International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

An Accession for Image Denoising by Multiple Filter and Correlative Examination for Random Impulse Noise

Shridevi Soma, Jyoti S.G.

***Abstract:** Denoising an image is a significant problem in the processing of digital images. Any impulse noise damages the image and the aim of denoising is to remove noise and restore the high-quality image as much as possible. This paper aims to develop a method to discriminate between corrupted and uncorrupted pixels and develop a novel filter to denoise the image. It is also necessary to consider images with different level of noise of various applications to develop an optimal system to remove the noise for further processing. In this paper different filtering techniques such as Median-Filter (MF), Weighted -Median-Filter (WMF),Centre-Weighted Median filter (CWMF), and adaptive centre weighted median filter (ACWMF) are used for denoising, also a novel filter Asymmetric Trimmed Median Filter(ATMF) is designed which outperforms compared to the filters designed earlier. Experimentation is carried by considering the dataset size of 700 noisy images. The average PSNR value of proposed system is 28.12%(DB).*

***Keywords:** MF, CWMF, ACWMF, WMF, ATMF, impulse noise.*

I. INTRODUCTION

Digital image processing technology enables us to computer to manipulate digital images, as there are deficiencies in raw information from imaging sensors from different platforms. Different steps to be taken to overcome these deficiencies and achieve the originality of the data. The three common steps that all type of data must go through when using digital images are processing, enhancement and display, and information extraction. Defective element of the camera sensors, memory location errors and impulsive noise due to synchronization errors. Denoising the image is essential for subsequent activities in most applications, some of those edge discovery, picture division, object acknowledgment, and so on. Decision tree based method [1] is used to remove random impulse noise.

Manuscript published on 30 September 2019
* Correspondence Author
Dr. Shridevi Soma*, presently as Professor in Department of Computer Science and Engineering, Poojya Doddappa Appa College of Engineering, Kalaburagi.
Jyoti S.G., pursuing M.Tech. in Computer Science Engineering from Department of CSE at PDACE Kalaburagi , Karnataka, India.

The decision tree based quantifiable evaluation tells that performance of system is good. Algorithm for the removal of the corrupted input image of salt and pepper noise [5,7] using adaptive median filter. This method uses the best performance of the edge in pixel label and removes the impulse noise. Due to the higher efficiency the user will be reliable in the real time environment also in order to address these issues,

In this paper a powerful image restoring technique for highly corrupted images, namely Asymmetric centering filter for highly corrupted images with impulsive noise of random values is proposed. In study articles, the proposed impulse detection filtering method followed by ATM filter can generate high-quality pictures and avoids blurred pictures compared to other noise reduction techniques[8,11]. In order to obtain better performance, different kinds of weighted nonlinear filtering methods have been explored over the years[4,6].By and large, the exchanging middle channel comprise of two steps:1) Impulse detection[1,2,3] and 2) Noise separating.

Remaining part of the paper details about the proposed ATMF and comparative analysis of ATMF over other filter.

II. PROPOSED SYSTEM

The proposed method is denoised to develop a novel algorithm for denoising to obtain high quality image. A novel filter called Asymmetric Trimmed Median Filter(ATMF) has been implemented and its PSNR value is compared with PSNR values of other filters such as Median Filter(MF), Weighted -Median-Filter (WMF),Centre-Weighted Median filter (CWMF), and adaptive centre weighted median filter (ACWMF) and Asymmetric Trimmed Median Filter(ATMF). The proposed filter outperforms compared to other filters. Fig. 1 shows the overall system design of this work. An input image database of size 700 noisy images are created. These images are collected from various websites. These images various in noise types, levels and Image size. The PSNR and MSE values are calculated. Based on PSNR value the denoised percentage can be concluded and accuracy is calculated. The graphical representation can be helpful for analyzing the data. In this paper we applied Median Filter(MF), Weighted -Median-Filter (WMF),Centre-Weighted Median filter (CWMF), and adaptive centre weighted median filter (ACWMF) and Asymmetric Trimmed Median Filter(ATMF).

A comparative study is performed by considering PSNR values of all the filters including the proposed ATMF. The resultant graph shows that the reduction in the noise level is high in ATMF compared to other filters. This paper aims to develop an algorithm that gives optimal results even with image having varied noise levels. Fig. 2 shows the sample images from noisy image database that has been used for experimentation.

