Removal of Impulse Noise by adoption of an Advance Modified Decision Based non linear filter

Pawan Kumar Gupta, Vipin Kumar Gupta

Abstract—Today we are living in digital world so we face various problems regarding to image is noise. NOISE is redundant information that corrupts an image. In digital images processing different types of noises are introduced. An image can be corrupted by Impulse noise, due to faulty camera sensors, Impulsive noise introduced during image acquisition systems, and transmission through noisy channel. Noise removing as an important for preserved the image

Index Terms— Decision based unsymmetrical median, median filter, mid-point filter, and impulse noise

INTRODUCTION

Image is often corrupted by impulse noise, also known as salt and pepper noise. A number of noise models which can corrupt images are Gaussian, Rayleigh or an erlang and speckle noise. An image can be corrupted by Impulse noise, due to faulty camera sensors, due to bit error in transmission or introduced during data acquisition systems. The Intensity of the corrupted pixels will be either comparatively low or high. According to the noise value, impulse noise can be classified as salt and pepper noise and random value impulse noise.

Salt and pepper noise can corrupt the images where the corrupted pixels takes either maximum [255] or minimum [0] gray level. The appearance of noise is as white and black dots superimposed on the image and hence the name salt and pepper noise. In the Presence of impulse noise information in the image may be get corrupted. Therefore, removal of this type of noise is critical for the removal of reliable and accurate We can propose algorithms for getting the original image, by removing impulse noise from the corrupted images. The proposed algorithm for the restoration of gray scale images from highly corrupted impulse noise image. In the proposed algorithm are used two steps. First step detects the processing pixel is corrupted or not. The Second step of proposed algorithm to reform the corrupted pixel. This algorithm shows superior outcome than the Standard Median Filter (MF), Center Weighed Median Filter (CWM), Adaptive Median Filter(AMF), adaptive Center Weighed Median Filter (ACWM), Decision Based Algorithm (DBA) and Decision Based Unsymmetric Trimmed Median Filter to Obtained results with various images and the proposed algorithm gives better Peak Signal-to-Noise Ratio (PSNR) and less Computational time and Image Enhancement Factor (IEF) and works fine in removing impulse noise at low, medium and high noise densities.

A number of nonlinear filters have been proposed for restitution of images can be infected by salt and pepper noise. A widely nonlinear digital filter used for removing impulse noise that is median filters.

Decision Based Unsymmetric Trimmed Median Filter is proposed at high noise densities if the selected window has all the 0's or 255's or both, and then trimmed median value cannot be achieved. Recently a Modified Decision based Unsymmetrical Trimmed Median Filter (MDBUTMF) has been proposed which performing fine at low and high noise densities.

Though at high noise densities, if the selected window contains all minimum [0] or maximum [255] or both then the processing pixel is replaced by mean value of it. This algorithm fails if all the elements of the window are '0' or '255' then the mean value will be either '0'or '255'. Therefore noisy pixel will not be effectively processed. The proposed algorithm technique removes this drawback at high noise densities by substitute the processing pixel then substitute with the mean of the element of window of the intensity level from the image, and filtering algorithm shows efficient performance with better Peak Signal to Noise Ratio (PSNR) and Image Enhancement Factor (IEF) values than the existing algorithm. The rest of the paper is organized as follows.

2 PROPOSED ALGORITHM

The proposed Modified Decision Based Unsymmetric Trimmed 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.

Decision Based Algorithm (DBA) is a recently proposed algorithm to remove salt and pepper noise. In DBA each pixel is processed for de noising using a 3 X 3 window. During processing ifa pixel is [0] or [255] then it is processed else it is left unchanged. In DBA the corrupted pixel is replaced by the median of the window. At higher noise densities the median itself will be noisy, and, the processing pixel will be replaced by the neighborhood-processed pixel. This repeated replacement

of neighborhood pixels produces streaking effect. In DBUTM, the corrupted pixels are identified and processed. The DBUTM algorithm checks whether the left and right extreme values of the sorted array obtained from the 3x3 window are impulse value

