ISSN 2278-3091

International Journal of Advanced Trends in Computer Science and Engineering, Vol. 3 , No.1, Pages : 01-05 (2014)
Special Issue of ICETETS 2014 - Held on 24-25 February, 2014 in Malla Reddy Institute of Engineering and Technology, Secunderabad– 14, AP, India

A Study on Reduction of Impulse Noise from Corrupted Images Using Simple Adaptive Median Filtering

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Abstract

This paper is based on a reduction of noise for a corrupted images using Simple Adaptive Median filtering. Recently many linear and non linear filtering was proposed for removing noise from images. Based up on the local noise level on digital images size of filter is changed.SAM has three derivatives namely Circular SAM, Weighted SAM and Weighted Circular SAM. In the proposed method of filtering several noises detection is done by simple thresholding. When a median type filter, filters a signal some characteristic will change. But impulse noise will be reduced significantly. Although the median filter is simple and provides a reasonable noise removal performance, it removes thin lines and blurs image details even at low noise densities. A prime benefit to this adaptive approach to median filtering is that it does not erode away edges or other small structure in the image. This paper gives a brief over view of SAM for reducing impulse noise from corrupted images.

Key words: Median filter, SAM, Impulse Noise.

INTRODUCTION

Digital image processing emerges in to various fields of engineering and technology. While acquiring or transmitting image, it is often contaminated with impulse noise due to a number of non-idealities in the imaging process. These noisy pixels can take only the maximum and the minimum values in the dynamic range. During the past years there is a significant increase in the impulse noise that appears as very large spikes of short duration. In the most applications, it is very important to remove impulse noise from image data, since the performances of subsequent image processing tasks are strictly dependent on the success of image noise removal operation. Since signals are nonlinear in nature, it is evident that nonlinear filters are generally superior to linear filters in terms of impulse noise removal. Impulse noise, also known as salt-and-pepper noise, A large number of methods have been proposed to remove impulse noise from digital images. The standard median filter is a simple rank selection filter that attempts to remove impulse noise Median filter is one of the order-statistic filters, which falls in the group of nonlinear filter. Median based filters are the popular methods to be employed for reducing the impulse noise level from corrupted images. This is because of their simplicity and capability to preserve edges. Median filtering follows this basic prescription. The median filter is normally used to reduce noise in an image, somewhat like the mean filter. However, it often does a better job than the mean filter of preserving useful detail in the image. This class of filter belongs to the class of edge preserving smoothing filters which are non-linear filters. This means that for two images *A (x)* and *B(x)*:

$$median[A(x)+B(x)] \neq median[A(x)]+median[B(x)]$$

These filters smoothes the data while keeping the small and sharp details. The median is just the middle value of all the values of the pixels in the neighborhood. Note that this is not the same as the average (or mean); instead, the median has half the values in the neighborhood larger and half smaller. The median is a stronger "central indicator" than the average. In particular, the median is hardly affected by a small number of discrepant values among the

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pixels in the neighborhood. Consequently, median filtering is very effective at removing various kinds of noise. Generally Noise gets introduced into the data via any electrical system used for storage, transmission, and/or processing. In addition, nature will always plays a "noisy" trick or two with the data under observation. When encountering an image corrupted with noise you will want to improve its appearance for a specific application. The techniques applied are application-oriented. Also, the different procedures are related to the types of noise introduced to the image. Some examples of noise are: Gaussian or White, Rayleigh, Shot or Impulse, periodic, sinusoidal or coherent, uncorrelated, and granular. In this paper, we present technique, which is switching median filter. This proposed method is fast, simple, and adaptable to the local noise level. The method can remove the impulse noise effectively from the image, and at the same time can preserve the details inside the image, even when the input image is very highly corrupted by the noise.

Simple Adaptive Median:

Operation of SAM is divided into two parts in first part noisy and noiseless pixels could be identify In second part Noisy pixel are processed and noise free pixel are copied to output image. For identification of noise in each pixel SAM technique is used, which is used to filter the input corrupted images by comparing with WSAM, CSAM and WCSAM to restore the images, but as Circular filter has complicated implementation that resulted in increase of execution time. The reason behind increase in execution time is the calculation of filter windows at each iteration. After calculating executation time of window in every iteration for each image reduces the quality of the algorithm. Hence we proposed a switched filter which Would be much efficient and will finally reduce the execution time.

