# Removal of Random Value Impulse Noise using Various Filters: A Review

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*Abstract*— **Digital image processing is significant in many areas. Noise detection and rectification in digital images is beneficial in many areas.In this paper we survey on efficient method for the removal of random valued impulse noise. Here applying a detection process and a filtering process. Detection process detects the noisy pixels by using the absolute difference and median filter for filtering. Removal of random valued impulse noise in digital images with edge preservation is one of the difficult tasks in digital image processing areas. For rectification of impulse noise as well as preserve edge implements a new filter that is Dual Threshold Median Filter (DTMF). The removal of impulse noise is applicable in two main stages, firstly, the rectification of the impulse noise on the basis of high and low value of pixels in a 3X3 window. The detection of impulse noise by using of median filter. In the filtering stage, the noiseless pixels remain constant in the low noise frequency, but in case of high noise frequency that is complex of identify the noisy pixel or edge of the image, this complexity is rectify by our new filter mechanism approach.**

*Index Terms*—**Dual Threshold, Random Valued Impulse Noise, Visual Quality, Bluer,Fixed Value Impulse Noise, Peak Signal to Noise Ratio.**

## I. Introduction

The common method for converting image sensor data to an image, on a computer or whether in-camera, entails some form of noise reduction. Apart from noise generated by sensors, digital images are often damaged by impulse noise during the process of image acquisition or transmission. Preservation of image details and suppression of noise are the two important aspects of image processing. Nonlinear filter provide a better alternative solutions to linear filter, due to their effectiveness in reducing impulse noise. To preserve edges, improve PSNR median filters are widely used. The centers of research are on the removal of impulse noise while minimizing the loss of details as low as possible.

Random valued impulse noise will generate impulses whose gray level values lies within a fixed range. The random-valued impulse noise is more difficult to remove due to the random distribution of noisy pixel and its value lies between 0 and 255. Most of the filters related to image denoising have two stages namely a detection stage and a replacement stage. Detection stage detects noisy pixel while replacement stage replaces the noisy pixel by estimated value. Noise detection is a key part of a filter, so it is necessary to detect whether the pixel is noisy or noise free. Only noisy pixels are manipulated to de-noising processing and noise free pixels.

With the time many result oriented features are added in the standard median filters, there were so alternate filters which has been designed like weighted median filter, center weighted median filter (CWMF)[2] [3], progressive converting median filter (PSMF), signal rank order median filter (SDROM) [5], Recursive adaptive center weighted median filter (RACWM) and many other improved filters, here we propose a nonlinear dual median filter which removes random valued impulse noise without edge blurring.

## II. Noise Model MECHANISM

Image noise is a random, usually unwanted, distortion in brightness or color information in an image. Image noise is most possible in image regions with low signal level, such as shadow region technique flow or underexposed pixels. Impulse noise is one of common type of noise present in images. There are two common kinds of the impulse noise square measure the Fixed-Valued Impulse Noise (FVIN), conjointly referred to as Salt and-Pepper Noise (SPN), and therefore the Random-Valued Impulse Noise (RVIN). They disagree within the potential values that vociferous pixels will take. The FVIN is often shapely by-

$$(Y_{ij}) = \begin{cases} X_{i,j} \text{ with probabilty } p \\ (0,255) \text{ with probabilty } 1-p \end{cases} \ldots\ldots\ldots\ldots(1)$$

Where x(i,j) and y(i,j) denote the intensity worth of the initial and corrupted pictures at coordinates (i,j), severally and p is that the noise density. This model implies that the pixels square measure haphazardly corrupted by 2 mounted extreme values, i.e. 0 and 255, with an equivalent likelihood.A model is taken into account as below:

$$(Y_{ij}) = \begin{cases} (0, m) & \text{with probabilty } p1 \\ X_{i,j} & \text{with probabilty } 1-p \\ (255-m, 255) & \text{with probabilty } p2 \end{cases} \ldots\ldots\ldots\ldots(2)$$

Where p = p1 + p2. We refer to this model as Random valued Impulse Noise (RVIN).

## III. RELATED WORK

All previous mechanisms implemented in the paper performs better accuracy for low valued random valued impulse noise techniques is useful and most of all shows blur in high density de-noising of the images as per the relevant dataset.

