International Journal For Technological Research In Engineering
Volume 5, Issue 9, May-2018 ISSN (Online): 2347 - 4718

# A NOVEL METHOD TO REMOVE OF IMPULSE NOISE FROM IMAGES

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***Abstract: The process of getting original form of image from its degraded image is known as restoration process. Image restoration mainly used to remove the degradation in an image to get a better image. The unwanted signal is called noise. The noise is due to clicking instrument, recording systems and transmission medium etc. It is the noise which degrades the quality of an original image to the poor quality. There are various types of noises such as salt and pepper noise(impulse noise), Gaussian noise etc. During image acquisition process degradation occurs. The degradation process first determine the type of noise, and then apply the inverse process to recover the corrupted image.***

***Keywords: DIP, Salt-and-pepper noise ,image restoration , Median filter***

## I. INTRODUCTION

Digital image processing orginate with refines of digital images through a digital computer. It is a subfield of signals and systems but concentration particularly on images. The input of DIP system is a digital image and well organized algorithm is use to process that image,and gives an image as an output. The most common example is Adobe Photoshop.

How it works.

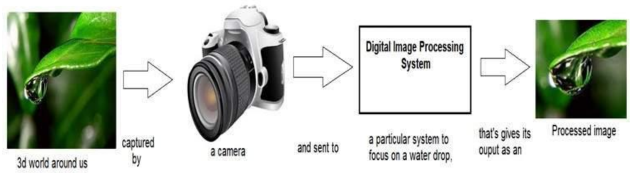
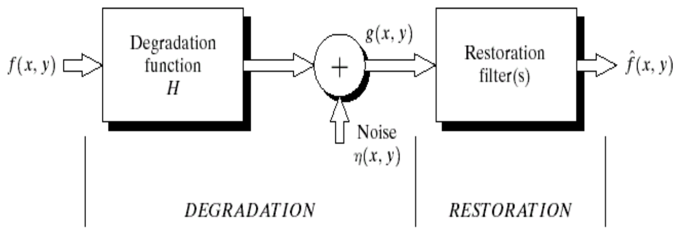



Image restoration process

Due to defect in the imaging and capturing process, however, the recorded image always represents a degraded version of the original scene .There exists a huge range of different degradations, which should be taken into account, for example noise, geometrical degradations, illumination and color imperfections and blur. Reconstruction or estimation of the uncorrupted image is concerned with the image restoration. Image Restoration refers to a group of methods or techniques that aim to remove or reduce the deterioration that have occurred while the digital image was being obtained.




Impulse (salt-and-pepper) Noise

It is also called data drop noise because statistically its drop the original data values. The salt noise means scattering of white dots in the image and Pepper noise is scattering of black dots in the image

The PDF of impulse noise is given by

$$p(z)=\begin{cases} Pa & for\ z=a \\ Pb & for\ z=b \\ 0 & otherwise \end{cases}$$

If either Pa=0 or Pb=0 => Unipolar impulse noise

If either Pa nearly equal Pb and Pb not equal to Zero then bipolar impulse noise or salt-and-pepper noise. Normally a=0 (black) and b=255 (white).

PSNR is the the ratio between the maximum power of the signal and the power of noise. It is an engineering term that affects the fidelity of its representation. Signals have a very wide vigorous range, PSNR is usually defined in terms of the logarithmic decibel scale. Higher the PSNR, the better the quality of the compressed ,or reconstructed image. PSNR can be defined as a mean squared error (*MSE*). The MSE is the cumulative squared error between the compressed & the original image and quantifies the average of squares of the “errors” whereas PSNR measure the peak error. The lower the value of MSE the lower the error.

