IMAGE DENOISING USING FIRST ORDER NEIGHBORHOOD MEAN FILTER

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Abstract— **In digital processing of image, image de-noising is to estimate a clean version of a given noisy image, utilizing prior knowledge of the statistics of natural images. The challenge of evaluating such limits is that constructing proper models of natural image statistics are a long standing and yet unsolved problem. To resolve this problem, this work aims to *presents* the new proposed algorithm to deal with the problems, namely, poor image enhancement at high noise density, which is frequently enhanced in the Improved Mean filter (IMF). In this paper Improved Mean Filtering is used for enhancing the peak signal to noise ratio (PSNR) and image enhancement factor (IEF) both. The performances of proposed 'Improved Mean Filter' (IMF) are quantitatively vies as well as the visual and human perception vies shows better result in both conditions as compared to other existing filters.**

Keywords— **PSNR, IEF, FONMF, RGB, HSI, CMY etc**

I. INTRODUCTION

Digital images play an important role both in daily life applications such as satellite television, magnetic resonance imaging, computer tomography as well as in areas of research and technology such as geographical information systems and astronomy. Data sets collected by image sensors are generally contaminated by noise. Imperfect instruments problems with the data acquisition process, and interfering with natural phenomena can all degrade the data of interest. Furthermore, noise can be introduced by transmission errors and compression. Thus, de-noising is often a necessary and the first step to be taken before the image data is analyzed. It is necessary to apply an efficient de-noising technique to compensate for such data corruption.

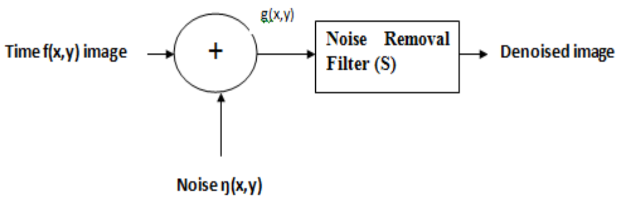


Figure 1: Denoising Model

II IMAGE DENOISING

Image de-noising is an important image processing task, both as a process itself, and as a component in other processes. There are many ways to de-noise an image or a set of data exists. The main properties of a good image de-noising model are that it will remove noise while preserving edges. The de-noising method aims to attenuate noise through two phases namely:-

1. Noise detection
2. Noise removal

The noise detection is a process in which, we check the image's pixel is noise or noise free. After this, noise removal replaces the corrupted pixels of the input image by the appropriate values which are computed from the specified values.

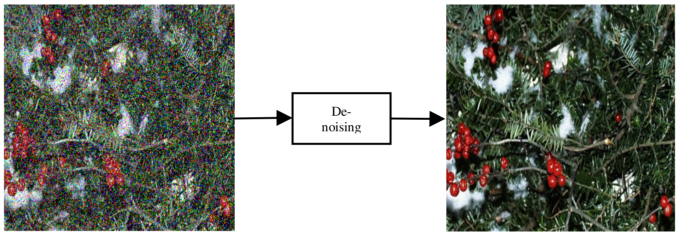


Figure 2: Image Denoising

The objective of image de-noising is to estimate a clean version of a given noisy image, utilizing prior knowledge of the statistics of natural images. The problem has been studied intensively with considerable progress made.

