



IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: VI Month of publication: June 2017 DOI:

www.ijraset.com

Call: 🛇 08813907089 🕴 E-mail ID: ijraset@gmail.com

www.ijraset.com IC Value: 45.98

International Journal for Research in Applied Science & Engineering Technology (IJRASET) Comparative Analysis of Image Denoising Techniques

Shipra Sood¹, Parul Malhotra²

¹Research Scholar, Department of ECE, Sri Sai University, Palampur(H.P.), India ²Assistant Professor, Department of ECE, Sri Sai University, Palampur(H.P.), India

Abstract- A noise gives an image a generally undesirable appearance, the most significant factor is that noise can cover and reduce the visibility of certain features with in the image. Now, a days use of image is becoming popular as it is used in various applications like medical, education, military etc. Introduction of various noises (Salt & Pepper noise, Gaussian noise, mixed noise etc.) in image can be from various factors like during transmission or any other mode. In this paper we compare about various denoising techniques to remove impulse noise from images and their features. Comparison is done on the basis of Peak Signal to Noise Ratio (PSNR) value.

Keywords-PSNR, Salt and Pepper Noise, Gaussian Noise, denoising, mixed noise.

I. INTRODUCTION

Image denoising is an important image processing task, both as a process itself, and as a component in other processes. There are many ways to remove noise from an image or a set of data exists. The main property of a good image denoising model is that it will remove noise while preserving edges. Images are often corrupted by two types of noise: Gaussian noise and impulsive noise. Gaussian noise typically occurred in image acquisition process and is modeled by adding each pixel a value from a zero-mean Gaussian distribution, thus all pixels of the image are affected. Because of its zero-mean nature, Gaussian noise can normally be removed by averaging similar pixels in a pixel's local neighborhood [4].Impulsive noise is also called as Salt and pepper noise or a fixed value impulsive noise because the intensity value of images is changed into 0 or 255 when the image is contaminated by noise. Impulse noise is caused by faulty camera sensors, faults in data acquisition systems and transmission in a noisy channel [5]. There are various methods that helps to remove noise from the image. But better performance depends on the selection of appropriate method for image denoising.

II. TECHNIQUES FOR NOISE REMOVAL

A. Standard Median Filter

The standard median (SM) filter is a simple nonlinear smoother that can suppress noise while retaining sharp sustained changes (edges) in signal values. It is particularly effective in reducing impulsive-type noise. This filter also attempts to remove impulse noise from the center pixel of a given filter window by replacing this pixel with the median of pixels with in the window. Though this method is simple and efficient in terms of noise removal capability.

B. Decision Based Algorithm

Decision Based Algorithm (DBA) is also known as Switching Median Filter (SMF). In this filter is used to minimize the undesired alteration of uncorrupted pixels by the filter. Overcome this problem, switching median filter checks each input pixel whether it has been corrupted by impulse noise or not. Then it will be change only the intensity of noisy pixel candidates, while left the other pixels unchanged the decision is based on a threshold value. This filter repeated replacement of neighboring pixel produces streaking effect.

C. Median Filter

The median filter is a nonlinear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

signal. For 1D signals, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higherdimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically. For an even number of entries, there is more than one possible median.

D. Adaptive Median Filter

This filter smooths 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 pixels in the neighborhood. Consequently, median filtering is very effective at removing various kinds of noise.

E. Modified Decision Based Unsymmetrical Trimmed Adaptive Median Filter

In order to overcome the drawback of Unsymmetric trimmed median filter, an Unsymmetric trimmed adaptive median filter is used in this window size is selected dynamically depending on the total number of noisy pixels in the selected window. If $\frac{3}{4}$ th or more pixels in the selected 3x3 window are noisy, then window of size 5x5 is selected. The selected 3x3 or 5x5 window elements are arranged in either increasing or decreasing order. Then the pixel values 0"s and 255"s in the window (i.e., the pixel values responsible for the salt and pepper noise) are removed from the window. Then the median value of the remaining pixels is taken. This median value is used to replace the noisy pixel. This filter is called trimmed adaptive median filter because the pixel values 0"s and 255"s are removed from the dynamically selected window.

F. Trilateral Filter

It is one of the very effective filtering techniques. It is the improved version of bilateral filter. It has two noise detector ROAD and ROLD for discovery of noise present in damaged pixels. Joining the bilateral filter it will gives the superior outcomes by performing task together. While discovering low impulse noise the ROAD trilateral filter perform task and after detecting low impulses it will eliminate them. On the other hand, preserving the high level noisy pixel discovery the ROLD trilateral filter will works and remove the raw valued impulses. In this type of noise applicants are reconstructed by using trilateral filter. The logarithmic approach defines that how much far and near the neighbor pixel from the reconstructed pixel.

G. Fuzzy Peer Group Filter

A fuzzy peer group will be defined as a fuzzy set that takes a peer group as support set and where the membership degree of each peer group member will be given by its fuzzy similarity with respect to the pixel under processing. The fuzzy peer group of each image pixel will be determined by means of a novel fuzzy logic-based procedure. We use the fuzzy peer group concept to design a two-step color image filter cascading a fuzzy rule-based switching impulse noise filter by a fuzzy average filtering over the fuzzy peer group. Both steps use the same fuzzy peer group, which leads to computational savings. This filter is able to efficiently suppress both Gaussian noise and impulse noise, as well as mixed Gaussian-impulse noise.

