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REMOVAL OF HIGH DENSITY SALT AND PEPPER NOISE THROUGH A MODIFIED MEDIAN FILTER

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ABSTRACT

In this research present a method to remove salt-and-pepper noise for single images. The method consists of two stages, noise detection and noise removal. In the first stage, a detector identifies corrupted pixels; in the second stage, an algorithm employs a nonlinear isotropic diffusion to suppression noise, which diffusion is only for those corrupted pixels. We apply our method to a test set containing five images. Experimental results show that the method is powerful for salt-and-pepper noise removal. In this research, a modified decision based median filtering approach is presented for the restoration of gray scale and color images that are highly corrupted by salt and pepper noise. It is an enhanced decision based algorithm where noise pixels are detected in several phases based on predefined threshold value. The noise pixels are replaced by median where median value is calculated without considering 0 and 255. As a result, at high density noise environment it is very efficient to find noise free median value. The algorithm initially select 3X3 filtering window for processing corrupted pixel. When all the elements in the window are corrupted, the processing pixel is replaced by noise free last processed pixel. If the last processed pixel is 0 or 255 then the algorithm will create a filtering window with a new dimension to identify pure black and white region of the image. Experiments exhibit better result at 9X9 filtering window. In this stage a standard median filtering approach is applied to determine probable intensity value. If the median value is noise pixel then the algorithm will

calculate the mean value of all elements in the window. After that, robust estimation algorithm is applied to the proposed filter to remove discontinuity of pixel intensity and smooth the restored image. Experimental result shows that it can provide very high quality restored images, when the noise density is large.

KEYWORDS: Salt-and-pepper, suppression noise.

Salt and pepper noise

Is a form of noise sometimes seen on images. It is also known as impulse noise. This noise can be caused by sharp and sudden disturbances in the image signal. It presents itself as sparsely occurring white and black pixels. An effective noise reduction method for this type of noise is a median filter or a morphological filter. For reducing either salt noise or pepper noise, but not both, a contra harmonic mean filter can be effective. Median Filtering is highly effective in removing salt-and-pepper noise.

To remove this impulse noise we have filters like Min. filter, Max. filter, MinMax. Filter, Mean filter, Median filter, weighted median filter, Adaptive Median Filter. In this paper we check that which filter is best for impulse noise removal.

Proposed Algorithm

The proposed Modified Median Filter (MMF) algorithm processes the corrupted image by first detecting the salt and pepper noise. The processing pixel is checked whether it is noisy or noise free. If the processing pixel is lies between maximum and minimum gray level values then it is noise free pixel, it is left unchanged. If the processing pixel takes the maximum or minimum gray level then it is noisy pixel which is processed by MMF.

Problem Formulation

The purpose of any filter is to remove unwanted noise from an image. Noise is a random variation of the original input signal. Images are often corrupted with noises. Noise creeps into an image during digitization. A trivial way to remove noise is to improve the digitization process. Noises can be categorized as Random or Salt and Pepper noise. Salt and Pepper noise occurs due to the presence of bit error in transmission, faulty camera sensor and digitization. These noises are generated with equal probability. The grey scale value 0 represents pepper and 255 for salt. Digitization of impulse noise causes the values of an image to extreme pure black or white. Noises determine the quality of an image. Hence the

removal of noise is essential for improving the image quality. In many applications, it is important to remove impulse noise from images with minimal loss of data. The median filter is a nonlinear method to remove noise from images while preserving the edges effectively. It consists of a sliding window which moves through each pixel in the images. The median of all the pixels in that window is calculated and the center pixel is substituted with this value.

OBJECTIVES

1. To reduce high density salt and pepper noise from images and restore the lost information without distorting the edges.
2. To improve the quality of image based on the PSNR and MSE value.
3. To analysis the results of proposed method with conventional median filters.

Flow chart of proposed algorithm

Microsoft Visual C++ (often abbreviated to MSVC) is an integrated development environment (IDE) product from Microsoft for the C, C++, and C++/CLI programming languages. These Visual C++ redistributable and runtime packages are mostly installed for standard libraries that many applications use.

