International Journal of Engineering Research and General Science Volume 6, Issue 5, September-October, 2018
ISSN 2091-2730

Enhanced local outlier factor incorporating with Open Close Sequence Filter

Harish Kumar Rolania
Computer Engineering Department,
Arya College of Engineering and IT
Jaipur, India
hk.rolania@gmail.com

Abstract— In this paper an enhanced local outlier factor incorporating with boundary discriminative noise detection is proposed to identify noisy pixels and restore them properly and do not give false alarm on those which are present at edges. In first stage the proposed algorithm detects noisy pixels by local outlier factor incorporating with Boundary Discriminative Noise Detection (LOFBDND). Since this detection stage using LOF detects edge as noise and miss detect some noisy pixels which will result in high miss detection and false alarm rate so before going into filtering stage, next step will take out edge information. Noise removal of Images using mean filter based on replacing the central pixel value by the general mean of all pixels inside the sliding window. Finally the quality of Image is improved by using Open Close Sequence Filter, this filter is applied as per proposed method in this paper. The results show quantitatively and graphically (in terms of peak signal to noise ratio, mean squared error, accuracy).

Keywords— local outlier factor(LOF), Image noise removal, Boundary Discriminative Noise Detection(BDND), Mean filter.

Introduction

Impulse noise is present in digital images because of bit error in transmission or introduced by malfunctioning of camera's sensor cells, transmission errors, faulty memory locations or timing errors in analog to digital conversion in the imaging process.impulse noise that usually corrupts images by replacing some of the pixels of the original image with new pixel values. Since , the performance of noise removal methods depends on its effectiveness to detect and remove the faulty pixels. Linear filtering techniques[1] are not widely used because they are unable to preserve the information regarding the distorted pixels while removing the noise. therefore non-linear filtering techniques are widely used in the restoration process.

The proposed method performs well in removing low to medium density impulse noise with detail preservation up to a noise density of 70% and it gives better Peak signal-to-noise ratio (PSNR) and mean square error (MSE) values.

Literature Survey

Local Outlier Factor

It is an outlier detection strategy to detect the pixels with noise and that detected pixel is different to the original pixel because of noise and that strategy is enhanced by the proposed method of this paper.

The local outlier factor (LOF) method is set of rows generated based on probability distribution[2].

Local outlier factor is a density-based method that finds its neighbors. It is used to calculate the average densities of pixels by calculating the densities of it's neighbors pixels.

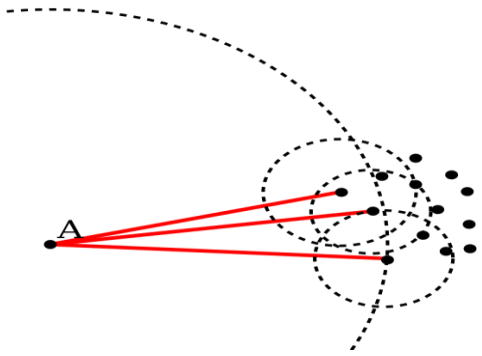
the estimated density[3] of a point h is the number of h's neighbors.

Suppose K(h) is the set of neighbors of point h, t is the number of points, and d(p,x) is the distance between points p and x. The density is:

$f^(p)=t\sum x\in K(p)d(p,x)$

and the local outlier factor value is:

$LOF(p)=1t\sum x\in K(p)f^(x)f^(p).$



Point A has a high LOF score because its density is low relative to its neighbors' densities. Dotted circles indicate the distance to each point's third-nearest neighbor.

Proposed Method

1) The input of the image is to processing based on open close sequence filter.
2) seqfilter(fastqFile)
3) seqfilter(fastqFile,Name,Value)
4) [outFiles,nSeqIn,nSeqOut] = seqfilter(___)

The detection stage is used to calculate the Local Outlier Factor of every pixel p in an image.

M = medfilt2(Y,[WF WF]); noise filtering process.

