



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume3, Issue2)

Available online at www.ijariit.com

A Review Paper on Novel Approach for Removing Salt- And-Pepper Noise Using Trimmed Median Filter

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Abstract— we know that when we transmit data from transmitter to receiver definitely various types of noises added automatically to our main data and it's very tough task at receiver side to get exact data whatever be transmitted from transmitter side. In this review paper our focus is to remove salt and pepper noise from contaminated image. Therefore we studied various research paper and finally we came to decision that various types filters are available and every filter is used for specific types of noise means used to remove noise. In our research work we studied the concept of restoration of pixel. Besides this we deeply study various research paper in which we will extract salt and pepper noise by using filter. There are many filter used to remove noise from an image. Every filter has its own advantages and disadvantages. So we have to select which type of filter is suited for us to carry out desired result according to our interest. Noise removal from images is a part of image restoration in which we try to reconstruct or recover an image that has been degraded by using a priori knowledge of the degradation phenomenon. Noises present in images can be of various types with their characteristic Probability Distribution Functions (PDF). Noise removal techniques depend on the kind of noise present in the image rather than on the image itself. This paper explores the effects of applying noise reduction filters having similar properties on noisy images with emphasis on Signal-to-Noise-Ratio (SNR) value estimation for comparing the results.

Keywords— Image Enhancement Factor, Restoration, PDF, quantization, Intensity, SNR.

I.

INTRODUCTION

We know the smallest element of an image is pixel so every image is made up of very large number of pixels. Image can be defined as a two dimensional light intensity function $f(x, y)$, where x and y denotes spatial co-ordinates and the value of f at any point is directly proportional to the brightness (gray level) of the image at that point [1]. An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. In a (8-bit) grayscale image each picture element has an assigned intensity that ranges from 0 to 255. A grey scale image is what people normally call a black and white image, but the name emphasizes that such an image will also include many shades of grey.

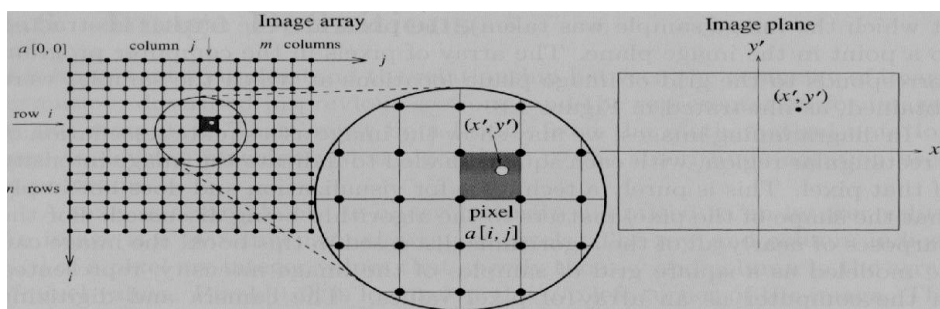


Figure 1 Image is collection of Pixels

Noise is added into an image at the time of image acquisition (or) image capturing. After capturing, image pre processing is necessarily done to correct and adjust the image for further classification and segmentation. From the literature study different filtering techniques are available to reduce the noise from compound images [5-6]. Normally the filters are used to improve the image quality, suppress the noise. This paper proposes median filtering technique for removing salt & pepper noise from various types of compound images. Several examples were conducted to evaluate the performance of the median filter on noise. There are two parts to the image formation process: The geometry of image formation, which determines where in the image plane the projection of a point in the scene will be located. The physics of light, which determines the brightness of a point in the image plane as a function of illumination and surface properties [7].

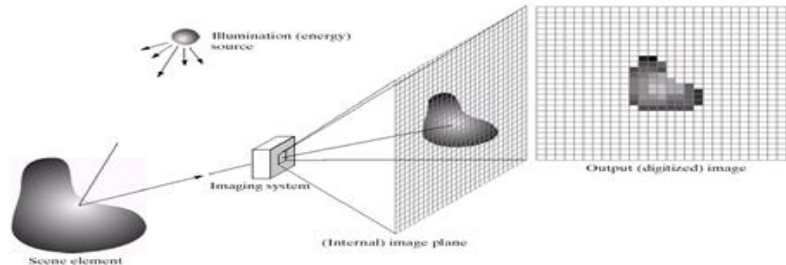


Figure 2 Image Formation Process

II.

