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Statistical Filter for Removing Noise in Digital Image

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Abstract:- A Median filter is used for eliminating Salt & Pepper Impulse noise and Wiener filter is used for eliminating Gaussian noise. This paper presents a hybrid filter for removal of both types of noises. Two Hybrid filters are presented for eliminating Salt and Pepper noise and Gaussian noise simultaneously from a noisy image. The first filter is a combination of a variant of Median filter and Wiener filter and the second filter is a combination of a variant of Median, Inverse and Wiener filters. The experimental results show that the second filter is an efficient filter for removal of the two mixed noises in terms of retaining the fidelity of the image.

Keywords:- Image Enhancement, Median filter, Wiener filter, Gaussian Noise, Salt & Pepper Noise.

I. INTRODUCTION

Digital Image Processing refers to processing a digital image by means of a digital computer [1]. Hence, the output and input of Digital Image Processing is an image and different operations such as enhancement, restoration, segmentation, color image processing etc. constitutes the processing work. Impulse noises are usually encountered during image acquisition and transmission. The other most frequently occurring noise is the Additive Gaussian noise. Gaussian noise is a set of values taken from a zero mean Gaussian distributions which are added to each pixel values.

There are various filters which are available for removal of salt and pepper noise and Gaussian noise. But these filters do not work for eliminating both the noises simultaneously. Taking few examples, Harmonic mean filter works well for salt noise but fails for pepper noise and does well for Gaussian noise [1], Median filter performs excellently for removal of salt & pepper noise [1], Midpoint filter is good for random Gaussian noise and uniform noise [1] etc. The weiner filter uses the statistical properties of the image and can be used to restore image in the presence of blurring as well as noise. The main objective of wiener filter is to minimize mean square error.

C. Wang et.al [3] presented a novel improved median filter algorithm for the images highly corrupted with salt-and-pepper noise. The presented method is compared with three typical methods - Standard Median filter, Extremum Median filter and Adaptive Median filter, respectively. The presented method can restore images corrupted with salt-and-pepper noises and provides better visual effect of the noise restoration than the other three filters. K. Nallaperumal et. al [4] presented an adaptive switching median filter to remove salt and pepper impulse noise. The presented method yielded recognizable, patches free restoration with a little degradation in fidelity in images corrupted with higher impulse noise levels. Another filter was presented by R. H. Chan et. al [7] which is a two-phase scheme for removing salt-and-pepper impulse noise. During the first phase, an adaptive median filter is used to identify pixels which are likely to be contaminated by noise. During the second phase, the image is restored using a specialized regularization method that applies only to those selected noise candidates.

II. PROPOSED WORK

The proposed work presents two hybrid filters. The purpose of these hybrid filters is to eliminate both the salt and pepper noise and Gaussian noise simultaneously.

A. Hybrid Filter Design – I

The hybrid filter design – I consists of a variant of Median filter i.e. a combination of techniques presented in reference [4] and [12] and a wiener filter. The block diagram of hybrid filter design – I is shown below :

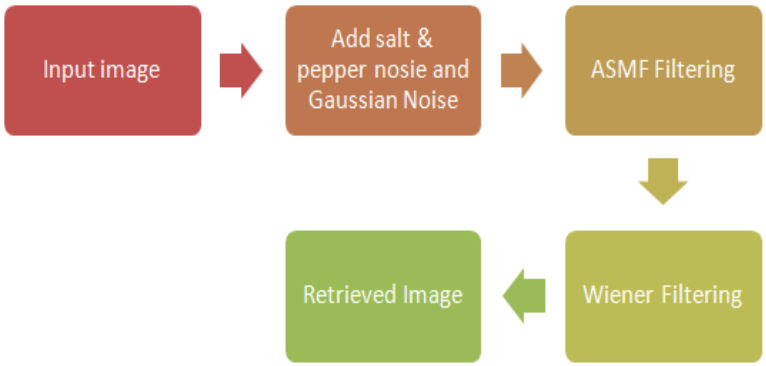

Fig. 1 Block Diagram of Hybrid Filter Design – I

An input image is taken and add salt & pepper and Gaussian noise into it. Then the noisy image is passed through the hybrid filter – I which is a combination of ASMF Filtering and Wiener Filtering. And the final image is retrieved.

B. Hybrid Filter Design – II

The hybrid filter design – II consists of a variant of Median filter i.e a combination of techniques presented in references [4] and[12] , an inverse filter and a wiener filter. The block diagram of hybrid filter deisgn – II is shown below:

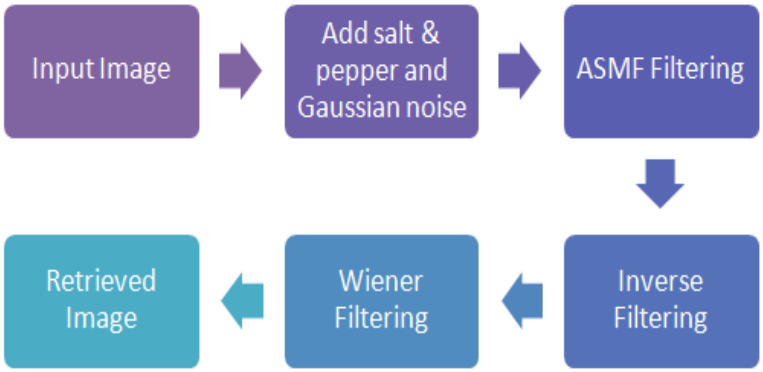

Fig. 2 Block Diagram of Hybrid Filter Design – II

An input image is taken and salt and pepper noise and Gaussian noise is added into the image. Then the noisy image passes through the hybrid filter – II which consists of varaint of Median filter, Inverser filter and Wierner filter.