5) To reduce the false alarm at the edges.

Get the edges of image using sobel operator edgeIm = sobel_mex(gray, 0.7);Divide edge image into blocks of 3×3.

For each 3×3 block if the block has more than two edge pixels then declare it genuine and remove edge information at that

5) It is to generate the less noise along edges and the quality of image is also improved.
6) By calculating the MSE and PSNR value.

SquaredErrorImage = (double (gray Image) - double (noisy Image)). ^ 2;

mse = sum (sum (squaredErrorImage)) / (rows * columns);

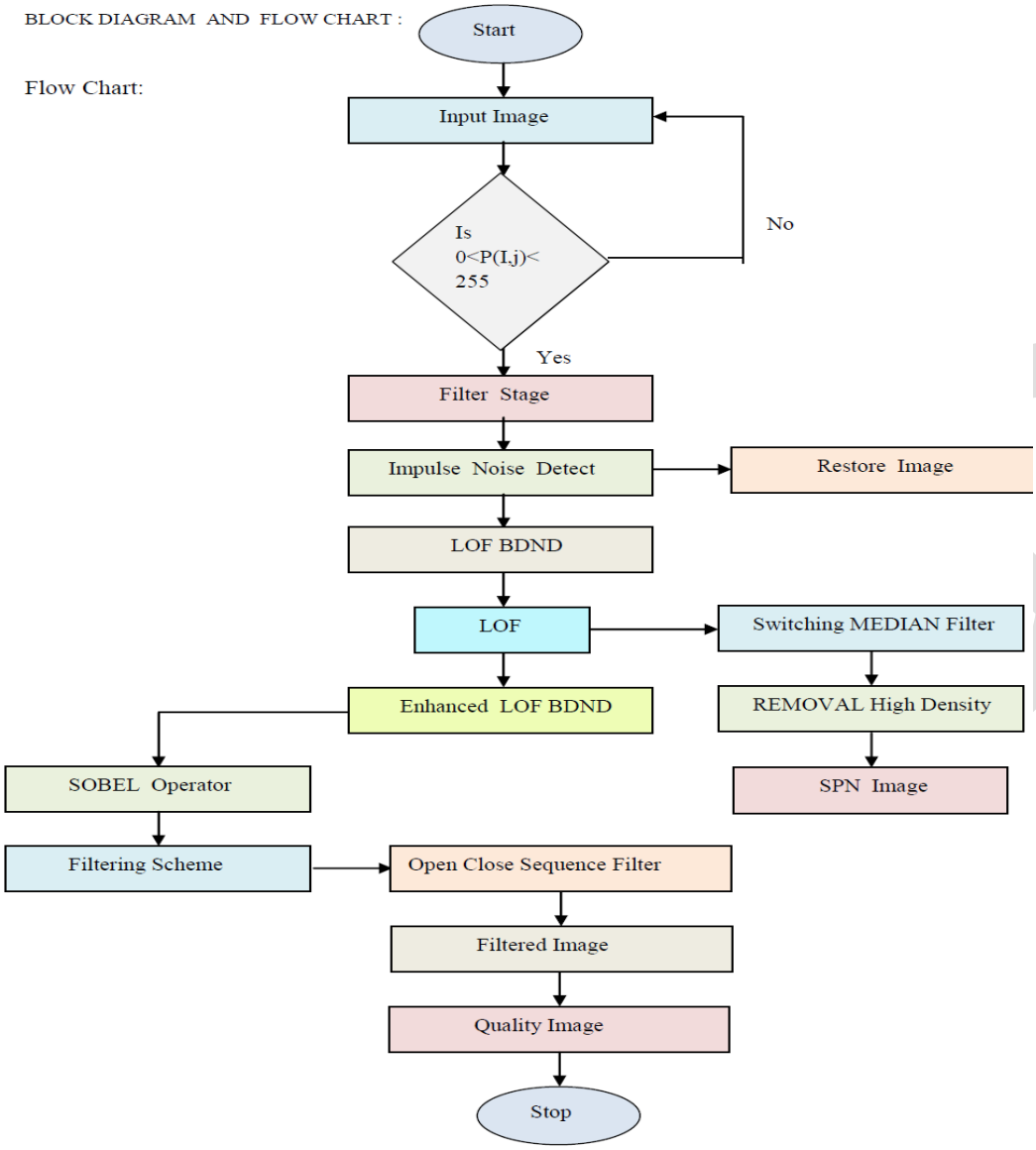
Calculate PSNR (Peak Signal to Noise Ratio) from the MSE according to the formula