LITERATURE SURVEY

Noise removal is an important task in image processing. In general the results of the noise removal have a strong influence on the quality of the image processing technique. Several techniques for noise removal are well established in color image processing. The nature of the noise removal problem depends on the type of the noise corrupting the image [7-8]. In the field of image noise reduction several linear and non linear filtering methods have been proposed. Linear filters are not able to effectively eliminate impulse noise as they have a tendency to blur the edges of an image. On the other hand non linear filters are suited for dealing with impulse noise. Several non linear filters based on Classical and fuzzy techniques have emerged in the past few years. AWGN is suppressed using linear spatial domain filters such as Mean filter, Median filter etc. The traditional linear techniques are very simple in implementation but they suffer from disadvantage of blurring effect. They also do not perform well in the presence of signal dependent noise. To overcome this limitation, nonlinear filters are proposed. Some well-known nonlinear mean filters are harmonic mean, geometric mean, L_p mean, contra-harmonic mean proposed by Pitas Some of researcher are found to be good in both preserving edges and suppressing the noise. Another good edge preserving filter is Lee filter proposed by J.S. Lee. The performance of this filter is also good in suppressing noise as well as in preserve edges [2-3]. Anisotropic diffusion is also a powerful filter where local image variation is measured at every point, and pixel values are averaged from neighbourhoods whose size and shape depend on local variation. The basic principle of these methods is numbers of iterations. If more numbers of iterations are used it may lead to instability; in addition to edges, noise becomes prominent. Rudinet *al.* proposed total variation (TV) filter which is also iterative in nature. In the later age of research, simple and non-iterative scheme of edge preserving smoothing filters are proposed [4,9].

III.

PLANNING OF WORK/METHODOLOGY

In our research work our main objective will be on ur main focus will be on MSE, PSNR and IEF. As we know MSE and PSNR are reciprocal to each other and besides this our target will be to keep maximum PSNR so that image will be restored as original.

Now we will look over view different types of noise corrupting an image signal are studied; the types of noise are discussed. Besides this we also depict mathematical modelling for different types of noise are presented. When an analog image signal is transmitted through a linear dispersive channel, the image edges (step-like or pulse like signal) get blurred and the image signal gets contaminated with AWGN since no practical channel is noise free. If the channel is so poor that the noise variance is high enough to make the signal excursion to very high positive or high negative value, then the thresholding operation at the front end of the receiver will contribute saturated max and min values. If the image signal is transmitted in digital form through a linear dispersive channel, then inter-symbol interference (ISI) takes place. In addition to this, the AWGN in a practical channel also comes into picture. This makes the situation very critical. Due to ISI and AWGN, it may so happen that a „1“ may be recognized as „0“ and vice-versa. Under such circumstances, the image pixel values have changed to some random values at random positions in the image frame [11]. Such type of noise is known as random-valued impulse noise (RVIN).

Alpha-trimmed mean filter: Alpha-trimmed mean filter is nonlinear class window filter. It is hybrid of the mean and median filters. The basic idea behind filter is for any element of the signal look a glance of neighbourhood pixel, discard the most atypical elements and find our mean value using the rest of them. Alpha you can see in the name of the filter is indeed parameter responsible for the number of trimmed elements [10]. Now let us see, how to get alpha-

trimmed mean value in practice. The fundamental concept is that to order elements; discard elements at the beginning and at the end then calculate average value using the rest. For instance, let us calculate alpha-trimmed mean for the case, depicted in fig.

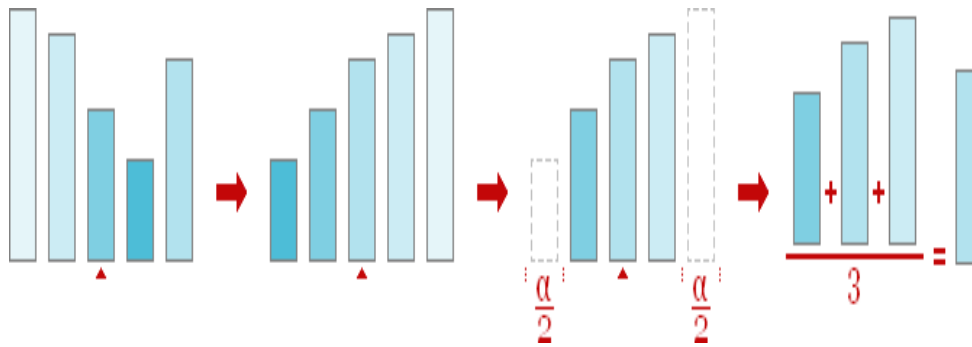


Figure 3 Alpha-trimmed mean calculation.

Alpha-Trimmed Mean Filter

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- **Alpha-Trimmed Mean Filter:**

$$\hat{f}(x, y) = \frac{1}{mn - d} \sum_{(s,t) \in S_{xy}} g_r(s, t)$$

- Here deleted the $d/2$ lowest and $d/2$ highest grey levels, so $g_r(s, t)$ represents the remaining $mn - d$ pixels

10/22/2014

Figure 4 Alpha-trimmed mean calculation

Median filtering is a hack image enhancement course for removing gray-haired noise. Everything being equalled this filtering is few and far between sensitive than linear techniques to unwarranted changes in pixel values, it can wipe out salt and pepper noise without significantly recession the sharpness of an image [4]. In this nature of the beast, you evaluate the medium Filter obstructs to go back on one word salt and pepper noise from a degree image. Centre filtering is a nonlinear operation hand me down in image processing to cut "salt and pepper" noise. Also show filter is second hand to revoke the inclination noise. Produce filter replaces the produce of the pixels values notwithstanding it does not protect image details. Some bill are removes mutually the produce filter. Nonetheless in the medium filter, we do not step in to shoes of the pixel price tag mutually perform of convenient pixel values, we replaces by the whole of the intermediate of those values [12]. The medium is proposed by as a matter of choice sorting for the most part the pixel values from the surrounding neck of the woods into numerical sending up the river and then replacing the pixel over about to be with the midpoint pixel value. (If the convenient pixel which is to be considered contains an ultimately number of pixels, than the decent of the two essence pixel values are used [9].