## II. LITERATURE SURVEY

This section covers the literature survey of the work of the paper :

Zayed M.Ramadan [1] introduces a method for elimination of salt-and-pepper noise from images. The method consists of two step: detection and filtering. In the detection step, to be considered the pixel noisy two conditions must be satisfied. The first condition is based on complication of the corrupted image with four difficult kernels and the second depends on the pixel under consideration in the sliding window and its neighborhood. In the filtering step, the common median filtering is used except that only pixels that are considered noise-free in the sliding window of the detection step are included in the calculations of the median value that replaces the infected pixel value. Small size of sliding windows and wide range of noise thickness are used in this paper.Tzu-chao lin and pao-ta yu [5] introduces a novel decision-based filter (multiple thresholds switching filter) which is use to restore images infected by salt-pepper noise. These MTS filter is based on a detection-estimation strategy. The impulse detection algorithm is used before the filtering process, and therefore only the noise-infected pixels are replaced with the estimated central noise-free ordered mean value in the current filter window. The new impulse detector in the filter window, which uses musltiple edges with multiple neighborhood information of the signal, is very precise, while keep away from an extreme increase in computational problem. Impulse noise can be prevented from those image which not contain dirty fine details and edges by using well-accepted decision-based methods and extensive experimental results demonstrate that our scheme performs significantly better than many existing. Madhu S. Nair, K. Revathy, and Rao Tatavarti [7] An improved decision-based algorithm for the restoration of gray-scale and color images that are highly infected by Salt-and-Pepper noise, is intended in this paper which efficiently removes the salt and pepper noise while maintaining the details. The algorithm apply previously processed neighboring pixel values to get better image. These algorithm is faster and also yields better result than a Standard Median Filter (SMF), Adaptive Median Filters (AMF), Cascade and Recursive non-linear filters. Sukhwinder Singh , Dr. Neelam Rup Prakash [8] proposed to locate the noisy pixels in image infected with salt & pepper noise they introduced a ROAD(Rank Order Absolute Difference) statistics . ROAD statistics values quantify how different in power the particular pixels are from their most similar neighbours. After detected the existence of impulse noise, adaptive window filtering concept is used to filter the salt & pepper noise. At the end, to check the filtering performance of the proposed filter; various tests were conducted by taking various salt & pepper noise corrupted gray scale images as test images. Abhishek R , Srinivas N [9] proposed that the Median filters are eliminate destroyed signal and unwanted signals without affecting the corners. In low densities median filter are operates but in higher densities it not operates because at higher densities the images are blurred. The infected pixel are accepted and uninfected pixels are leaves by filtering. Median filter is applied to image unconditionally for alert the strength of eliminate the noisy signal from image then the results between the infected and uninfected pixels are earlier to applying nonlinear filtering is highly responsible in images. The process of "Adaptive Median filter" is to find the noisy images or pixels then median filter is use to eliminate the noisy pixels and replace them at same position, where the remaining are same. A low level for removal of noisy pixels the filter which is best is adaptive median filter. But at high level noise it can provide a large Window size which is not to fit the pixel. The Adaptive median filter is also called as "switching" and "decision based" system.

## III. PROPOSED WORK

In our proposed work we take an input two dimensional image. Which have 30% of salt and pepper noise then we try to reduce the salt and pepper noise from images. For this we have to find the value of pixel of an image. Then we observe that if the pixel value is 0 or 255 then the pixel is noisy (salt and pepper) and when the value of pixel is greater than 0 and less than 255 then we use masking operation to reduce noise.If the masking value is non zero then we find length of matrix.

Let suppose we take array of size 3*3.Array size can vary according to requirement. Elements of these array is g[1],g[2],g[3],g[4],g[5],g[6],g[7],g[8],g[9]. Now we take first 4 elements of these array on which we apply interpolation. so we collect the non noisy in array and calculate its length. If the length of the array is greater than equal to 4 then we assume that we have atleast 4 non noisy pixel available to use in the interpolation. Therefore we can use the order 3 equation(i.e. eq. (1)) i.e. in this equation the value of i ranges from 0 to 3 so then we multiply the element(g[1],g[2],g[3],g[4]) with 4 part .If the condition is not so then 3 other possible case be there. Array could have 3 non noisy pixel, 2 non noisy pixel ,1 non noisy pixel and may non. Then we will choose the order of eq. accordingly i.e. when n would be 2 then we multiply the element (g[1],g[2],g[3]) with 3 part in eq.(2) and when n would be 1then we multiply the element (g[1],g[2]) with 2 part in eq.(1).