PSNR = 10 * log10(256^2 / mse);

RESULT ANALYSIS OF SIMULATION

The proposed algorithm is simulated in MATLAB R2018a(64 bit). Here some colored and gray scale images are passed to simulation for result analysis. To compare the results of different Images , these Images have density ranging from 40% to 75%. Now these noisy images are restored by using both LOFBDND[4] and the proposed algorithm.

Detection and filtering phase Analysis



In the given algorithm, Image is being processed to detect the noise and after that filtering step is taken place with open close sequence filter to improve the quality of Image.

Analysis of Visual Performance

TABLE 1:RESULT ANALYSIS FOR TEST IMAGES

Test Image	**Parameter**	**Mean Filter**	**LOFBDND**	**Proposed Algorithm**
Image 1	SNR	1.16	5.20	7.61
(figure 1)	PSNR	13.11	17.16	19.56
(Graph 1 & 2)	MSE	46.20	50.82	49.77
Image 2	SNR	9.96	13.70	15.62
(figure 2)	PSNR	14.22	17.96	19.88
(Graph 3 &4)	MSE	69	55.91	54.83
Image 3	SNR	6.51	10.45	12.57
(figure3)	PSNR	13.51	17.45	19.57
(Graph 5 &6)	MSE	74.83	64.95	64.66