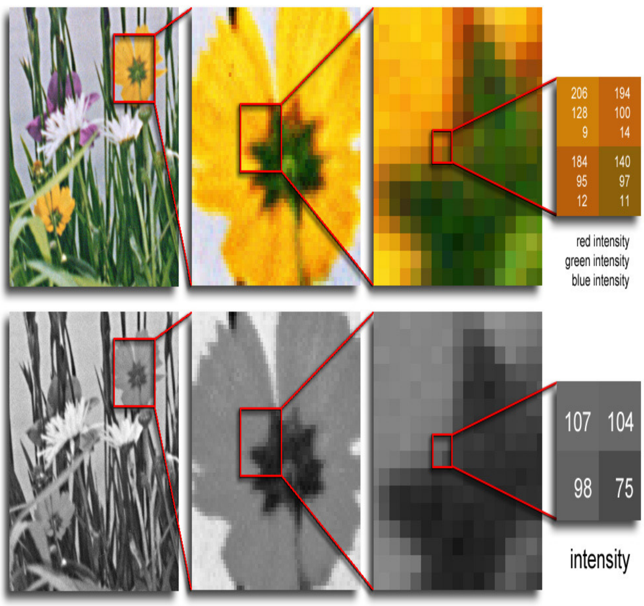


Figure 3: Pixel information

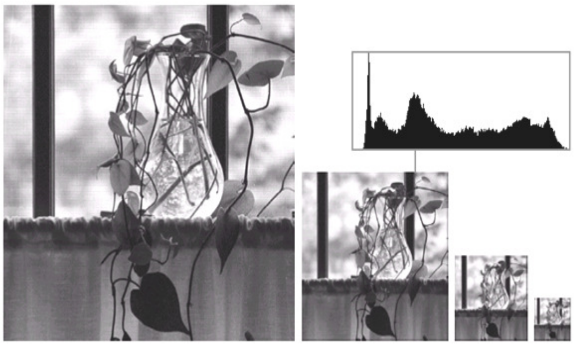
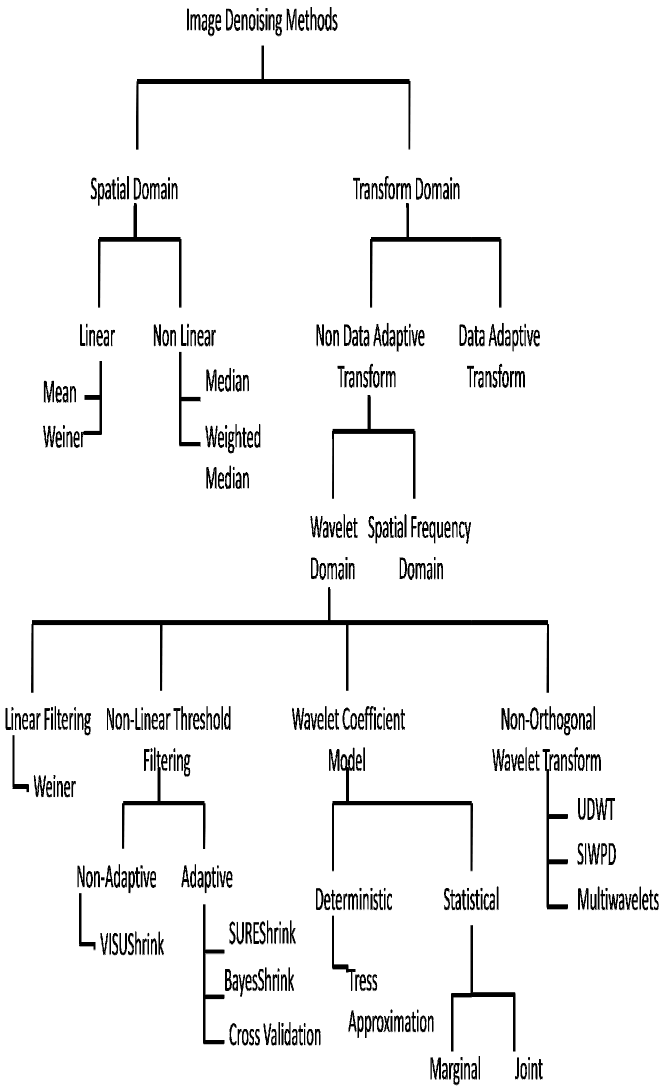


Figure 4: Resolution Scaling

II.I Classification of Denoising Algorithm

Denoising algorithm can be classified as:



II.II Different type of Noise

An image passes through several media and transmission channels before it reaches the processing phase. During this time, the image may be subject to interference from several Sources.