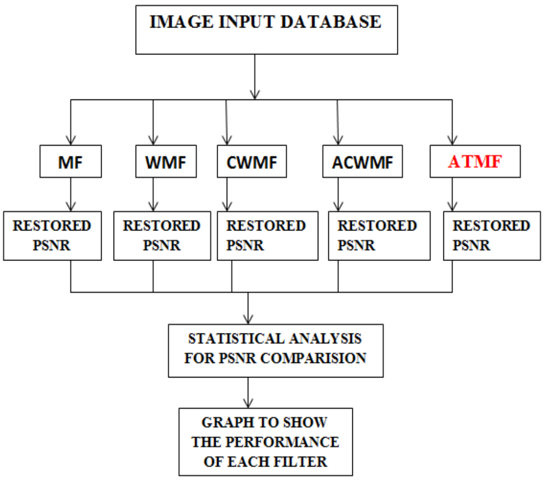

Fig.1 System design of multiple filter analysis

Fig.2 Database Collection

Image denoising nothing but Pre-processing technique. After pre-processing the image can be used for the various purposes. The results are stored in temporary database where PSNR and MSE values are stored. Based on these values the percentage of denoise can be concluded.

2.1 MEAN SQUARE ERROR(MSE)

PSNR is best defined as mean squared error (MSE) and provides a strong approximation to the noisy image m*n I.

$$\text{MSE}=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j)-K(i,j)]^2 \quad (1)$$

2.2 PEAK SIGNAL TO NOISE RATIO(PSNR)

The two error measurements used to compare image compression quality are the mean square error (MSE) and maximum signal to noise ratio (PSNR). MSE is the cumulative square error between the compressed picture and the initial picture, and PSNR is the maximum error metric. Typical PSNR values are between 25 and 40 dB for lost pictures if the depth of the chip is 8 bits. Calculated by PSNR as,

$$\text{PSNR}=10\log_{10}\left(\frac{MAXI^2}{MSE}\right) \quad (2)$$

Where MAXIis the largest possible pixel value in the image.For all filtering techniques, PSNR and MSE values are calculated using equation 1 and equation 2is calculated. In data users to find the files from cloud they need to enter multi-keywords to search the similar data or files from the cloud. For authentication secret key is sent to data users for giving permission to access the data. Then data users able to copy the files. In cloud server it will return the top-k results of files.

III. IMPLEMENTATION AND MULTIPLE FILTER ANALYSIS

The proposed system is implemented on MATLAB 2010a version. In this paper multiple filters can be analysis based on their technique. They are Median Filter, Center Weighted Median Filter, Weighted Median Filter, Adaptive Centre Weighted Median Filter a Asymmetric Trimmed Median Filter. Comparative analysis can be performed based on their PSNR values.

3.1 MEDIAN FILTER (MF)

The order-statistics filter which will use the median value of the pixel is the *median filter* ,it replaces value of one pixel with the equaling median value of the same pixel value in the graylevel scale with respect to the neighborhood of pixel represented by the following,

$$f(x,y) = \underset{(s,t)\in S_{xy}}{\text{median}}\{g(s,t)\} \quad (3)$$

It has the higher efficiency in case of the low level noise the image pixel is low. But causes the blurring of the image when the threshold value is increase linearly.

3.2 WEIGHTED MEDIAN FILTER (WMF)

The proposed median filter extension is a weighted median (WM) filter. Add weighting to pixel values in the same window. If you put the input and output values in X and Y, the intermediate filter,

$$Y= (i,j)= \text{median}\{X(i-s,j-t)|W(s,t)\} \quad (4)$$

3.3 CENTER WEIGHTED MEDIAN FILTER (CWMF)

This filter allows the higher weight of the pixel in the center based value of the same pixel. Hence it is easy compared to the WMF.

X and Y are the inputs and outputs of the MF that the CWMF can represent :

$$Y(i,j)=\text{median}\{X(i-s,j-t)|(s,t)eW\} \quad (5)$$

3.4 ADAPTIVE CENTER-WEIGHTED MEDIAN FILTER (ACWM)

Estimates based on the total difference between the image-based current pixel and the pixel output were filtered to a central center weight filtered using multiple center weights. The switching method is based on a full pulse detection system.

It is assumed that X and Y are the total input and output of the MF in which the ACWMF can be expressed,

$$I(i,j)=\text{median}\{C(X)\{(i-x,y-t-j)|(s,t)eW\} \quad (6)$$

The ACWMF used the varied weights of the pixel in the window of the varied center weights in the way of the more general operator; it will be realizing impulse detection by the total differences which has been made to define the different weight between outputs of the CWM filters. In the respect to the current pixel will be in the concern.