CASE 1: If length is greater then equal to 4 then we apply interpolation of 4 degree.

$$\sum_{i=0}^{n} C_i^n t^i (1-t)^{(n-i)}$$

Here n=3

Y(i,j) = g[1]* $C_0^3 t^0 (1-t)^3 + g[2] * C_1^3\, t^1 (1-t)^2$ +g[3] * $C_2^3\, t^2 (1-t)^1$ +g[4]* $C_3^3\, t^3 (1-t)^0$ ………. …..eq. (1).

CASE 2: If length is less then 4.

2.1 If length is equal to 3 then we apply interpolation of 3 degree.

$$\sum_{i=0}^{n} C_i^n t^i (1-t)^{(n-i)}$$

Here n=2

Y(i,j) $= g[1] * C_0^2 t^0 (1-t)^2 + g[2] * \ C_1^2\, t^1 (1-t)^1$ +g[3]* $C_2^2\, t^2 (1-t)^0$

.

..……..eq.(2)

2.2 If length is equal to 2 then we apply interpolation of 2 degree.

$$\sum_{i=0}^{n} C_i^n t^i (1-t)^{(n-i)}$$

Here n=1

Y(i,j) $= g[1] * C_0^1 t^0 (1-t)^1 + g[2] * \ C_1^1\, t^1 (1-t)^0$ ……..eq.(3)

2.3 If length is equal to 1 then we will replace only non noisy value in array

2.4 If length is equal to 0 then we will keep the current value

ALGORITHM TO REDUCE IMPLUSE NOISE FROM IMAGES

Input: Let X be the image with impulse noise
X(i,j) <- Input image of size M*N
For all (X(i,j))
S(x,y) <- Kernel of size m*n
a[] <- S(x,y) //all the pixel in window of size m*n
if (a(x,y)<=255 || a(x,y)>=0)
2.3.1 g[] <- a(x,y) // g be the vector
2.4 l <- |g| // |g| be the length of array
2.5 if ( l >= 4 )
2.5.1 Y(i,j) <- g[1]* $C_0^3 t^0 (1-t)^3 + g[2] * C_1^3 t^1 (1-t)^2$ +g[3] $*C_2^3 t^2(1-t)^1$ +g[4]* $C_3^3 t^3(1-t)^0$
2.6 if ( l < 4 )
2.6.1 if( l == 3)
2.6.1.1 Y(i,j) <- $g[1] * C_0^2 t^0 (1-t)^2 + g[2] * C_1^2 t^1 (1-t)^1$ +g[3]* $C_2^2 t^2(1-t)^0$
2.6.2 if ( l ==2 )
2.6.2.1 Y(i,j) <- $g[1] * C_0^1 t^0 (1-t)^1 + g[2] * C_1^1 t^1 (1-t)^0$
2.6.3 if ( l ==1 ) then we will replace only non noisy value in array
2.6.4 if ( l == 0 ) then we will keep the current value
3. Y( i,j ) <- output image or restored image have better quality

## IV. RESULTS

When Noise added in original image is 30% the window size is 3 then restored the noisy image.


Fig: (a) Lenna original image (b) Noisy image(30% noise added) (c) Restored image(PSNR=33.0972 db)

When Noise added in original image is 50% and the window size is 3 then restored the noisy image.

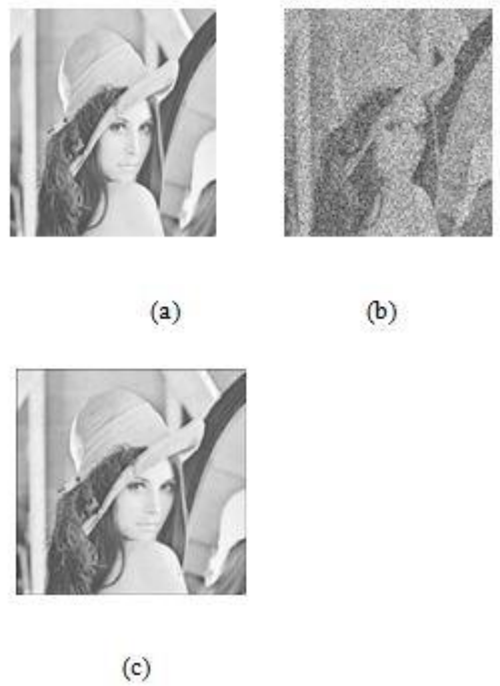



Fig: (a) Lenna original image (b) Noisy image(50% noise added) (c) Restored image(PSNR=29.0388 db)

When Noise added in original image is 70% and the window size is 3 then restored the noisy image.