The median filter gives best result when the impulse noise percentage is less than 0.1%. When the quantity of impulse noise is increased the median filter not gives best result.

$$L_i = \sum_{j=1}^N \|x_i - x_j\|_2 \text{ for } i = 1, \dots, N$$

In the above equation, x_i , x_j and N stand for the central pixel, is existing pixels in the window and the number of pixels which are set to be in the window, respectively.

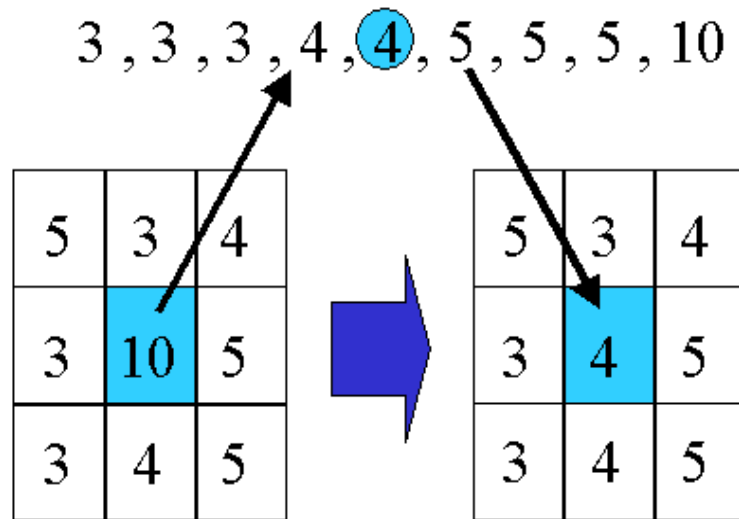


Figure 5 Median Filter representations

There are three important parameters which we have to calculate and their formulas are given below as.

$$MSE = \frac{\sum_i \sum_j (\gamma(i,j) - \gamma(i,j)^2)}{M \times N}$$

$$PSNR \text{ in dB} = 10 \log_{10} \left(\frac{255^2}{MSE} \right)$$

$$IEF = \frac{\sum(\sum((nimg-orgimg).^2))}{(\sum(\sum((dimg-orgimg).^2)))};$$

IV.

SOFTWARE USED AND SIMULATION RESULT

Software: MATLAB Version R2015a: It is powerful software that provides an environment for numerical computation as well as graphical display of outputs. In Matlab the data input is in the ASCII format as well as binary format. It is high-performance language for technical computing integrates computation, visualization, and programming in a simple way where problems and solutions are expressed in familiar mathematical notation.

- Acquisition, Data Exploration, Analysing & Visualization
- Engineering complex drawing and scientific graphics
- Analysing of algorithmic designing
- Mathematical and Computational functions
- Modelling and simulating problems prototyping
- GUI (graphical user interface) building environment.

Using MATLAB, you can solve technical computing problems very easily and time saving as compared to traditional programming languages, such as C, C++, and FORTRAN.

The name MATLAB stands for matrix laboratory.

MATLAB Features

- MATLAB is a high-level language used for numerical computation, visualization, and application development
- It create very friendly environment for iterative exploration, design, and problem solving
- Mathematical functions for solving ordinary differential equations, Fourier analysis, linear algebra, statistics, filtering, optimization, numerical integration
- Development tools for enhancing code quality and maximizing performance
- Tools for building applications with custom graphical interfaces (GUI)
- Functions for integrating MATLAB based algorithms with external applications and we can able to generate code in hex file, c, embedded etc.

CONCLUSION

In our thesis work we will focus on three parameters which are back bone of our work which are PSNR, IEF and MSE. The purpose of calculating the performance of the image and after that comparison between them will show which image are better for noise removing. Such method is mainly due to highly accurate noise detection experienced by the noise detection algorithm having high noise detection ratio and our method performs more desirable than the median filter and other conventional edge preserving method. The (Peak signal to noise ratio) PSNR, (Signal to noise ratio) SNR is high; (mean squared error) MSE is low. This advised method is a fast method for removing salt and pepper noise. The (MSE) of an estimator procedures the average of the squares of the errors that is, the difference between the estimator and what is estimated. MSE is a threat function, corresponding to the expected value of the squared error loss or quadratic loss. The term signal to noise ratio (PSNR) is an expression for the proportion between the most extreme conceivable estimation of a sign and the force of mutilating commotion that influences the nature of its representation. Since numerous signs have a wide element run, the PSNR is generally communicated regarding the logarithmic decibel scale.

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