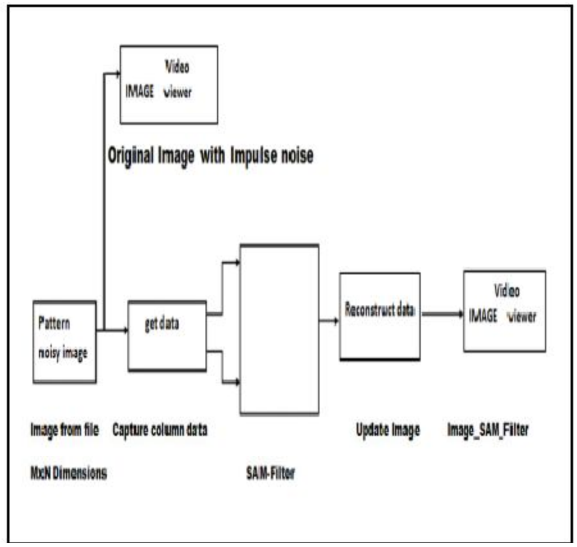
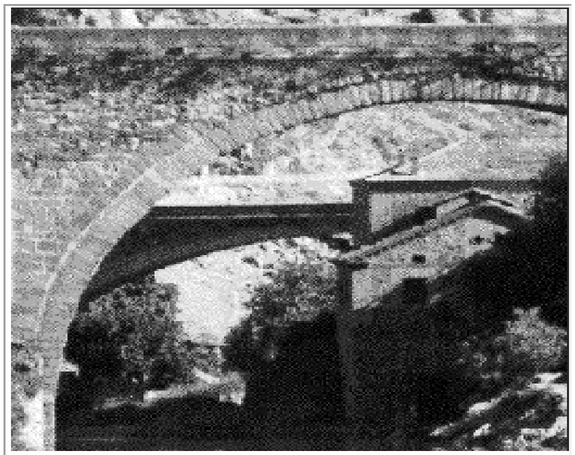


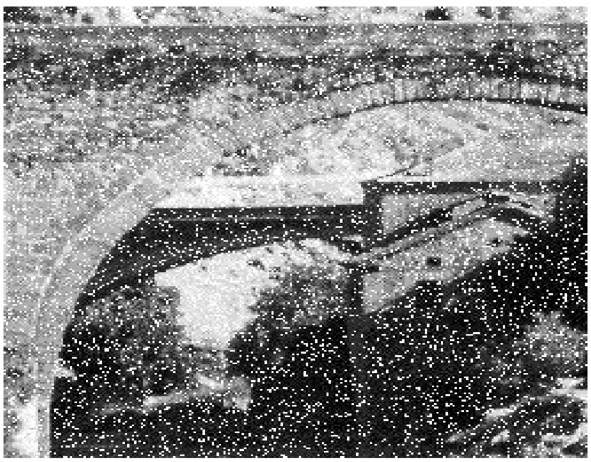
Figure 1 Block Diagram of SAM Filter

Detection of Noisy pixel

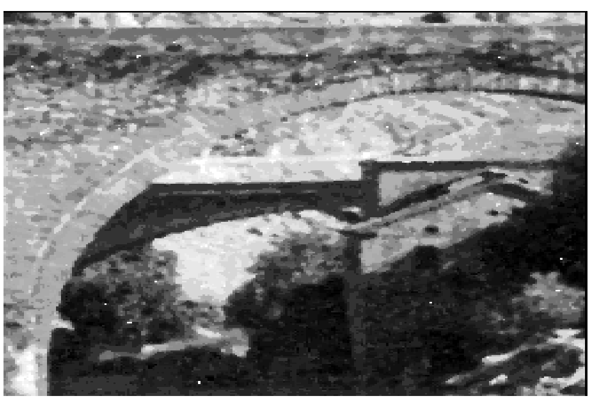
An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions. Due to reason images that are impulse with salt and pepper noise appear as white and black dots. The amplitude of the Imposed noise in the image is very high as compared to the original signal strength of the image. The median filter is a non-linear tool, while the average filter is a linear one. In smooth, uniform areas of the image, the median and the average will differ by very little. The median filter removes noise, while the average filter just spreads it around evenly. The performance of median filter is particularly better for removing impulse noise than average filter. As Figure 2 shown below are the original image and the same image after it has been corrupted by impulse noise at 10%. This means that 10% of its pixels were replaced by full white pixels. Also shown are the median filtering results using 3x3 and 5x5 windows; three (3) iterations of 3x3 median filter applied to the noisy image; and finally for comparison, the result when applying a 5x5 mean filter to the noisy image.



a)Original image;



b) Added Impulse Noisy at 10%



a)3x3 Median Filtered;

b)5x5 Median Filtered

Therefore the adaptive median filtering has been applied widely as an advanced method compared with standard median filtering. The Adaptive Median Filter performs spatial processing to determine which pixels in an image have been affected by impulse noise. The Adaptive Median Filter classifies pixels as noise by comparing each pixel in the image to its surrounding neighbor pixels. The size of the neighborhood is adjustable, as well as the threshold for the comparison. A pixel that is different from a majority of its neighbors, as well as being not structurally aligned with those pixels to which it is similar, is labeled as impulse noise. These noise pixels are then replaced by the median pixel value of the pixels in the neighborhood that have passed the noise labeling test.