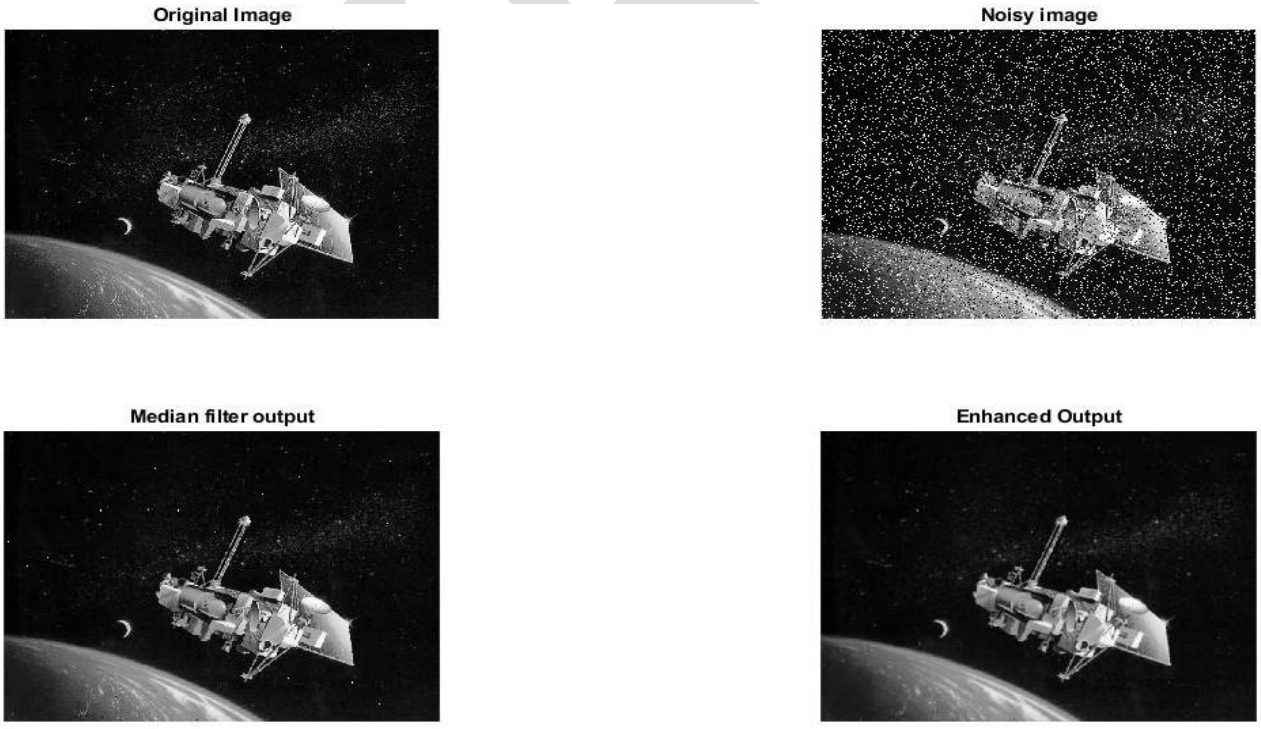
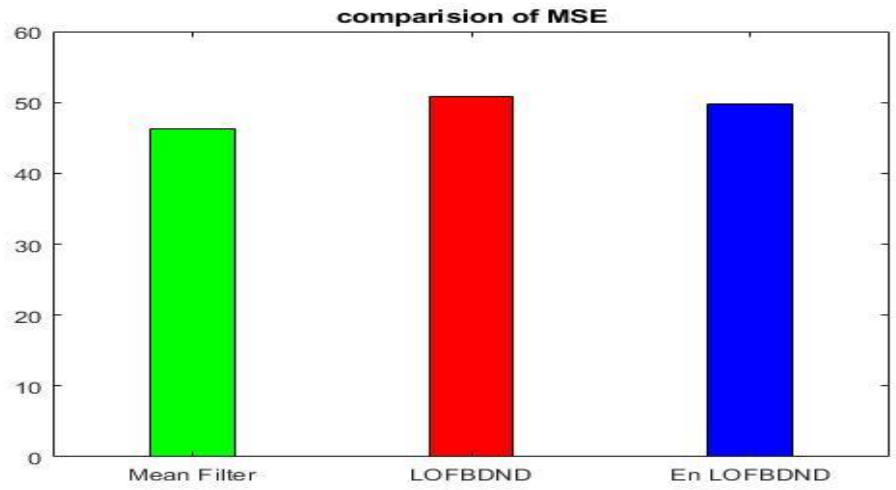