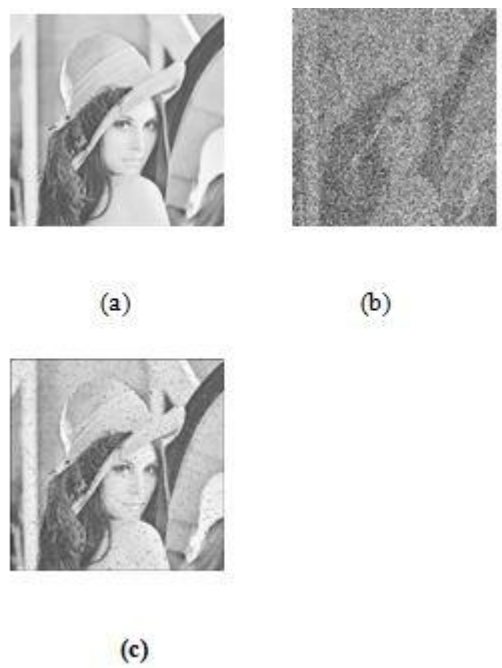



Fig: (a) Lenna original image (b) Noisy image(70% noise added) (c) Restored image(PSNR=18.5819 db)

When Noise added in original image is 30% and the window size is 5 then restored the noisy image.

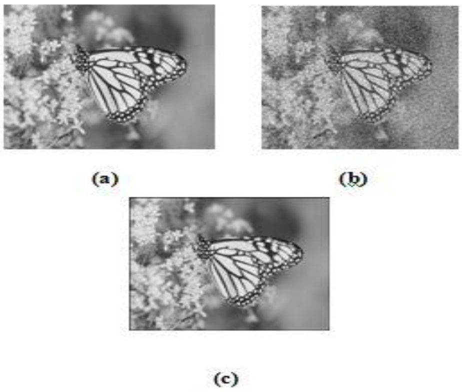



Fig: (a) Monarch original image (b) Noisy image(30% noise added) (c) Restored image(PSNR=21.5570 db)

When Noise added in original image is 50% and the window size is 5 then restored the noisy image.

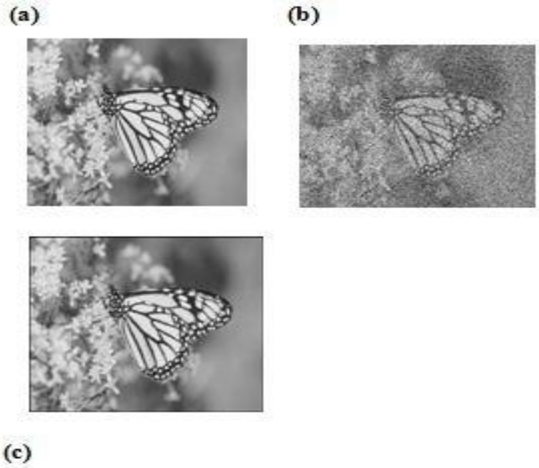



Fig: (a) Monarch original image (b) Noisy image(50% noise added) (c) Restored image(PSNR=22.4023 db)

When Noise added in original image is 70% and the window size is 5 then restored the noisy image.

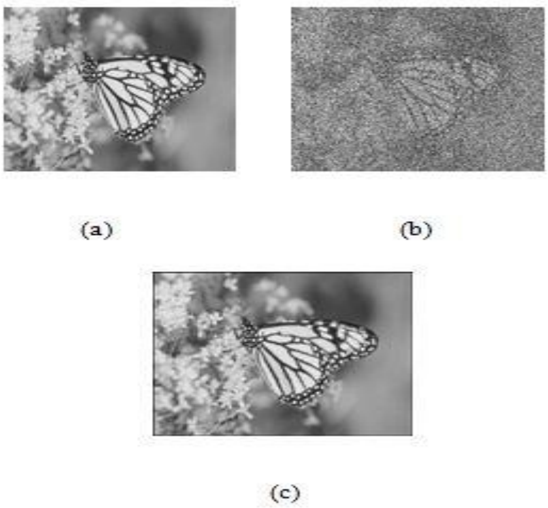



Fig: (a) Monarch original image (b) Noisy image(70% noise added) (c) Restored image(PSNR=23.9066 db)

When Noise added in original image is 30% and the window size is 7 then restored the noisy image.