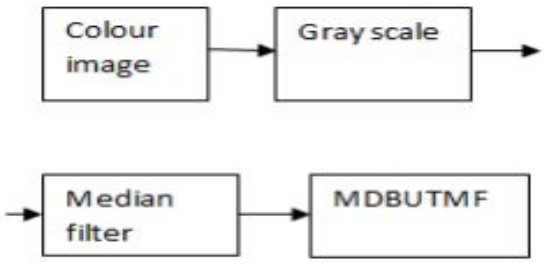

Fig1: Block diagram

The corrupted processing pixel is replaced by a median value of the pixels in the 3 X 3 window after trimming impulse values. The corrupted pixel is replaced by the median of the resulting array.

3 STEPS OF PROPOSED ALGORITHM

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 is pij.

Step 2: If 0<pij<255 then are a pij is uncorrupted pixel and its value is left unchanged.

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

Case i): If the selected window contains 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 pij with the media value.

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

4 ILLUSTRATION OF PROPOSED ALGORITHM

The proposed algorithm consists of two stages. First stage is detects whether the processing pixel is corrupted or not, the second stage used to recreate the corrupted pixels by using the proposed algorithm. Each pixel of the image is checked for the occurrence of impulse noise. Number of possible cases is illustrating in this Section. If the processing pixel is noisy and all the pixel values are given either 0's or 255's.

$$\begin{bmatrix} 0 & 255 & 0 \\ 0 & <255> & 255 \\ 255 & 0 & 255 \end{bmatrix}$$

Wherever "255" is processing pixel P (i,j) and all the neighboring elements are 0's and 255's. If one takes the median value, it will be either 0 or 255 which is again noisy. To resolve this difficulty, the mean of the preprocessed neighborhood pixels from the selected window is found then the processing pixel is replaced by it. For finding this mean value we used midpoint filter.

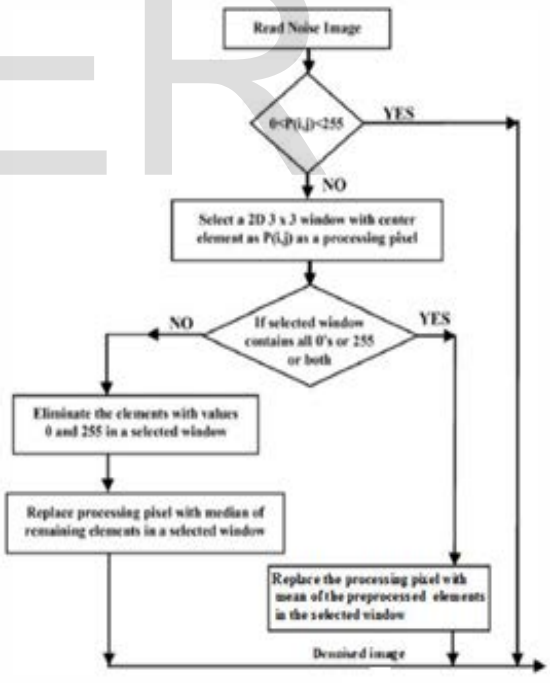

Fig2: Proposed Algorithm

Case ii): If the selected window contains salt or pepper noise as processing pixel (i.e., 255/0 pixel value) and neighboring pixel data values contains a number of pixels that adds salt(i.e., 255 pixel value) and pepper

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75	90	0
110	< 0 >	255
97	255	78

Where "0" is processing pixel, i.e., P (i,j). Now eliminate the salt and pepper noise from the selected window. That is, elimination of 0's and 255's. Here the elimination is unsymmetric and so it is unsymmetrical trimming. The I-D array of the above matrix is [75 90 0 110 0 255 97 255 78]. After elimination of 0's and 255's the pixel values in the selected window will be [75 90 110 97 78]. Here the median value is 90 therefore substitute the processing pixel by 90.

Case iii): If the selected window contains a noise free processing pixel, it does not require further processing. For example, if the processing pixel is 90 then it is noise free pixel.