For image collection we use the software known as paint shop pro (PSP). This software is used for image editing such as image resize, add noise etc. The visual quality that is the performance of the standard algorithms are quantitatively measured by the following parameters such as peak signal-to-noise ratio (PSNR) and the mean squared error (MSE). All the filters are implemented in Visual C++ 6.0.

RESULT ANALYSIS

The performance of the proposed improved median filter and conventional median filters were analysed for different noise density (ND) of salt and pepper noise added to gray level images. The threshold was varied to obtain maximum PSNR and MSE.

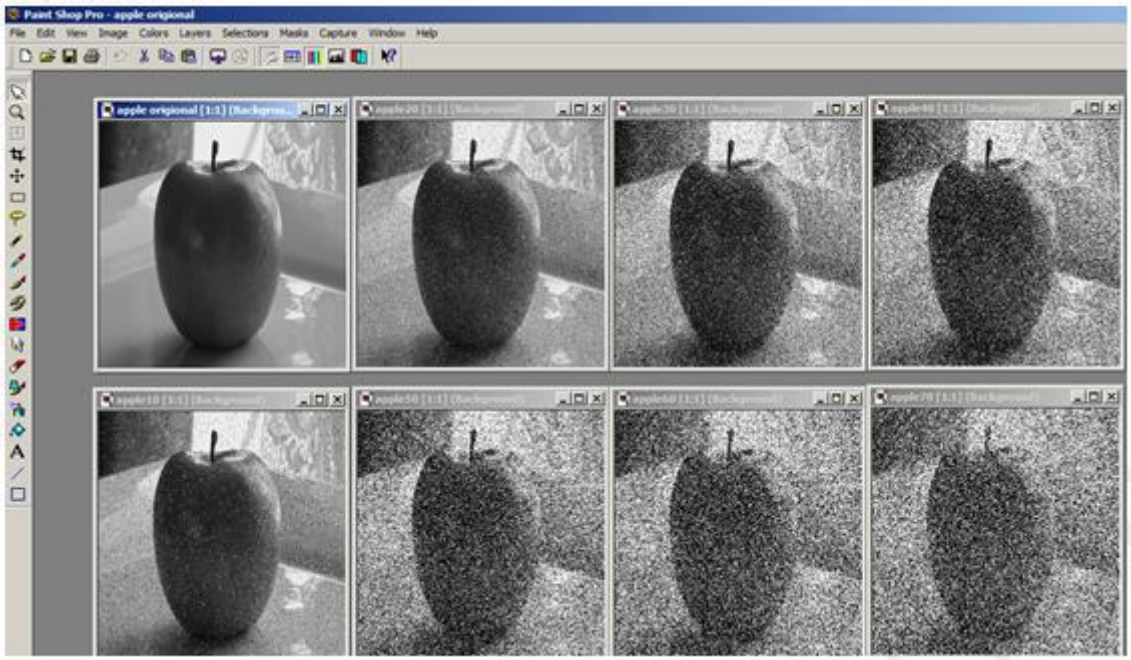


Figure 5.1: Illustrates noisy images for 10%, 20%, 30%, 40%, 50%, 60% and 70% noise densities along with their filtered images and the original image of apple.

Table I: Comparison of psnr values on apple image for varying noise densitie.

Noise Density	MMF	MDBA	AMF	MF
10	15.17	11.17	7.34	8.3
20	15.35	11.31	7.36	8.33
30	14.72	11.57	7.23	8.18
40	13.94	11.12	7.07	8
50	13.43	11.28	6.96	7.88
60	13.16	11.3	6.87	7.79
70	13.02	11.33	6.8	7.73

MMF= Modified Median Filter, MDBA= Modified Decision Based Algorithm, AMF=Adaptive Median Filter, MF=Standard Median Filter

