CH.Sravana Lakshmi, V.Ambika, K.Suri Babu / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 5, September- October 2012, pp.2163-2166

Impulse Noise Removal Inimages Using Modified Trimmed Median Filter:Matlab Implementation And Comparitive Study

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ABSTRACT

In this work,anovel decision based trimmed median filter algorithm for restoring gray scale, and color images of highly corrupted is proposed. It replaces the noisy pixel by trimmed median value when other pixel values, 0's and 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. This 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 gray scale and color images and it gives better Peak Signal-to-Noise Ratio (PSNR) and Image Enhancement Factor (IEF). The performance is evaluated and results compared.

Keywords: Standard median Filter, Decision based algorithm, PSNR;

1. INTRODUCTION:

Due to bit errors in transmissionimages may containsimpulse noise . two kinds of impulse noise, like salt and pepper noise and random valued noise. Salt and pepper noise can corrupt the images where the corrupted pixel takes either maximum or minimum gray level. standard median filterhas been established as reliable method to remove the salt and pepper noise without damaging the edge detail,drawback of standard Median Filter (MF) is that the filter is effective only at low noise densities [1].When the noise level is over 50% the edge details of the original image will not be preserved by standard median filter. Adaptive Median Filter (AMF) [2] performs well at low noise densities. But at high noise densities the window size has to be increased whichmay lead to blurring the image. In switching median filter[3], [4] the decision is based on a pre-defined threshold value. The major drawback of this method is that defining a robust decision is difficult. Also these filters will not take into account the local features as a result of which details and edges may not be recovered satisfactorily, especially when the noise level is high.To overcome the above drawback, Decision Based Algorithm(DBA) is proposed [5]. In this, image is denoised by using a 33 window. If the processing pixel value is 0 or 255 it is processed or else it is left unchanged. At high noise density the median value will be 0 or 255 which is noisy. In such case, neighboringpixel is used for replacement. This repeated replacementof neighboring pixel produces streaking effect [6]. In order toavoid this drawback, Decision Based Unsymmetric Trimmed Median Filter (DBUTMF) is proposed [7]. At high noise densities, if the selected window contains all 0's or 255's or both then, trimmed median value cannot be obtained. So this algorithm does not give better results at very high noise density that is at 80% to 90%. The proposed Modified Decision Based Un symmetric Trimmed Median Filter (MDBUTMF) algorithm removes this drawback at high noise density and gives better Peak Signal-to-Noise Ratio (PSNR) and Image Enhancement Factor (IEF) values than the existing algorithm. The rest of the paper is structured as follows. A brief introduction of unsymmetric trimmed median filter is given in Section-2. Section-3 describes about the proposed algorithm and different cases of proposed algorithm. MATLAB implementation and Simulation results with different images are presented in Section-4. Finally conclusions are drawn in Section-6.

2. UNSYMMETRIC TRIMMED MEDIAN FILTER

The idea behind a trimmed filter is to reject the noisy pixel from the selected 3 by 3window.Alpha Trimmed Mean Filtering(ATMF) is a symmetrical filter where the trimming is symmetricat either end. In this procedure, even the uncorrupted pixels are also trimmed. This leads to loss of image details and blurring of the image. In order to overcome this drawback, an Un symmetric Trimmed Median Filter (UTMF) is proposed. In this UTMF, the selected 3 3 window elements are arranged in either increasing or decreasing order. Then the pixel values 0's and 255's in the image (i.e., the pixel values responsible for the salt and pepper noise) are removed from the image. Then the median value of the remaining pixels is taken. Thismedian value is usedto replace the noisy pixel. This filter is called trimmed median filter because

the pixel values 0's and 255's are removed from the selected window. This procedure removes noise in better way than the ATMF.

3. PROPOSED ALGORITHM

The proposed Modified Decision Based UnsymmetricTrimmed Median Filter (MDBUTMF) algorithm processes the corrupted images by first detecting the impulse noise. The processing pixel is checked whether it is noisy or noisy free. That is, if the processing pixel 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 MDBUTMF. The steps of the MDBUTMF are elucidated as follows.

Step 1: Select 2-D window of size 3 by 3. Assume that the pixel being processed isp_{ij} .

Step 2: If $0<_{pij}<255$ then is an p_{ij} is uncorrupted pixel and its value is left unchanged.