III. RESULTS

For both the hybrid filters – I & II, the original image, the noise matrix image and the ASMF filtered image is same. But the final outputs are different.

A. Hybrid Fitler Design – I Results

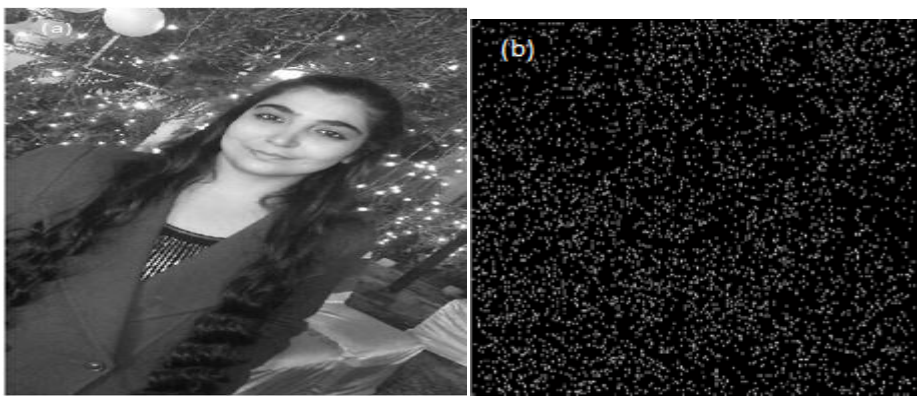

Fig. 3 (a) Original Image (b) Noise Matrix Image

Fig 3 (c) ASMF Filter (d) Wiener Filter output (e) Retrieved Image

B. Hybrid Filter Design – II Results

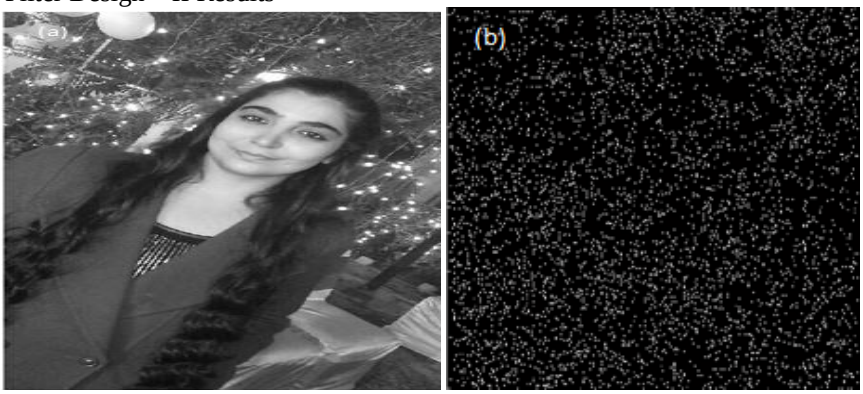

Fig. 4 (a) Original Image (b) Noise Matrix Image

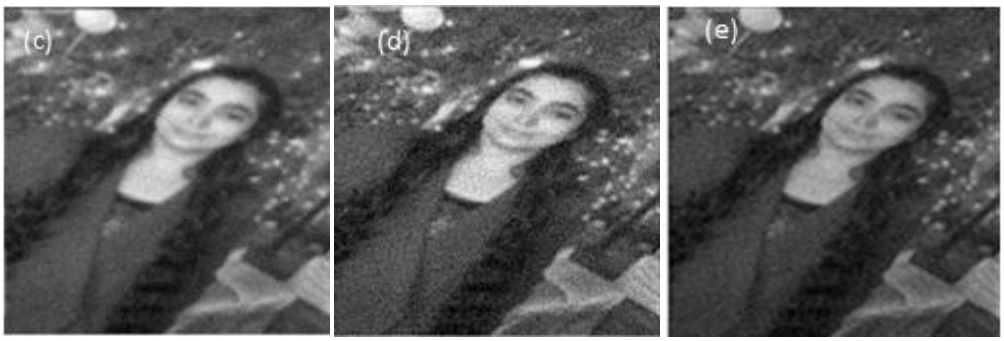

Fig 4 (c) ASMF Filter output (d) Inverse Filter output (e) Wiener Filter output

Fig. 4 (f) Retrieved Image

IV. CONCLUSION

In Field of image processing, user is the final judge. The evaluations and comparisons can be easily made through visual observations. A median filter is mostly used for eliminating salt & pepper noise and a wiener filter is used for eliminating Gaussian noise. In real time, there is mixture of noises present in the images

when they are acquired, processed or transferred. So, there is a need of a strong filter which can eliminate the mixture of noises.

The same image is passed through the two hybrid filters with same noise matrix. It is concluded that the hybrid filter design- II provides better retrieved image than the hybrid filter design – I through the visual observatoins. The quality of the retrieved image can be further improved.

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