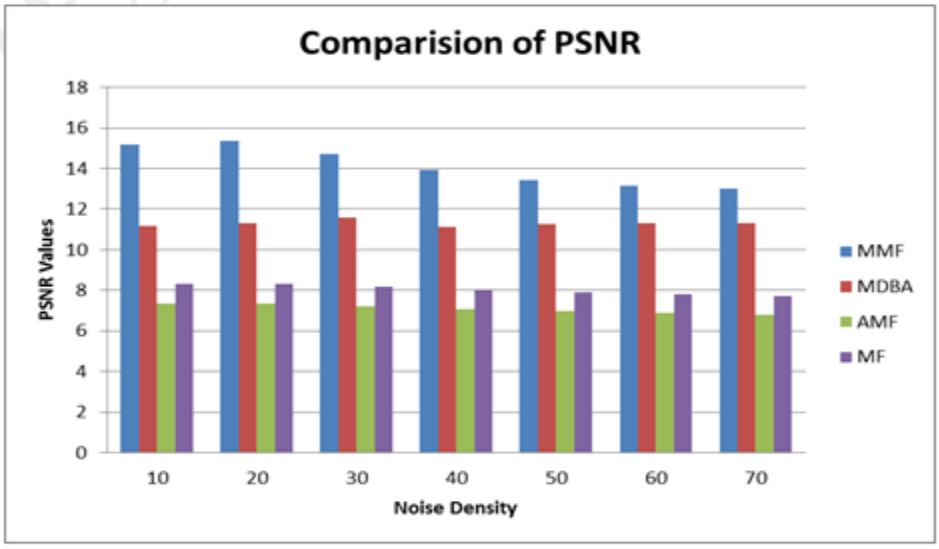


Figure 5.2: Illustrates a graph of PSNR values plotted Against density of noise for different algorithms.

Table 2: Comparison of MSE values on apple image for varying noise densitie.

Noise density	MMF	MDBA	AMF	MF
10	1975.31	4965.43	11994.74	9614.36
20	1892.71	4798.55	11935.13	9536.22
30	2190	4523.86	12288.65	9885.74
40	2620.52	5019.6	12742.89	10294.68
50	2951.65	4833.77	13085.4	10591.07
60	3140.58	4817.8	13361.83	10810.88
70	3240.15	4777.85	13567.07	10956.35