The basic implementation behind this paper is the estimation of the noise-free image from the distorted image as per the dataset logic, and is also called to as image "denoising". There are different techniques to help restore an image from noisy distortions image data. The evaluation of each algorithm is compared by computing Signal to Noise Ratio (SNR) besides the visual interpretation mechanism. The image s(x,y) is blurred by a linear operation and noise n(x,y) technique is added to form the degraded image w(x,y). This is convolute with the restoration mechanismg(x,y) to produce the restored image z(x,y).

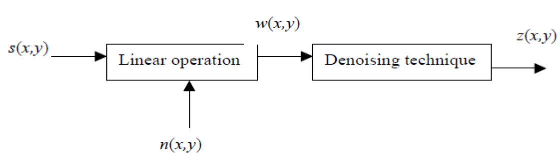


Figure: Denoising concept

***Median Filter***

The median filter is a nonlinear digital filtering mechanism, basically used to remove noise. Such noise reduction is a bettermechanism step to improvethe results of later processing. Median filtering is widely used in digital image processing era because, under certain assumptions, it preserves edges while clearing noise in the spatial domain the most basic nonlinear filter is the standard median filter (MF) [1]. Standard median filter replaces each pixel in the image by the median value of the corresponding filtering window technique. The standard median filter works effectively for low noise densities but at the cost of blurring the image. Assume that the pixel values in a neighborhood are taken in to sequence M1, M2, M3………... Mn. To achieving, the median value of pixels, first all pixels are arrange in ascending or descending order. After sorting these pixels, the arrangement will be Mi1≤Mi2≤Mi3≤................Min, in ascending order and Mi1≥Mi2≥Mi3≥................Min, in descending order.

Thus, mathematically median is representing as:

$$\text{Median (M)} = \text{Med}\{\text{Mi}\}$$
$$= \begin{cases} \text{Mi}(n+1)/2, & \text{n is odd} \\ ½[\text{Mi}(n/2) + \text{Mi}(n/2)+1], & \text{n is even} \end{cases}$$

'n' is generally odd.

A median filter follows the class of nonlinear filters unlike the mean filter. The median filter also pursues the moving window principle similar to the mean filter technique. A 3× 3, 5× 5, or 7× 7 kernel of pixels is scanned over pixel gridtechnique of the complete image. The median of the pixel results in the window is analyzed as per the values given, and the center pixel of the window is change with replaced with the computed median mechanism. Median filtering is accomplish by, first sorting all the pixel values from the surrounding pixel into numerical sequence and then replacing the pixel being considered with the middle pixel value scenario. Note that the median value must be implements to an individual buffer so that the results are not damaged as the process is implemented.

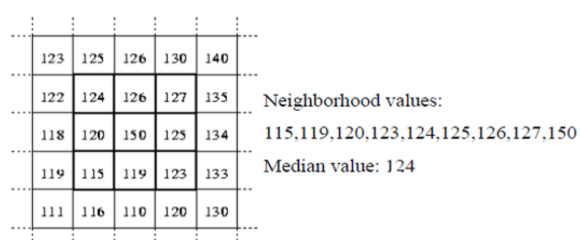


Figure: Concept of median filtering

The central pixel value of 150 in the 3×3 window shown in above Figure is rather abnormal of the surrounding pixels and is replaced with the median value of 124. The median is mostaccurate compared to the mean. Thus, a single very unrepresentative pixel in a nearest will not affect the median value incomparably. The median value actually be the value of one of the pixels in the nearest, the median filter is not implement new unrealistic pixel values when the filter straddles an edge. For this reason the median filter mechanism is much excellent at preserving sharp edges than the mean filter. These influence assistance median filters in denoising uniform noise as well from agiven image.

***Mean filter (M.F)***

The mask or kernel is a square it is a very popular technique. Often a 3× 3 square kernel is used for this purpose. If the coefficients of the mask sum up to one, then the average brightness ratio of the image are not updated in the original image. If the coefficients sum to zero, the average brightness are lost, and it returns a dark image implementation. The mean or average filter works on the shift-multiply-sum principle mechanism.