3.5 Asymmetric trimmed median filtering Technique (Proposed)

Asymmetric Trimmed Median Filtering for the image de noising has been subsequently used to eliminate stunning noises. It also keeps the edges and details of the pixels in the digital image.

The steps of the proposed methodology are as follows:

Step 1: 2-dimensional square analyzing filtering in the weight of the window of the size 3 x 3 will be initially slid over on input image X(i , j). It went up and down through raster scan mode.

$$W(i,j) = (X_{-n}(i,j), X_0(i,j), X_1(i,j), \ldots, X_n(i,j)) \quad (7)$$

Where $X_{0(i,j)}$ (or) $X_{(i,j)}$ - original central vector-valued pixel

Step 2: In the given input image, the central valued pixel inside the used 3x3 window will be verified too see whether it is corrupted. If central valued pixel is uncorrupted, it will be left unaltered. A 3 x 3 weight window $w(i,j)$ will be centred around the $X_{0(i,j)}$ which is than considered to filter can be shown as;

$$W(i,j) = X_{-4(i,j)}, \ldots, X_{-1(i,j)}, X_{0(i,j)}, X_{1(i,j)}, \ldots, X_{4(i,j)}) \quad (8)$$

Step 3: If central pixel is corrupted, 383 using the filtering selected in the weight window. The median value of the pixel is found among uncorrupted pixels. It is later replaced with the median value.

Step 4: Finally weight moved,and it is formed a new set of the pixel reconstructed values, by using the neighbor pixel which has been processed at the center of the weight 3*3 window as shown in the Fig 3. This process is carried out for each of the pixel.

Impulse noise detection and noise filtering are performed under the following conditions:

If $x_{LNL} < X_{0(i,j)} < X_{HNL}$
{$X_{0(i,j)}$ it is noiseless pixel }
$X_{0(i,j)} = X_{0(i,j)}$
Else
{$x_{o(i,j)}$ noisy values;
Determine the median value}
$X_{0(i,j)} = X_{med}$
end

Fig3. Algorithm of Asymmetric Trimmed Median Filtering Technique

Here, the $X_{0(i,j)}$-intensity of center pixel of the filter window,
X_{LNL}, X_{HNL} – low-high noise level
Xmed- the middle value of the pixel in the filter window, the weight of the noisy image.

IV. RESULT AND DISCUSSION

To check image quality using the ATMF experimentation is conducted using MATLAB on several images known as 8-bit gray scale or RGB grading test images. Every impulse noise has a distinct density in each test picture. In terms of qualitative and quantitative development, the suggested technique gave better results has been confirmed. The peak signal-to-noise ratio of the reconstructed image is calculated to demonstrate the quantitative quality of the reconstructed image.

Fig. 4 Results for restoration and improvement 20% damaged image "baby".

Table1: PSNR value of various filters

Methods \ Images	PSNR values				
	Lena	Penguin	Peppers	Baby	Cameraman
Noisy	17.08	17.84	17.22	17.20	21.78
Median Filter	17.92	18.04	18.06	18.08	22.29
Weighted MF	18.02	22.91	22.32	21.38	23.52
Center WMF	19.12	19.21	19.35	19.27	22.63
Adaptive CWMF	19.86	28.11	27.27	25.95	28.65
Asymmetric Trimmed median Filter	28.16	26.64	27.68	28.49	26.54

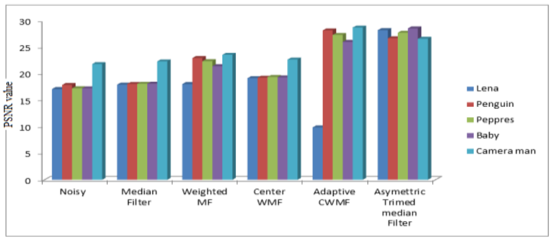

Fig. 5 PSNR value of various filters

Fig. 4 shows that filters that are applied on image baby. And Table1 is various filters applied on different kind of images such as Lena, Penguin, Peppers, Baby and Cameraman. Results analyzed in Fig. 5 PSNR values in ATMF is more than the other filters hence we can conclude that ATMF is good among these.