Step 3: If $p_{ij}=0$ or $p_{ij}=255$ then$p_{ij}$is a corrupted pixel then two cases are possible as given in Case i) and ii).

Case i): If the selected window contain all the elements as 0's and 255's. Then replace with the mean of the element of window.

Case ii): If the selected window contains not all elements as 0's and 255's. Then eliminate 255's and 0's and find the median value of the remaining elements. Replace $p_{ij}$with the median value.

Step 4: Repeat steps 1 to 3 until all the pixels in the entire image are processed.

4. SIMULATION RESULTS

The performance of the proposed algorithm is tested with different grayscale and color images. The noise density (intensity)is varied from 10% to 90%. DE noisingperformances are quantitatively measured by the PSNR and IEF as defined in (1) and (3), respectively and performance of MDBUTMF(Modified Decision Based UnsymmetricTrimmed Median Filter) is compared with Switching median filter(SMF) and Decision Based Algorithm(DBA) and results are presented .

$$PSNR\ in\ dB = 10log_{10}\left(\frac{255^2}{MSE}\right)\text{-----(1)}$$

$$MSE = \frac{\sum_i \sum_j (Y(i,j)-Y^{\wedge}(i,j))^2}{M*N}\text{----(2)}$$

$$IEF = \frac{\sum_i \sum_j (\eta(i,j)-Y(i,j))^2}{\sum_i \sum_j (\hat{Y}(i,j)-Y(i,j))^2}\text{---(3)}$$

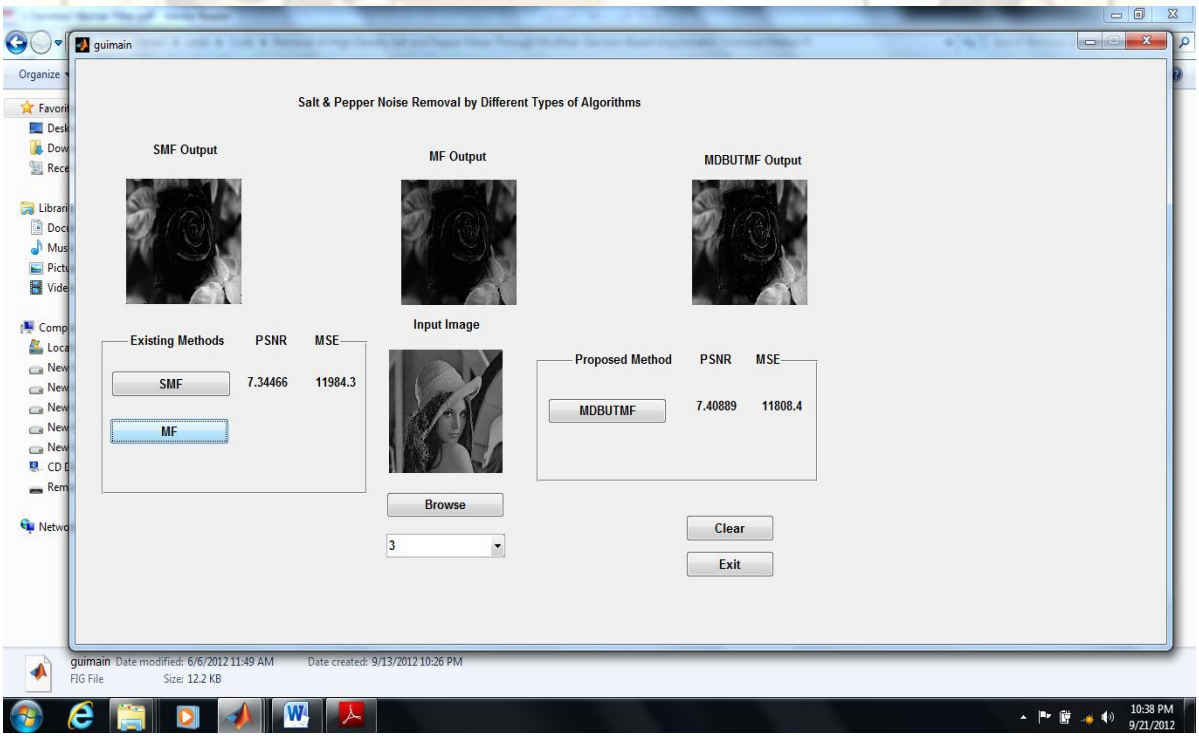
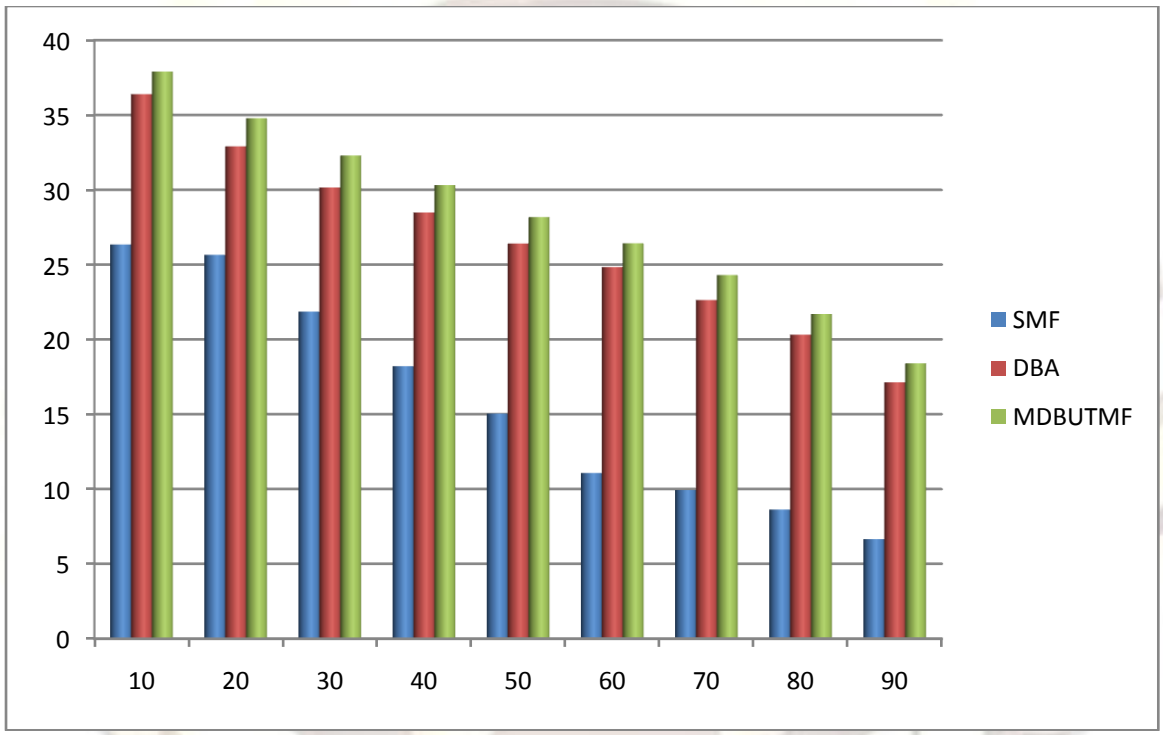