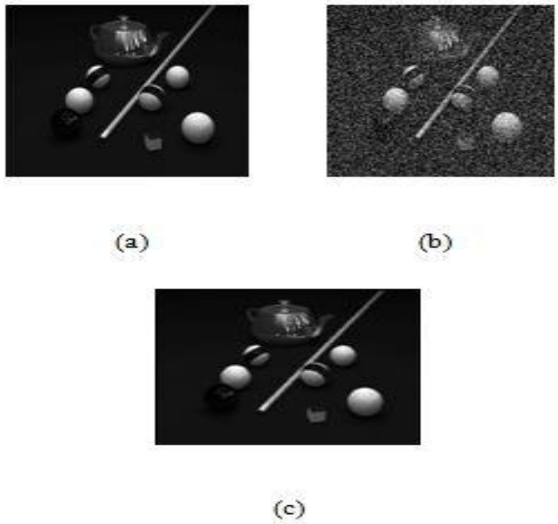



Fig: (a) Ball original image (b) Noisy image(30% noise added) (c) Restored image(PSNR=22.5630 db)

When Noise added in original image is 50% and the window size is 7 then restored the noisy image.

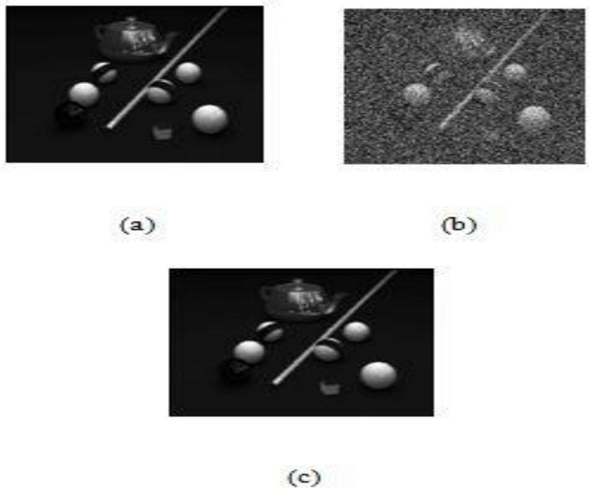



Fig: (a) Ball original image (b) Noisy image(50% noise added) (c) Restored image(PSNR=22.9074 db)

When Noise added in original image is 70% and the window size is 7 then restored the noisy image.

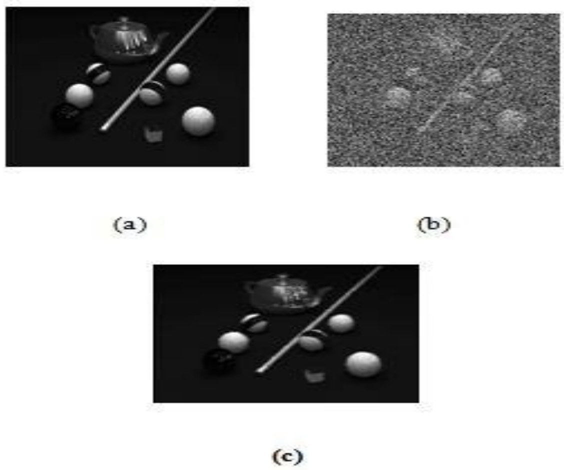



Fig: (a) Ball original image (b) Noisy image(70% noise added) (c) Restored image(PSNR=23.7036 db)

## V. CONCLUSION

In this thesis, we proposed an algorithm for reducing impulse noise of images by using interpolation methods. The proposed algorithm not only reduce noise from images but also maintain the high quality of images with same information present in the objects of image. And we apply this algorithm on different images and compare all the results with each other. From the different results produce on different images we can infer that our algorithm works efficiently and effectively in a good manner. Image restoration and filtering is one of the prime areas of image processing and its objective to recover the images from degraded observations. The restored image which is produce have low value of noise and also improve the PSNR value. Techniques can be developed to estimate the peak signal to noise more accurately.

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