H. Boundary Discriminative Noise Detection Filter(BDND)

Boundary discriminative noise detection (BDND) is a highly used noise reduction method for strongly denoising extremely corrupted images. BDND works under different impulse noise models. It mostly uses switched Enhanced BDND Algorithm for High Density Impulse Noise removal median filter as it removes noise without any pixel misclassification. It classifies pixels of localized current window pixels into three distinct categories and this algorithm works on the affected pixels and replaces it for the noise free image

The BDND algorithm is applied to each pixel of the noisy image in order to identify whether it is uncorrupted or corrupted. The uncorrupted pixels are left unchanged. It comprises of noise detection and filtering stages for impulse noise removal.

III. PERFORMANCE METRICS

To evaluate the performance of the de noising techniques several parameters are available. We are using Peak Signal to Noise Ratio (PSNR). Peak Signal to Noise Ratio (PSNR) estimates the superiority of the recreated image in respect to the original image. Greater

www.ijraset.com IC Value: 45.98 *Volume 5 Issue VI, June 2017 ISSN: 2321-9653*

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

the PSNR better will be the reconstructed images. Equation 1 shows the mathematical function of peak signal to noise ratio.

$$PSNR(dB) = 10 \log_{10} \left(\frac{255^2}{\frac{1}{M \times N} \sum_{i=0}^{M-1} \sum_{j=0}^{N-1} (O-D)^2} \right)$$
(1)

where *O* is the original image of size $M \times N$ and *D* is the restructured image.

IV. PERFORMANCE ANALYSIS

 Table 1. shows the PSNR (peak signal to noise ratio) for various techniques at different impulse noise densities.

 Table 1.Comparison of PSNR values of different algorithms at different noise densities.

		-				0		
Noise	Standard	Fuzzy	Decision	Median	Adaptive	Trilateral	Boundary	Modified Decision
Density	Median	Peer	Based	Filter	Median	Filter	Discriminative	Based Symmetrical
(%)	Filter	Group	Algorithm		Filter		Noise	Trimmed Adaptive
		Filter					Detection	Median
							Filter (BDND)	Filter(MDBSTAM)
10	22.37	25.773	27.16	28.47	28.43	31.662	32.1528	38.08
20	19.7	24.85	26.77	27.00	27.40	30.91	30.1956	34.44
30	18.24	24.45	26.22	25.48	26.11	29.98	29.2674	32.02
40	16.2	23.12	25.40	24.51	24.40	28.57	28.1822	30.39
50	13.66	22.08	24.58	23.65	23.36	26.05	27.034	28.89

V. CONCLUSION

In this paper impulse noise reduction techniques were compared by using PSNR value .The experimental results show that Modified Decision Based Symmetrical Trimmed Adaptive Median Filter performed well than the other methods.

REFERENCES

- [1] Sanparith Marukatat, "Image enhancement using local intensity distribution equalization", EURASIP Journal on Image and Video Processing, pp. 1-18, 2015.
- [2] V.Murugan, T.Avudaiappan and Dr.R.Balasubramanian, "A Comparative Analysis of Impulse Noise Removal Techniques on Gray Scale images", International Journal of Signal Processing (IJSIP), ISSN: 2005-4254, Volume 7, pp. 239-248, 2014.
- [3] Christo Ananth, Vivek, Selvakumar.S, Sakthi Kannan.S., "Sankara Narayanan.D, "Impulse Noise Removal Using Improved Particle Swarm Optimization", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Volume 3, pp. 360-370, 2014.
- [4] Faruk Ahmed and Swagatam Das, "Removal of High Density Salt-and- Pepper Noise in Images with an Iterative Adaptive Fuzzy Filter using alpha-trimmed Mean", IEEE, pp 1-7,2013.
- [5] Madhu S.Nair, P.M Ameera Mol, "Direction based adaptive weighted switching median filter for removing high density impulse noise," Computer and Electrical Engineering (ELSEVIER), pp.663-689, 2013.
- [6] Rafał Petryniak, "Edge Preserving Techniques in Image Noise Removal Process," Technical Transactions (Mechanics), pp. 301-307, 2013.
- [7] Aswini Kumar Samnantaray, Priyadarshi Kanungo, "First Order Neighborhood Decision Based Median Filter," IEEE, pp785-789, 2012.
- [8] Muhammad Mizanur Rahman, M. Abdullah-Al-Wadud and Chrysanthe Preza, "A Decision-Based Filter For Removing Salt-and-Pepper Noise," IEEE, pp.1-5, 2012.
- [9] T.Veerakumar, S.Esakkirajan and Ila Vennila, "Salt and Pepper Noise Removal in Video using Adaptive Decision Based Median filter", IEEE, pp.87-90, 2011.
- [10] S. Esakkirajan, T. Veerakumar, Adabala N. Subramanyam, and C. H. PremChand, "Impulse Noise Filtering Using Robust Pixel-Wise S-Estimate of Variance," EURASIP Journal on Advance in Signal Processing, Volume 2010, pp.1-10,2011.











45.98



IMPACT FACTOR: 7.129







INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 🕓 (24*7 Support on Whatsapp)