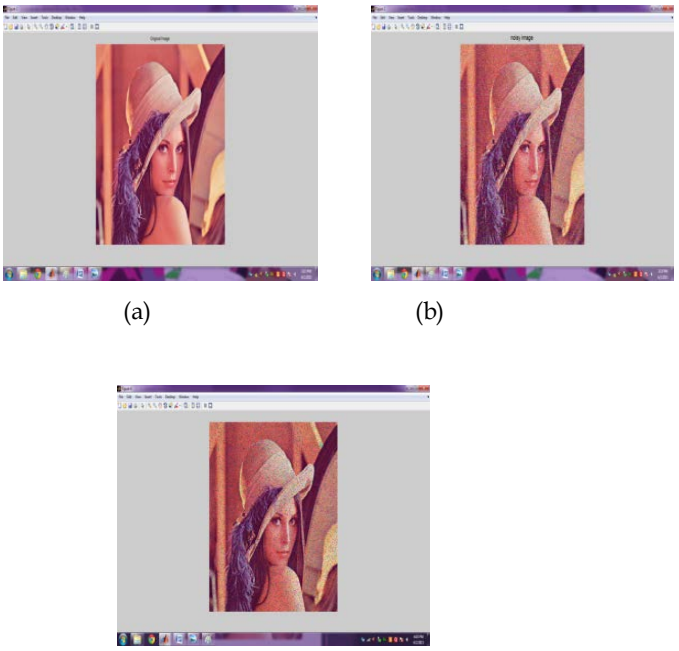
56	67	65
55	< 90 >	51
85	81	68

Where "90" is processing pixel, i.e. p(i,j), "90" is a noise free pixel it does not require further processing.

5 RESULTS

The performance of the proposed algorithm is tested with different images. The value of noise density is varied from 10% to 50% for the image. De noising performance is quantitatively calculated by the Proposed Source to Noise Ratio (PSNR) and Mean Square Error (MSE) as defined respectively.

Where MSE stands for mean square error, MXN is size of the image, Y characterizes the original image and Ŷ denotes the denoisy image. The PSNR and MSE values of the proposed algorithm s are compared against at different noise density from 10% to 50% for heart image were shown in Table; it is shows that the performance of the proposed algorithm is better than the existing algorithms at both low and high noise densities. The qualitative analysis of the proposed algorithm against at different noise densities for heart image is shown. Results obtained for heart image at 50% noise density for different algorithms and proposed algorithm was shown in the figure below. The proposed algorithm is tested against images namely , Lena and zebra.



(a) (b)

(C)

Fig.4.3: Results on LENA Image. (a) original image (b) Noisy image with ND=10% (c) MDBUTMF

(d) (e)

(f)

Fig.4.4: Results on LENA Image. (d) Original image (e) Noisy image with ND=20% (f) MDBUTMF

(g) (h)

(i)

Fig.4.5: Results on LENA Image. (g) Original image (h) Noisy image with ND=30% (i) MDBUTMF

Noise density in %	MSE	PSNR
10	0.0020	62.9012
20	0.0028	60.0762
30	0.0941	58.3947

Table: shows the value of PSNR and MSE at different noise density

6. CONCLUSION

In this paper the proposed algorithm present a new approach to get better PSNR of highly corrupted images. This method gives a suitable and familiar restoration of image corrupted with noise as high as 50%. some filtering techniques are not suitable for filtering, thus these consumed long processing time, the proposed filter only need to be applied once and is very capable with its computational time. According to the experimental results, the proposed technique is superior to the conventional applied methods in perceptual image superiority, and it provides a stable performance over a wide range of images with different noise densities. One of the advantages of this technique is that this technique does not require any threshold limit or parameter. Simulation results shows that this technique always produces good result, even at low and high noise density.

7. FUTURE SCOPE

The work presented in this paper is evaluated impulse noise removal technique in digital images. This work can be extended for the numerous other aspects.
The work can be extended to color images.
The work can be extended to non-impulse noise like Gaussian noise, Rayleigh noise, and an erlang and speckle noise.
The work can be extended to de-noising videos or.
We show the result like as PSNR, MSE and IEF parameters of image by using MDBUTMF technique for the noisy image.
The speed of the algorithm can also be enhancing by simulating this algorithm on C or C++ software gives better result than MATLAB software.

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