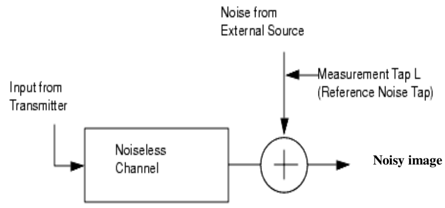
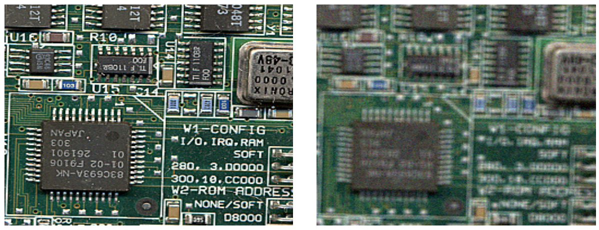


Figure 5: Noise Model

The different types of Noise are following:-

- Amplifier noise (Gaussian noise)
- Impulse noise(Salt & pepper noise)
- Shot noise (Poisson noise)
- Speckle noise
- Brownian Noise

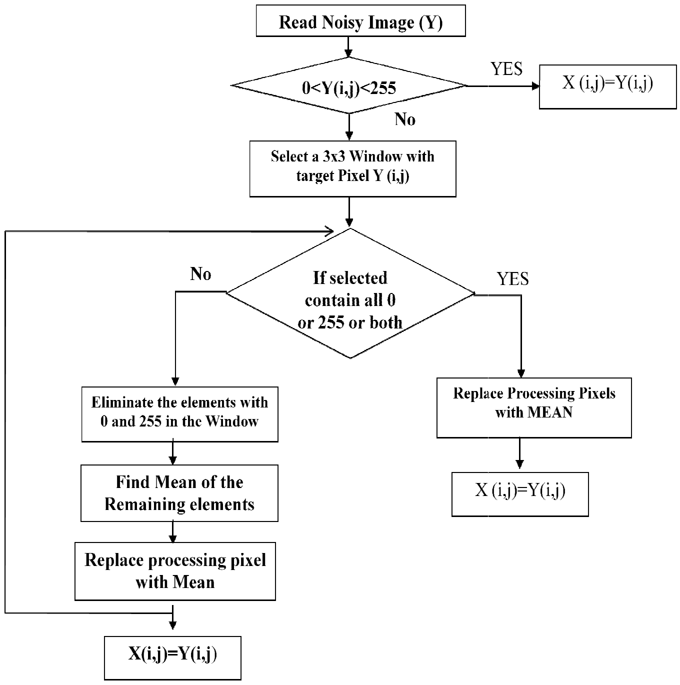


(a) (b)

Figure 6: (a) Original Image (b) Noisy Image

III FIRST ORDER NEIGHBORHOOD MEAN FILTER

The proposed noise removal using First Order Neighbourhood Mean Filter (FONMF) algorithm processes each and every pixel of an image by detecting the noisy pixel in the image. This algorithm is based on windowing technique so a least size window 3 x 3 is taken to reduce the complexity. Here the pixel of interest is the centre pixel known as processing pixel P(i, j). Processing pixel is checked whether it is noisy or noise free by verifying that the pixel lies between maximum (255) and minimum (0) gray level values. If the pixel is in between the range of gray level then the pixel is noise free otherwise the pixel is corrupted pixel and it is processed to be replaced with the noise free Pixel value. Uncorrupted pixels that lie in the range are left unchanged. In this work RGB color model is chosen to represent the color image. Noisy color images are formed by adding salt and pepper noise independently to each of these color components.



IV EXPERIMENTAL RESULTS & ANALYSIS

For simulation of proposed method we have to use MATLAB 8.0 software. To perform our new approach we have to take a 'Mandrill', 'Lena' and some other images of size 256x256 as a reference image for testing purpose. The testing images are artificially corrupted by Salt and Pepper impulse noise by using MATLAB and images are corrupted by different noise density varying from 10 to 90 %. The performance of the proposed algorithm is tested for different gray scale image.