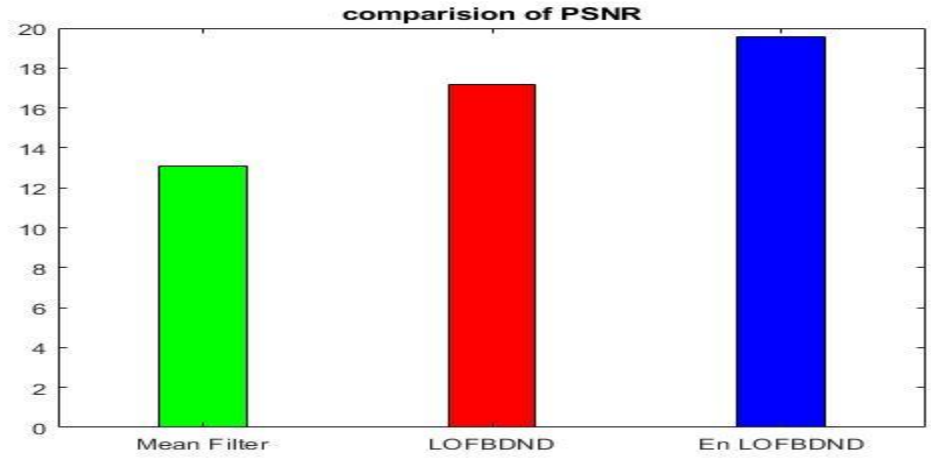