Fig.1: mat lab screen shot of simulation

PSNR in dB			
Noise density in %	SMF	DBA	MDBUTMF
10	26.34	36.4	37.91
20	25.66	32.9	34.78
30	21.86	30.15	32.29
40	18.21	28.49	30.32
50	15.04	26.41	28.18
60	11.08	24.83	26.43
70	9.93	22.64	24.30
80	8.63	20.32	21.70
90	6.65	17.14	18.40

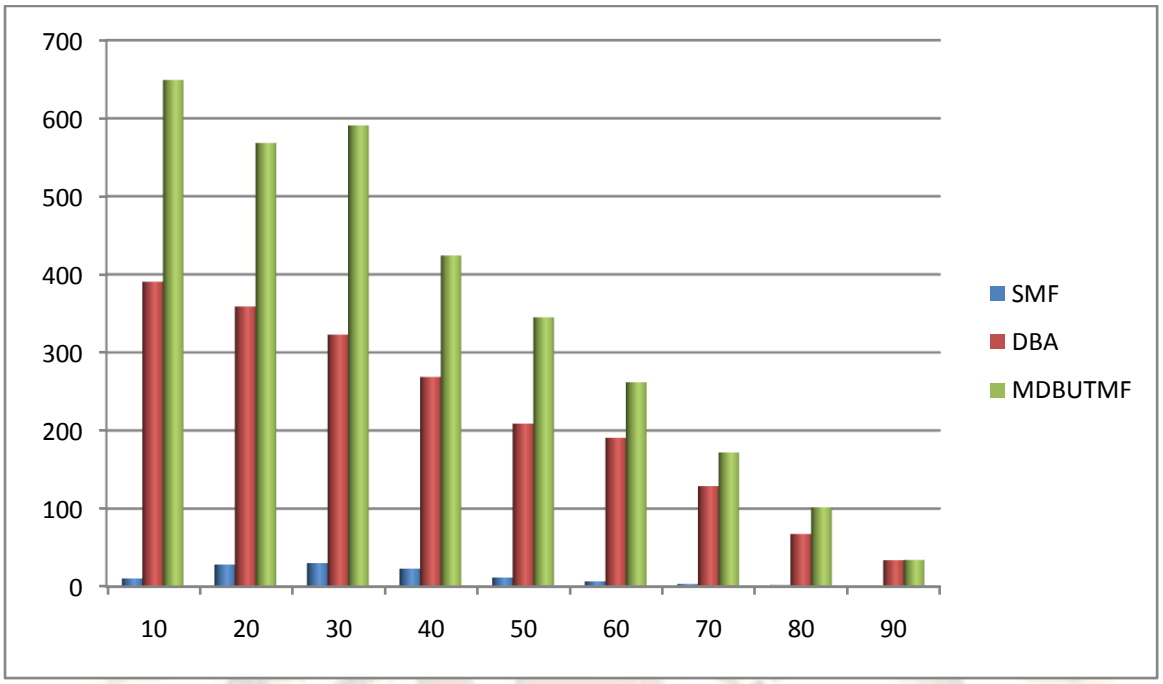
Table-1:Comparison of psnr values of different algorithmsForlena image at different noise densities



Graph-1:Comparison of psnr values of different algorithms Forlena image at different noise densities

IEF			
Noise density in %	SMF	DBA	MDBUTMF
10	10.36	390.67	648.98
20	28.17	358.91	568.43
30	30.02	322.89	590.83
40	23.12	268.49	424.18
50	11.72	208.77	345.13
60	6.73	190.70	261.66
70	3.31	128.58	171.69
80	2.00	67.42	101.72
90	1.37	33.85	34.23

Table-2 :comparison of IEF values of different algorithmsFor lena image at different noise densities



Graph-2:comparison of IEF values of different algorithmsForlena image at different noise densities

In the above table 1 to 2 and graphs 1 to 2 ,results are compared and performance compared in terms of PSNR and IEF.

5. CONCLUSION:

In this letter, a new algorithm (MDBUTMF) is proposed which gives better performance in comparison with SMF, and DBA in terms of PSNR and IEF. The performance of the algorithm has been tested at low, medium and high noise densities on both gray-scale and color images. Even at high noise density levels the MDBUTMF gives better results in comparison with other existing algorithms. Both visual and quantitative results are demonstrated. The proposed algorithm is effective for salt and pepper noise removal in images at high noise densities.

REFERENCES

[1] J. Astola and P. Kuosmaneen, Fundamentals of Nonlinear Digital Filtering.Boca Raton, FL: CRC, 1997.

[2] H. Hwang and R. A. Hadded, "Adaptive median filter: New algorithms and results," IEEE Trans. Image Process., vol. 4, no. 4, pp. 499–502, Apr. 1995.

[3] S. Zhang and M. A. Karim, "A new impulse detector for switching median filters," IEEE Signal Process. Lett., vol. 9, no. 11, pp. 360–363, Nov. 2002.

[4] P. E. Ng and K. K. Ma, "A switching median filter with boundary discriminative noise detection for extremely corrupted images," IEEE Trans. Image Process., vol. 15, no. 6, pp. 1506–1516, Jun. 2006.

[5] K. S. Srinivasan and D. Ebenezer, "A new fast and efficient decision based algorithm for removal of high density impulse noise," IEEE Signal Process. Lett., vol. 14, no. 3, pp. 189–192, Mar. 2007.

[6] V. Jayaraj and D. Ebenezer, "A new switching-based median filtering scheme and algorithmfor removal of high-density salt and pepper noise in image," EURASIP J. Adv. Signal Process., 2010.

[7] K. Aiswarya, V. Jayaraj, and D. Ebenezer, "A new and efficient algorithm for the removal of high density salt and pepper noise in images and videos," in Second Int. Conf. Computer Modeling and Simulation, 2010, pp. 409–413.