De-noising performances are quantitatively measured by the PSNR.

$$PSNR = 10\log_{10}\frac{(255)^2}{MSE}$$

Where MSE (Mean square error) is:

$$MSE = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{Y(i,j)-\hat{Y}(i,j)\}^2}{m\ x\ n}$$

And the IEF (Image Enhancement Factor) is :

$$IEF = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\{\eta(i,j)-Y(i,j)\}^2}{\sum_{i=1}\sum_{j=1}\{\hat{Y}(i,j)-Y(i,j)\}^2}$$

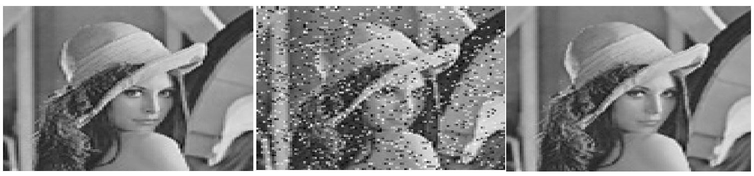


Figure 7.1: (a) Original image (b) 10% Noise density (c) Restored image

Figure 7.2: (a) Original image (b) 20% Noise density (c) Restored image

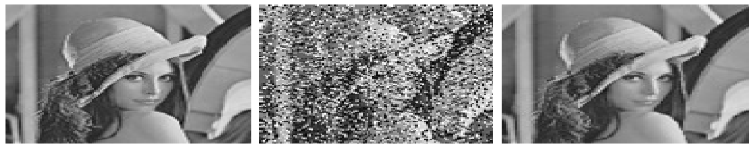


Figure 7.3: (a) Original image (b) 30% Noise density (c) Restored image

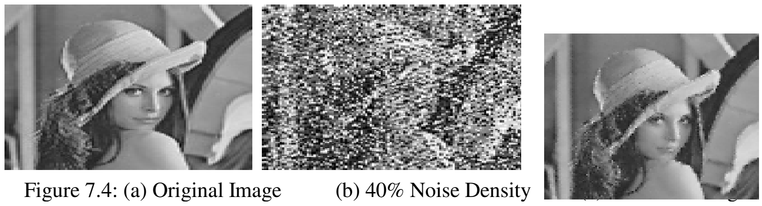


Figure 7.4: (a) Original Image (b) 40% Noise Density

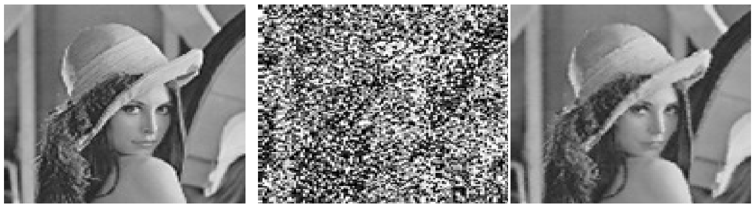


Figure 7.5: (a) Original Image (b) 50% Noise Density (c) Restored Image

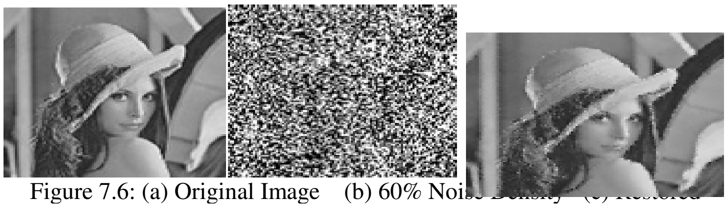


Figure 7.6: (a) Original Image (b) 60% Noise Density (c) Restored

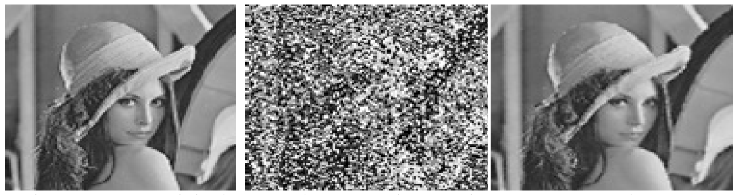


Figure 7.7: (a) Original Image (b) 70% Noise Density (c) Restored Image

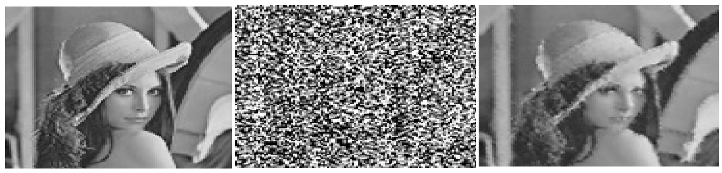


Figure 7.8: (a) Original Image (b) 80% Noise Density (c) Restored Image

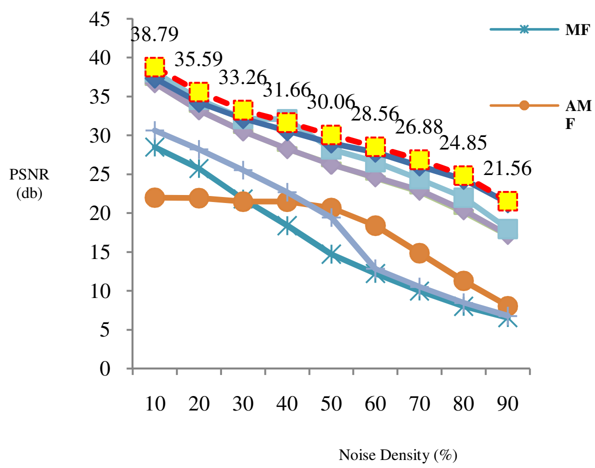


Figure 8: PSNR Vs Noise Density

Mean filtering is a simple, intuitive and easy to implement method of *smoothing* images, *i.e.* reducing the amount of intensity variation between one pixel and the next. It is often used to reduce noise in images. The idea of mean filtering is simply to replace each pixel value in an image with the mean (`average') value of its neighbors, including itself. This has the effect of eliminating pixel values which are unrepresentative of their surroundings.

V . MERITS OF PROPOSED METHOD

This method has the following advantages:

1) The mean value is reducing the blurring in restoring image as compared to other filters. Because we are not using simple mean value but use trimmed mean value which gives better results than simple mean.
2) Most of the filtering algorithms used today are not able to remove high density salt and pepper noise. By using a filtering system based on improved trimmed mean filter it is possible to remove noise efficiently with better preservation of image details.
3) It does not require to increase the size of the filtering window in other filtering techniques they are increasing the size of the filtering window. But