Fig. 1 Test Image 1



Graph 1 Test Image 1



Graph 2 Test Image 1

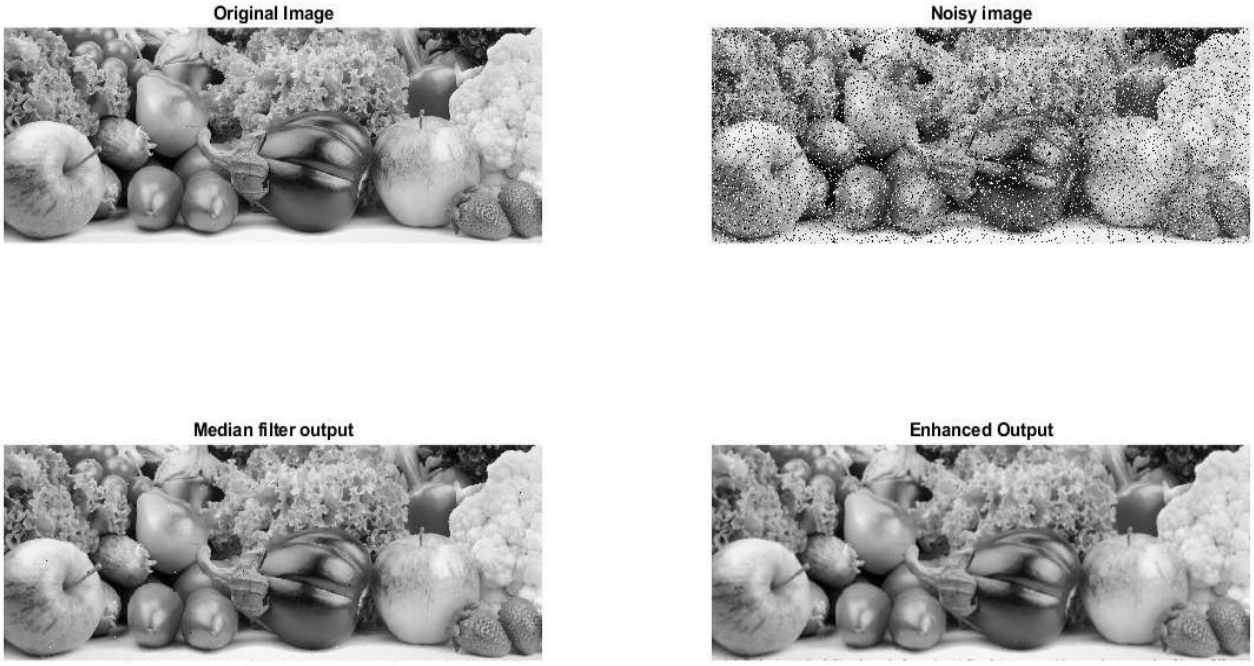
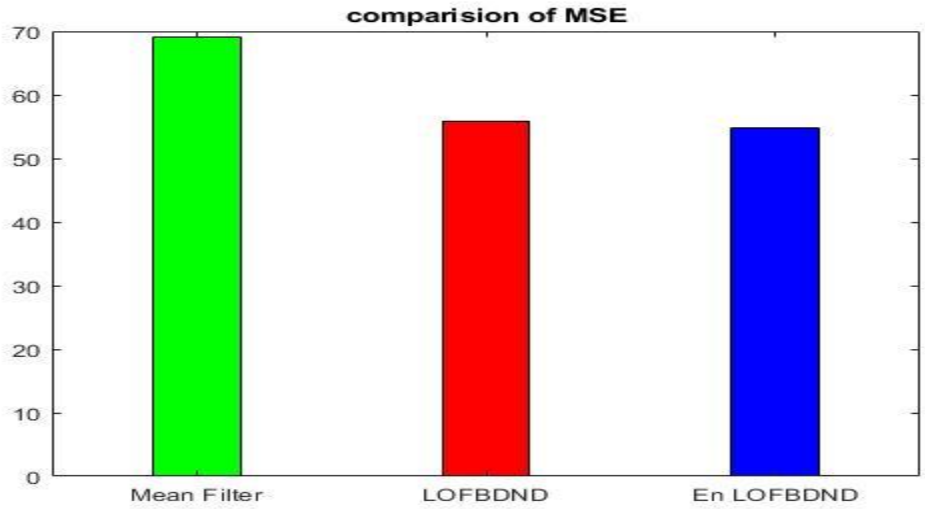
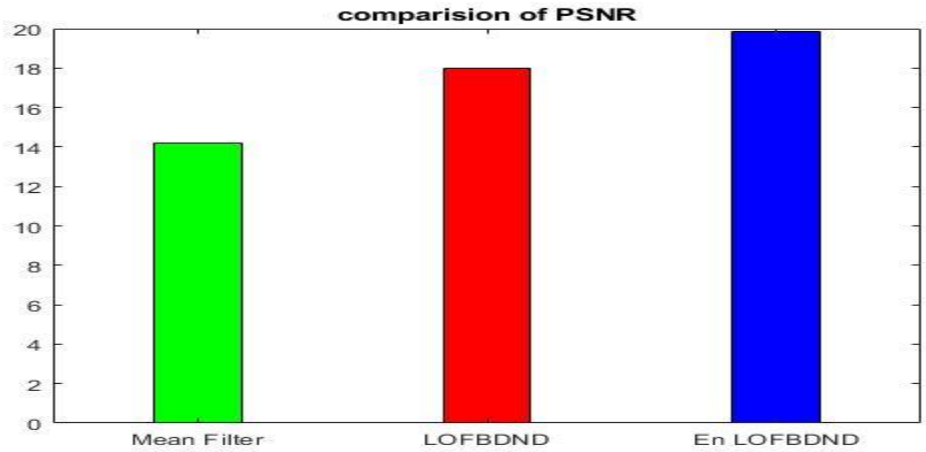


