR, MSE and IEF at 75% Salt and Pepper Noise for different format of Same image				
Sr. No	Input Image	PSNR	MSE	IEF
1	PNG	33.5703	0.2131	1.0918
2	TIF	33.5509	0.2133	1.0926
3	BMP	33.5722	0.2131	1.0949
4	JPG	33.5515	0.2133	1.0978

C. The result of Webcam Image for Format (JPEG) @ 30 % Noise

SNR, MSE, and IEF at 30% Salt and Pepper Noise				
S.N	Real-time image	PSNR	MSE	IEF
1	Type 1 Real time image	60.1276	0.0627	1.4464
2	Type 2 Real time image	59.9472	0.0632	1.4634
3	Type 3 Real time image	58.1302	0.0688	1.4549
4	Type 4 Real time image	66.9865	2.1587	0.0457

5. CONCLUSION

During transmission of data from source to destination then some unwanted information added to authentic information which is known as noise. There are different types of noises and also there are various techniques are used to separate these unwanted signals from original data. Data may be in form for example image, binary or any other form. In this paper work carried out how to remove salt and pepper noise from original data with help of a specified filter. To execute the research first some data base is collected of images of various format and besides this real-time data also used by web cam. By applying proper filter salt and pepper noise removed. Various case has been studied using same and different images of the same and different format at a various noise level from 30% to 70%. At the end, important parameters are calculated which determine how efficiently salt and pepper noise removed from original data. These parameters include PSNR, MSE, and IEF. PSNR and MSE are inversely proportional to each other and if the value of PSNR would be high then the image would be considered as best. After carrying out research work in MATLAB 2015a and by analyzing a comparative work between the base paper and proposed work we found that our methodology is best as compared to base paper work.

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