***Adaptive median filter (AMF)***

The adaptive median filtering mechanism has been implemented widely as an advanced method technique correlated with standard median filtering method. The Adaptive Median Filter achieves spatial processing to find out which pixels in an image have been concerned by impulse noise. The Adaptive Median Filter mechanism differentiates pixels as noise by comparing each and every pixel in the image to its nearest pixels. The size of the neighborhood is flexible, as well as the threshold for the comparison. A pixel that is contrasting from a majority of its neighbors, as well as being not structurally allocate with those pixels to which it is found same, is labeled as impulse noise. These noise pixels are then achieved by the median pixel value of the pixels in the nearest that have passed the noise labeling testmechanism.

## IV. DRAWBACK OF PREVIOUS METHODS

By Using Our Method We list the best results in PSNR for the two images with different noise ratios. It can be seen that in all cases our method provides the best results. For 60% noise ratio, ourmethod outperforms all the others by more than 1 dB. To compare the results subjectively, enlarged areas of the images restored by different methods. In the results of the old two-phase iterative method, there are still many identifiablenoise patches which are a common. Although no noticeable noise is obtained, the details, such as edges and lines, are not restored well in previous methods. In comparison, our approach performs better, and can suppress the noise profitably while preserving more details data regarding image. Considering the profusion of image details and the high noise level, the visual facilities of our restored images are quite better than that. For better result, the capability of noise detection is very measurable. Here, we compare our method with all the methods. Because some of the random-valued impulse noise values are not so different from their neighbors as in salt-and-pepper noise, there may be much more noise-free pixels detected as noise when detectingrandom-valued impulse noise.

## V. CONCLUSION AND FUTURE WORK

Here we conclude that our method gives better PSNR values than other filters. The advance filter has shown that it is very efficient for random valued impulse noise because analytically noise is not uniform over the channel in any aspect. We have utilized the concept of maximum and minimum threshold to identify both edges and noisy part of image. It produces good PSNR and reduced MSE for highly corrupted images, especially for more than 50% noise density. This method has the following advantages: The main advantage of our method that is two thresholds used and the threshold values can attentively update according to the noise density of filtering window. Threshold values will be disparate for different noise density methods as compare toother de-noising methods have either single threshold value or threshold having constant value throughout the image irrespective of density of noise. Our method shows good performance at different noise level. Also less complex sorting algorithm require because small number of elements are need to sort for the selection of minimum, maximum and median values. For future scope Dual Threshold Median Filter (DTMF) is all address of impulse noise removal for both low and high-density noise level with detail or edge preservation for getting better result.

## REFERENCES

[1] R. C. Gonzalez and R. E. Woods, Digital Image Processing. Englewood Cliffs,NJ: Prentice-Hall, 2002

[2] S.-J. Ko and Y. Lee, “Center weighted median filters and their applications to image enhancement,” IEEE Transactions on Circuits and Systems, vol. 38, no. 9, pp. 984–993, September 1991.

[3] T. Song, M. Gabbouj, and Y. Neuvo, "Center weighted median filters: some properties and applications in image processing," Signal Processing, vol. 35, no. 3, pp. 213-229, 1994.

[4] H. Hwang and R. A. Adaptive Median Filters: New Algorithms and Results Haddad 1EEE Transactions on image processing, Vol. 4, No. 4, April 1995

[5] E. Abreu and S. Mitra, "A signal-dependent rank ordered mean (SDROM) filter-a new approach for removal of impulses from highly corrupted images," in ICASSP, vol. 4, pp. 2371 –2374, 1995 IEEE.

[6] T.-C. Lin, P.-T. Yu, , A new adaptive center weighted median filter for suppressing impulsive noise in images, Information Sciences 177 (2007)1073–1087

[7] James C. Church, Yixin Chen, and Stephen V. Rice A Spatial Median Filter for Noise Removal in Digital Images, Southeastcon, 2008

[8] WANG Chang-you, YANG Fu-ping, GONG Hui, A new kind of adaptive weighted median filter algorithm, 2010 I.J.C on Computer Application and System Modeling (ICCASM 2010).

[9] Zhu Youlian, Huang Cheng, An Improved Median Filtering Algorithm Combined with Average Filtering, IEEE, 2011 Third International Conference on Measuring Technology and Mechatronics Automation, 6-7 Jan. 2011, pp.420-423

[10] Vikas Gupta, Madhu shandilya ―Image De-noising by Dual Threshold Median Filtering for Random Valued Impulse Noise Nirma University International Conference On Engineering, nuicone-2012,06-08 DECEMBER 2012

  