Fig. 2 Test Image 2

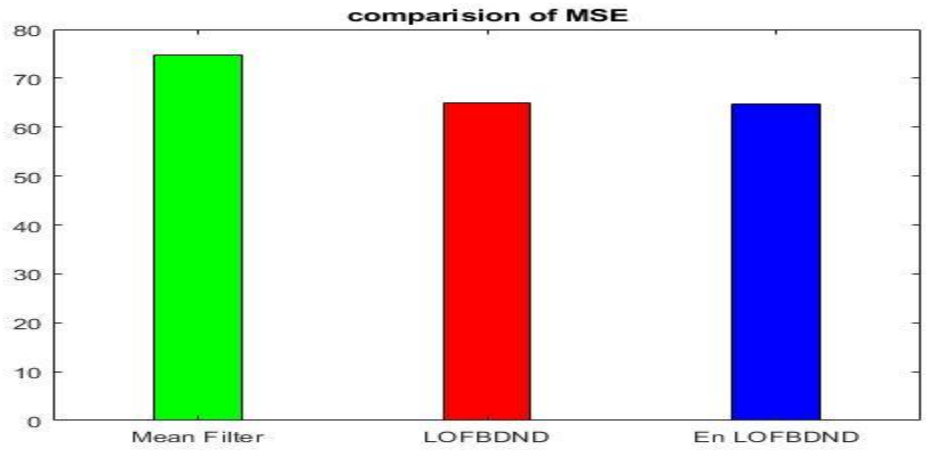


Graph 3 Test Image 2

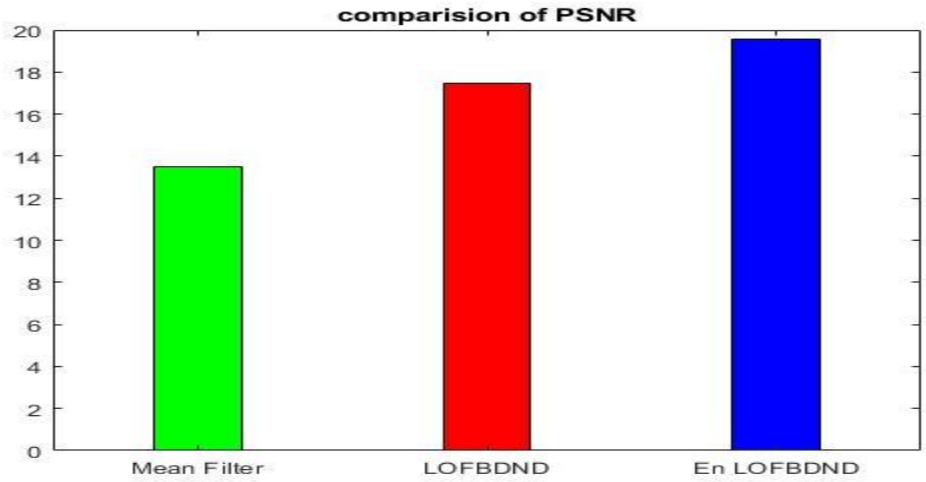


Graph 4 Test Image 2

Fig. 3 Test Image 3



Graph 5 Test Image 3



Graph 6 Test Image 3

Proposed Method is applied to different Test Images i.e. Image 1, Image 2, Image 3 and accordingly the result is displayed in Graphs and calculated values SNR, PSNR ,MSE are mentioned in the table1. Here Test Image 1 , Test Image 2 & Test Image 3 are compared with graphs by using values of PSNR & MSE[5].

CONCLUSION AND FUTURE WORK

In this paper, the image is restored with proposed method to improve the quality, it uses LOFBDND to find the false pixels present in the Image and restore them with open close sequence filter[6].

A comparison of proposed algorithm is also done with the existing noise removal algorithms in terms of PSNR,MSE.

In future the quality of Image can be improved by introducing Cascading window[7].

REFERENCES:

[1] Gonzalez R., Woods R. ―Digital Image Processing‖ 2/E, Prentice Hall Publisher, 2002.

[2] R. H. Chan, Chung-Wa Ho, M. Nikolova, ―Salt and Pepper Noise Removal by Median Type Noise Detectors and Detail

Preserving Regularization,‖ *IEEE Transactions on Image Processing*, Vol. 14, No.10, pp. 1479-1485, October 2005.

[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] M.M. Breuig *et al.*, ―LOF: Identifying density based local outliers[C],‖ in *Proc. ACM SIGMOD Conf.*, New York, 2000, pp. 427– 438.

[6] Wei Wang and Peizhong Lu,‖An Efficient Switching Median Filter Based on Local Outlier Factor,‖ *IEEE Signal Process. Lett.*,vol. 18, no. 10, pp.587–590, Oct. 2011.

[7] J. Astola and P. Kuosmanen, Fundamentals of Non Linear Digital Filtering, BocRaton, CRC, 1997. International Journal of Engineering Research and General Science Volume 3, Issue 2, March-April, 2015 ISSN 2091-2730 1233 www.ijergs.org

[8] 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.

[9] V. Jayaraj and D. Ebenezer, ―A new switching-based median filtering scheme and algorithm for removal of high-density salt and pepper noise in image,‖ *EURASIP J. Adv. Signal Process.*, 2010.

[10] S. Esakkirajan, T. Veerakumar, Adabala N. Subramanyam, and C. H. Prem Chand, ―Removal of High Density Salt and Pepper Noise through Modified Decision Based Unsymmetric Trimmed Median Filter‖, *IEEE Signal Process. Lett.*, vol. 18, no. 5, May 2011