Analysis of Image Denoising Techniques

[1]Seema Jain, [2]Dr. Seema Malik, [3]Rakhi, [4]Arun Pratap Singh Bharati

[1,2,3,4]Assistant Professor
Department of Electronics and Communication Engineering
HMRITM, GGSIPU, Delhi, India

***Abstract*: With the modern world being highly digitized, the use of digital cameras has also increased and the demand for high quality images has become the need of the hour. People click a variety of images in their everyday life, we come across images of good as well as poor quality. The quality of images degrades due to presence of noise. This noise may be caused by low light conditions. As a result, Image Denoising Techniques were immersed. In this paper, we will discuss about the different techniques of Image Denoising.**

***Index Terms*: Image Denoising, Spatial Filter, Wavelet Transform, DWT, LMS**

I. INTRODUCTION

Image Denoising is the method of extracting noise or distortion from the image. During the transmission of image, different types of noises are introduced such as Salt and Pepper noise, Poisson noise, Speckle noise. As a result of this, the image becomes blurred and its bandwidth is reduced [1]. Here, we will analyze the linear and non-linear techniques. Linear technique does not perform in case of Impulsive noise. Non -linear techniques are used for image restoration. Previously, we used pixel based denoising techniques but now a days wavelet-based image denoising methods are used and they have astonishing results.

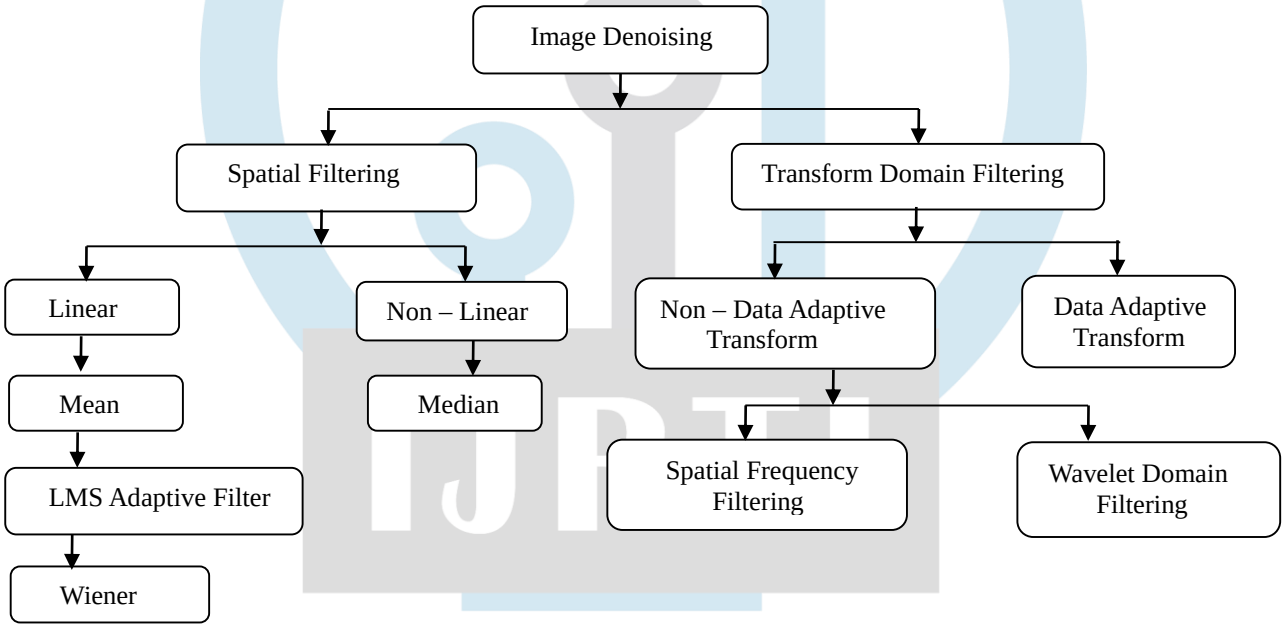

Fig.1. Flow Chart of Image Denoising

II. IMAGE DENOISING TECHNIQUES

Spatial Filtering

When an image is corrupted with salt and pepper noise, we use filtering method. Salt and pepper noise is also called as Intensity Spikes.

LINEAR FILTERS

There are different types of linear filters used in Image Denoising Technique.

Mean Filters - A mean filter [1] acts on an image to reduce the intensity variation between adjacent pixels. It replaces the center value with the average of all neighboring pixels values including itself, so it is also called average filtering. It is used on the basis

of digital convolution. These filters work on the shift-multiply -sum theory. The main demerit of the mean filter technique is that the edge preserving criteria is poor [2].

LMS Adaptive Filtering - This filter is used for the images that have sharp changes in the intensity. LMS adaptive filter repeatedly adjusts its parameter to match the image generating mechanism. The LMS adaptive filter is a combination of stationary low pass and non-stationary high pass components through the weighing function [1]. For Image Sharpening, we use linear masking and Laplacian Filter Techniques. There are some disadvantages of this method which are-
1. It enhances contract area and results in troublesome artifacts.
2. It is very sensitive to noise, to reduce the noise sensitivity issue we use non-linear filters.

Weiner Filters- To remove the noise from a corrupted image Weiner filter uses mathematical approach. In this technique, we need spectral properties of original signal and noise. To achieve this, LTI filters are used whose output will be close to the original signal [3].

NON-LINEAR FILTERS

When the noise is multiplicative and function based, we use Non –Linear filters technique. In this method, we don't need to identify the noise. In this method, median of the neighborhood pixels finds the value of an output pixel [4].

Median Filters - This technique is mostly used because of its ability to reduce random impulsive noise without blurring edges but it doesn't provide sufficient smoothing. In this method, we find the median value across the window and then replace each entry in the window with pixels Median value [5]. If the window entries are odd then median is simple to define and if entries are even, there is one possible median. Median filter is also known as Robust filter. The Median filter is much less sensitive than Mean filter. Therefore, it is capable to remove maximum values by reducing the sharpness. The disadvantage of this filter is that it is not location variant in nature. Median filter is further classified as Vector Median filter and Standard Median filter.

Transform Domain Filtering

NON –DATA ADAPTIVE TRANSFORM

Spatial Frequency Filtering

In this method, we use the Low Pass filter followed by Fast Fourier Transform. We require the cut –off frequency in this technique but it has a disadvantage that it is time consuming and it may generate artificial frequencies in the image.

Wavelet Domain Filtering

When an image is corrupted with Gaussian noise, Wavelet-based approach used. Wavelet productivity eliminates noise while protecting the signal information [5]. In this method, we use the DWT (Discrete Wavelet Transform). It concentrates the signal energy in a small number of coefficients having high Signal to Noise Ratio (SNR) while large number of coefficients have a low SNR. After removing the coefficient with low SNR, inverse DWT is used to recover the image. The main advantage of this method is that it provides time and frequency simultaneously. It characterizes the signal more efficiently than the original domain.

III.CONCLUSION

In this paper, we have discussed different techniques of Image Denoising. All techniques help to remove the interference from the image. Image Denoising plays an imperative role in visual tracking, Image registration, Image segmentation, Image restoration and remote sensing.

IV. ACKNOWLEDGEMENT

We are extremely grateful to previous works done in the field of Image Denoising. We believe that our detailed discussion of Image Denoising methods in this paper will prove fruitful and of help to the coming researches in this field.

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