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## Survey on Edge Preserving Denoising Filters

J. Mercy Jeya Rani<sup>1</sup>

M. Phil Scholar, Department of Computer Science, St. Xavier's College, Tirunelveli, India<sup>1</sup>

**ABSTRACT:** Image Enhancement is one of the challenging factors in image processing. The important role of image enhancement is to make the clear appearance of an image and provide better clarity in the image. The contrast and noise of the image depend on the environment of the particular location which means various kinds of images like medical images, satellite images, and photography images depend upon the lights of the particular place. So, it places an important role in removing noise and adding contrast (increasing in effects) to make image clear. This paper deals with the techniques in image enhancement, to remove the noise from the image so that the original quality of the image is retained.

**KEYWORDS:** Image Enhancement; Image Processing; Noise.

### I. INTRODUCTION

Image Processing strategies are playing a vital role nowadays. The main goal of an image processing is to improve the quality of the image through, familiar techniques. One of the techniques is Image Enhancement. It is a technique for upgrading the quality of an image and highlighting the hidden details in the blurred image. Also, it enhances the image to high contrast from low contrast image.

Noise is defined as the random variation of image brightness. Noise depends upon the lights and contrast of the environment where the pictures are taken. It can be classified into different valued noises such as Gaussian noise, Salt and pepper noise, Speckle noise, and Poisson noise.

The main challenging task in image enhancement is image denoising which is otherwise called noise removal. This is a task of removing a noise in a given input image through various methods. The quality of good denoising is considered as removing noises as much as possible and also preserving edges. Denoising technique can be classified into two models: Linear Model removes the noise as fast as possible. But it did not preserve edges. But nonlinear model performs both the tasks in an efficient manner.

### II. RELATED WORK

Manyu Wang and Sheng Zheng, Xiaolong Li, Xiongjie Qin [1] proposed a new image denoising method by the use of the Gaussian filter. The article describes that Gaussian filter which selects the weights by the shape of Gaussian methods. In both spatial domain and frequency domain, Gaussian filter react as an efficient low pass filter, especially for removing noise.

S. Rajeshwari, T. Sree Sharmila [2] Proposed MR brain image enhancement to improve the image quality by the use of denoising technique. The denoising image is a technique which can be processed with discrete wavelet transform. The denoising image is decomposed into four sub-bands (LL, LH, HL, HH) using interpolation based discrete wavelet transform technique. The main use of the discrete wavelet transform is to preserve the edges and to provide contour information.

Bhagirathi Halalli, Aziz Makandar [3] used Low Pass and High Pass Filters. The usage of the high pass filter in their system is to preserve the edges in the given input image. The image with preserved edges can be denoised by the low pass filter. Finally, it provides the output as a denoised image with preserve edges in image transformation.

Sylvain Paris, Pierre Kornprobst, Jack Tumblin and Fredo Durand [4] discussed that the bilateral filter is a filter that follows non-linear technique to blur the image with respective edges. This article discussed with some of the qualities of bilateral filter. They are i) It has a simple formulation. This is because it every pixel can be replaced with its



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neighbor pixels. ii) It consists of two parameters, window size, and a feature that need to be preserved. iii) It is the technique of non-iterative, which can help to perform very easily without any chain.

## III. IMAGENOISE

### A. *Gaussian Noise:*

Gaussian noise is one of the noises which occur on the image during image acquisition. Noise caused in the picture by variations in temperature during acquisition. Gaussian noise can be reduced by using a spatial filter for smoothing an image in digital image processing.

In color cameras, there is the possibility of more amplification that can be applied to blue channel than rest channels, which leads to being noise in the blue channel.

There is the advantage of Gaussian noise is, it can be used for cryptography images. While applying Gaussian noise to the image, it creates a blurred image of the given image as an output which can be kept secure from hackers.

### B. *Salt and Pepper:*

Salt and Pepper noise is an impulse type of noise. This noise occurs because of the errors during data transmission. It happens in the image due to sharpening and the sudden changes images. If the image is attacked by salt and pepper noise, then the noisy pixels attacks only, maximum and minimum values dynamically. This kind of noise is generally happened by the problems occurred in sensors or in the location during photography.

### C. *Speckle noise:*

Speckle noise is multiplicative noise. It can be calculated by the multiplication of both pixel value of an image and random value. This noise can be normally observed by radar sensing system. The waves that are emitted by sensors travel through stages and interact with the target area. By reducing the speckle noise it permits to automatic image segmentation.

### D. *Poisson noise:*

Poisson noise is also called as shot noise. This type of noise happens when a number of photons in the image that are sensed by the sensor is not sufficient to provide statistical information. It occurs when light and electric current consists of the movement of discrete packets. The magnitude of this noise can be increased by the average value of the magnitude of the current.

## IV. FILTERING TECHNIQUES

### *Bilateral Filter:*

Bilateral filter is a filter which is local and non-iterative which can be mostly used for edge-preserving. It takes the input value as a weighted sum of local neighborhood pixels. The weights value depends on spatial domain and its intensity distance. This is how the bilateral filter preserves edge from noises. Since it calculates the value of local neighborhood pixels, its formulation is very simple and done in a non-iterative manner.

The advantage of bilateral filter is simple, local and easy to implement. Bilateral filter preserves edges and smoothens image. The disadvantage is that it does not sharpen the image.

### *Gaussian Filter:*

The Gaussian filter is a filter which follows the procedure of impulse response and produces a Gaussian function which is the approximate value of the Gaussian filter. The Gaussian filter is a technique of following linear smoothing which can choose the value from the approximation value (i.e) from Gaussian functions. In both spatial and frequency domain, it reacts like an effective low pass filter to remove noises.

The Gaussian filter used for the blurring of an image. The disadvantage of the Gaussian filter is that it slows down the process and it does not preserve the edges.



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## Laplacian Filter:

Laplacian Filter is a filter which can be used to highlight the image on the rapid intensity and most commonly used for edge detection. Also, it can be used to smoothen the image with a Gaussian filter to reduce the sensitivity to noise. Basically, the input of the Laplacian filter is a single gray level image. After the complexity of its process, and also by applying filters, it produces another gray level image as an output.

Laplacian filter is used to test wider area around the pixel, and to find the edges correctly. The disadvantage is its malfunction at corners and curves.

## Non Local Mean Filter:

Non- Local Mean (NLM) is a filter in image processing which can be used for image denoising. NLM filter can be processed by calculating a mean value for all pixels in a given input image and compared to the target pixel to find the similarity of the values. NLM is an approach to calculating the intensity of the pixel from the information of the given image.

Non-local means filter is that it removes the noise and cleans the edges without losing too many fine structure and details. But as the noise increases, the performance of non-local means filter deteriorates and the denoised image suffers from blurring and loss of image details. This is because the similar local patches used to find the pixel weight contains noisy pixels.

## V. CONCLUSION

This survey paper discussed the techniques that are used in image enhancement. It contains the brief explanation about the techniques for the image denoising using filters. Some of the filters and noises are discussed in this paper. By comparing with each filter, it is concluded that bilateral filter provides a better result than the other filters.

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