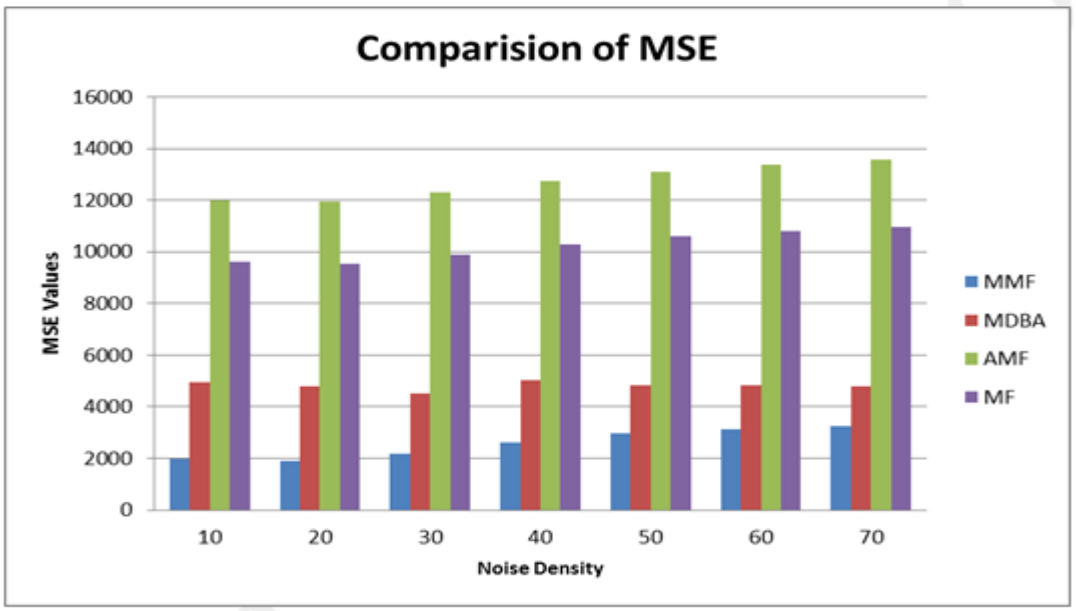
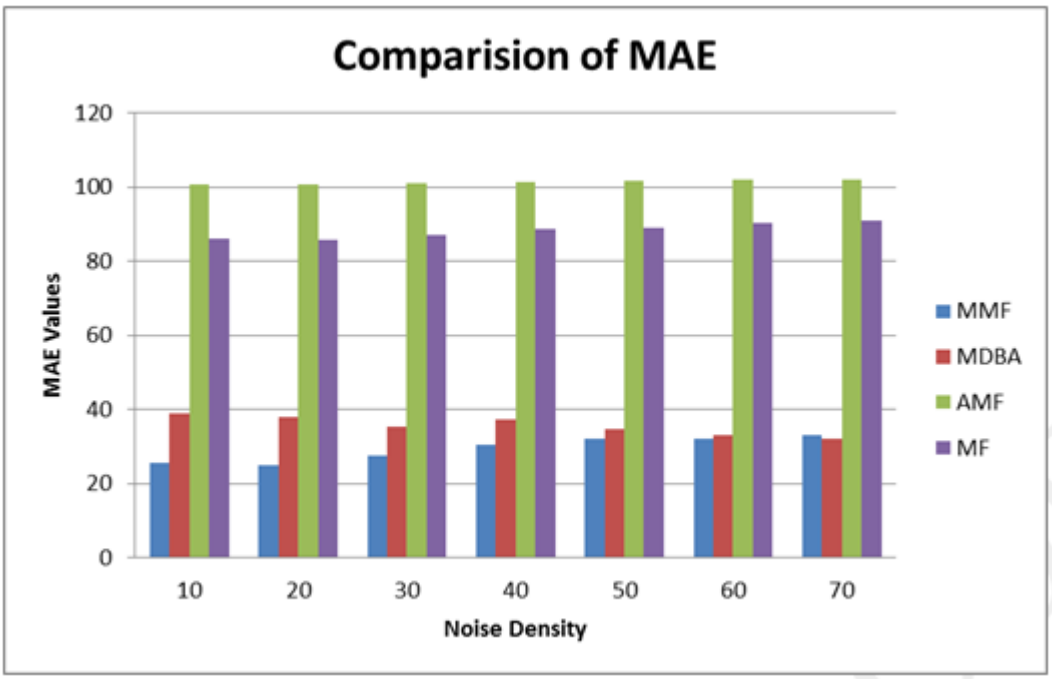


Figure 5.3: Illustrates a graph of MSE values plotted Against density of noise for different algorithms.

Table 3: Comparison of mse values on apple image for varying noise densitie.

Noise Density	MMF	MDBA	AMF	MF
10	25.57	38.88	100.84	85.96
20	25.07	37.81	100.87	85.76
30	27.59	35.46	100.97	87.03
40	30.53	37.25	101.38	88.56
50	32.19	34.59	101.64	89.01
60	32.21	33.16	101.85	90.4
70	33.1	32.01	102.07	90.83



CONCLUSION

The performance of the algorithm for various images at different noise levels is studied. Results are shown in figures 5.1 to 5.15. The first column represents the output of proposed filter Modified Median Filter (MMF), second column represent output of the standard Median filter (MF), third column represent the output of Median Decision Based Algorithm (MDBA) and fourth column represent output of the Adaptive Median Filter(AMF). Tables 1-12 display the quantitative measures.

In this research, a new algorithm (MMF) is proposed which gives better performance in comparison with MF, MDBA and AMF in terms of PSNR, MSE, MAE. Proposed algorithm shows good denoting capability and can also preserve necessary details. The performance of the algorithm has been tested at low, medium and high noise densities on different images.

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