Purpose for Adopting SAM

1). Remove impulse noise

2). Smoothing of other noise

3). Reduce distortion, like excessive thinning or thickening of object boundaries

● Adaptive median filter changes size of Sxy (the size of the neighborhood) during operation.

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● Notation

Zmin = minimum gray level value in Sxy

Zmax = maximum gray level value in Sxy

Zmed = median of gray levels in Sxy

Zxy = gray level at coordinates (x, y)

Smax = maximum allowed size of Sxy

● Algorithm

Level A: A1 = Zmed - Zmin

A2 = Zmed - Zmax

if A1 > 0 AND A2 < 0, go to level B

else increase the window size

if window size < Smax, repeat level A

else output Zxy

Level B: B1 = Zxy - Zmin

B2 = Zxy - Zmax

if B1 > 0 AND B2 < 0, output Zxy

else output Zmed

● Explanation

Level A: IF Zmin < Zmed < Zmax, then

• Zmed is not an impulse

(1) go to level B to test if Zxy is an impulse ...

ELSE

• Zmed is an impulse

(1) the size of the window is increased and

(2) level A is repeated until ...

(a) Zmed is not an impulse and go to level

(b) Smax reached: output is Zxy

Level B: IF Zmin < Zxy < Zmax, then

• Zxy is not an impulse

(1) output is Zxy (distortion reduced)

ELSE

• either Zxy = Zmin or Zxy = Zmax

(2) output is Zmed (standard median filter)

• Zmed is not an impulse (from level A)

Removal of Noisy Pixels

1. Initialize the size of the square filter W = 2R Rminis an integer value calculated using Where G is the output of the lookup table.

2. Output of the lookup table decides the noise free pixels.

3. If the number of "noise free pixels" is less than eight pixels, increase the size of the square filter by two (i.e. W= W+2) and return to step 2.

4. Calculate the value of n(x, y) based on the "noise free pixels" contained in window of size M x N

5. Update the value of f(x, y) by using the step (4)

CONCLUSION

These paper posses a impulse noise removal algorithm proposed in this work have good characteristics for impulse noise removal and may be supplied in different devices for digital image processing. The computation time required increases as noise density increases which are quite acceptable for the image.SAM has three derivatives namely Circular SAM, Weighted SAM and Weighted Circular SAM. In the proposed method of filtering several noises detection is done by simple thresholding. When a median type filter, filters a signal some characteristic will change. Here we studies about a SAM for removal of impulse noise and also proposed an algorithm for this reducing impulse noise from corrupted images. One of the

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advantages of this method is that this method does not need the threshold parameter.

REFERENCES

[1] M. Juneja, R. Mohan, May 2009. An Improved Adaptive Median Filtering Method for Impulse Noise Detection, International Journal of Recent Trends in Engineering, Vol 1, No. 1, pp 274

[2] H. Hosseini, F. Marvasti, "Fast Impulse Noise Removal from Highly Corrupted Images, http://arxiv.org/ftp/arxiv/paper/1105/11052899.pdf

[3] A.Rosenfeld and A.C.Kak,Digital Picture Processing, New York Academic Press,1982,vol-1.

[4] D.T.Kuan,A .A.Sawchuk,T.C.Strand and P.Chavel,"Adaptive noise smoothing filter for images with signal dependent noise,"IEEE Trans pattern Anal.mach.Intell,vol.pami-7,pp-165-177,mar-1985.

[5] T. Acharya, A. K. Ray, 2005. Image processing: principles and applications, John Wileyand Sons, pp 116-127.

[6] Rafael C. Gonzalez, and Richard E. Woods, "Digital Image Processing", 2nd edition, Prentice Hall, 2002.

[7] J. Astola and P. Kuosmanen (1997), Fundamentals of Nonlinear Digital Filtering, CRC, Boca Raton, FL

[8] Acharya T., Ray A. Image Processing Principles and Application. John Wiley & Sons. New Jersey, 2005.

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