   if the window will process by improving mean filter it gives better result.
4) The Less complex algorithm requires a few second to proceed at lower as well high noise density level so our proposed algorithm easy to implement in industrial level.

VI CONCLUSION

The new proposed algorithm has been proposed to deal with the problems, namely, poor image enhancement at high noise density, which is frequently enhanced in the Improved Mean filter (IMF). In this paper Improved. Mean Filtering is used for enhancing the peak signal to noise ratio (PSNR) and image enhancement factor (IEF) both. The performances of proposed 'Improved Mean Filter' (IMF) are quantitatively vies as well as the visual and human perception vies shows better result in both conditions as compared to other existing filters.

Results reveal that the proposed filter exhibits better performance in comparison with MF, AMF, DBA, MDBA, MDBUTMF, MNF filters in terms of higher PSNR and IEF. Indifference to AMF and other existing algorithms, the new algorithm uses a small 3x3 window having only eight neighbors important to better edge preservation as well as more better Human & visual prescription. The New algorithm filter also shows reliable and stable performance across a different range of noise densities varying from 10% - 90%. The performance of the proposed method has been tested at low, medium and high noise densities on gray scales. Infect at high noise density levels the new proposed algorithm gives better performance as compare with other existing de-noising filters of the corrupted pixel that have higher connection.

VII FUTURE WORK

Image noise is present in most of the fields of image applications like surveillance, remote sensing, medical imaging etc. The system can be implemented on an FPGA with dedicated DSP core to speed up the de-noising process. With more memory it's possible to de-noise images of larger resolution. Edge detection can also be implemented, but with a high noise density it is difficult to detect the edges satisfactorily.

This method can have great application in the field of communication, because large amount of noise introduced during the transmission of data. With the help of trimmed mean processing we can speed up the process and reduce execution time. Because of its easy hardware implementation, this method can replace the existing de-noising methods. It can be used in GPS system as well with some modification and can give better picture quality at high noise environment.

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