Table 2: Average PSNR values for input image database of size 700

Filtering Method	PSNR value
Noisy image	18.06
MF	20.34
WMF	21.16
CWMF	19.92
ACWMF	27.42
ATMF	28.12

Retrieval Number: C3936098319/19©BEIESP
DOI:10.35940/ijrte.C3936.098319
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

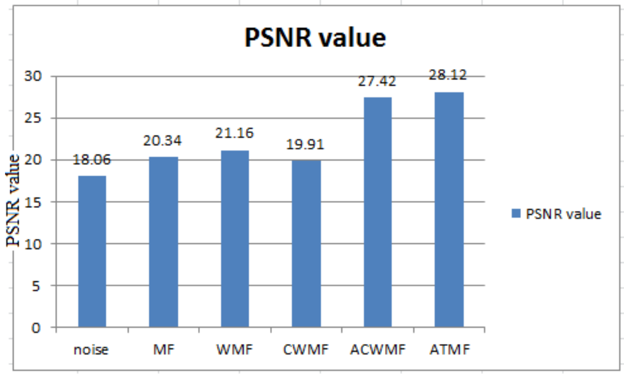

Fig.6 PSNR values for image database

The overall performance is shown in Fig.6 The denoised percentage result asymmetric Trimmed Median Filter (Proposed filter). This is better when compared to researched filter.

IV. CONCLUSION AND FUTURE WORK

In this paper we suggested that the novel accession by applying the multiple filers and proposed the comparative study based on the PSNR, MSE, values of the input image. Image denoising can be done using the different techniques in the existing system. The image will be initially performed de noising of random impulse noise by using the multiple level noise of 10, 20, to 50%. And multiple techniques can give the various results based on the features of images which are applied to them. So in the suggested novel algorithm scheme to overcome some issues of the current scheme. Adaptive methods assist enhance the quality of images that have been rebuilt. The method's quantitative analysis has been assessed. The findings of MATLAB demonstrate that the image quality is significantly enhanced.

REFERENCES

1. Ramitha Rajesh and Dr.P.Malathi, "A compelling Denoising and Enhancement Technique for Removal of Random Impulse Noise in Images," IEEE Image Processing, 2016.
2. Chih-Yuan " An Efficient Denoising Architecture for Removal of Impulse Noise in Images. In: IEEETrans .on Computers, vol.62, no. 4, pp. 631-643,(Apr 2013).
3. W. Luo.: A compelling method to safeguard subtleties to stifle drive commotion in a picture. In : IEEE Signal Processing Letters, vol.13,no. 7, pp. 413-416, (July 2006).
4. R.H. Chan, C.W. Ho and M. Nikolova, " Reduction and Preservation of clamor in Salt and Pepper with Average Noise Detector and quot:, IEEE Trans. Picture Processing, vol. 14, no. 10, pp. 1479-1485, October 2005.
5. P.- Y. Chen and C.- Y. Connection, "Productive Edge safeguarding Algorithm to Eliminate commotion from Salt and Pepper Noise and quot:, IEEE Signal Processing Letters, vol. 15, pp. 833-836, December 2008.
6. H. Yu, L. Zhao, and H. Wang. : An Effective Procedure to smother arbitrary worth heartbeat commotion in a picture. In: IEEE Signal Processing Letters, vol. 15, pp. 922-925, (2008).
7. Zhang and Y. Xiong. "Drive Noise Removal Using Directional Difference Based Noise Detector and Adaptive Weighted Mean Filter.In : IEEE Signal Processing Letters, vol. 16, no. 4, pp. 295-298, (Apr. 2009).
8. Xu, H.R. Wu, B. Qiu, and X. Yu, "Separating dependent on Geometric highlights for great clamor concealment of shading pictures" IEEE Trans. Picture Processing, vol. 18, no. 8, pp. 1742-1759, Aug. 2009.
9. Aizenberg, C. Butakoff, and D. Paliy, "Indiscreet Noise Removal Using Threshold Boolean Filtering Based on the Impulse Detecting Functions," IEEE Signal Processing Letters, vol. 12, no. 1, pp. 63-66, Jan. 2005.
10. Aizenberg and C. Butakoff. : Effective Impulse Detector Based on Rank-Order Criteria. In : IEEE Signal Processing Letters, vol. 11,no. 3,pp. 363-366, (Mar. 2004).

AUTHORS PROFILE

Dr. Shridevi Soma working presently as Professor in Department of Computer Science and Engineering, Poojya Doddappa Appa College of Engineering, Kalaburagi. She has 18 years of Teaching and 10 years of Research Experience, and completed her B.E, M.Tech. and Ph.D. in Computer Science and Engineering. Her Research Area includes Digital Image Processing and Pattern Recognition, Cloud Computing, Internet of Things, Big Data Analytics. She published more than 30 Research papers in above mentioned areas, also Guiding Research Students.

Jyoti S.G. is currently pursuing M.Tech. in Computer Science Engineering from Department of CSE at PDACE Kalaburagi , Karnataka, India.