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An Image Noise Reduction Approach with Channel and Other Noise Removal

Gursharan Kaur
Research Scholar, Sachdeva Engg. College for Girls, Gharuan, Mohali, Punjab, India
Rakesh Kumar
Dean, Department of Computer Science & Engineering,
Sachdeva Engg. College for Girls, Gharuan, Mohali, Punjab, India
Jasmine Kaur
Assistant Professor, Department of Computer Science & Engineering,
Sachdeva Engg. College for Girls, Gharuan Mohali, Punjab, India

Abstract:
A noise disturbance that occurs in the channel at the time of transmission irks viruses. For ages researchers have been proposing several techniques in order to remove the noise from the image. Image denoising is the process of recovering true image from the noisy image. At the time of such process it is difficult to reduce noise while containing the boundary of the image as noise and boundary shares same frequency i.e. high frequency. Owing to this difficulty, numerous nonlinear denoising techniques have been proposed. These techniques have focused on the noise that enters through the channel but many times noise might have also entered at the time of preprocessing. So, technique in the proposed work, hybridization (i.e. combination of Median and Gaussian filter) has been applied which removes noise that occurs at the time of transmission as well as at the time of preprocessing. Experiments have been performed to check the performance of the proposed technique.

Keywords: *noisy image, image denoising, filters, hybridization.*

1. Introduction

Noise can hinder the actual information of the source and makes people obstruct in understanding meaning of the data. Noise entered into the signal at the time of acquisition and transmission. Thus Gaussian noise make the quality of the image degrade at the time of transmission from source to destination. There can be different types of noises that can enter into the image such as channel noise or Gaussian noise, salt and pepper noise, speckle noise. Due to these noises, unfavorable effects have been performed on the image processing such as segmentation, compression and image understanding. Consequently, noise should be removed from the image for enhancing the quality along with for further processing. The main idea behind denoising is to keep the actual information of the image remains such as texture and edge information in order to enhance the quality of the image. Noise in the image can disrupt the process of image observation, feature extraction and image analysis.

Thus to remove noise from the image, number of filters can be applied on the image. After applying these filters on the noisy image, original image can be obtained accordingly. But an application of these filters can lose some information about the edge and texture of image at the time of denoising. Owing to this drawback, many researchers have been focusing on developing different denoising methods.

Existing methods of denoising are based on the statistical characteristics of noise and signal with the help of low-pass filters. Like in the spatial domain local smoothening operator has been used for denoising in case of unknown statistics characteristics of noise. Such type of method is helpful in terms of parallel processing, takes less time for computation. On the other hand, it has a drawback of producing window size which can affect the ability of denoising. But if the statistical characteristics of the noise are known in frequency domain, least square filter and the Wiener filter can be applied in order to perform global denoising. But to use this model, statistical characteristics of the noise and signal must be known. Additionally, computational cost is high in comparison with spatial domain. Low pass filters used in spatial domain can remove the noise effectively from the image but image edge can become fuzzy.

A number of denoising methods have been proposed based on level set, morphological filter and Markov filter. Some of the algorithms that have been used to remove Gaussian noise from the image are:(1) improved wavelet denoising method, (2) improved ICA denoising method, (3) method based on neural network etc. Gaussian noise reduction was the most critical problem in image processing and to remove it completely from the image is a serious issue.

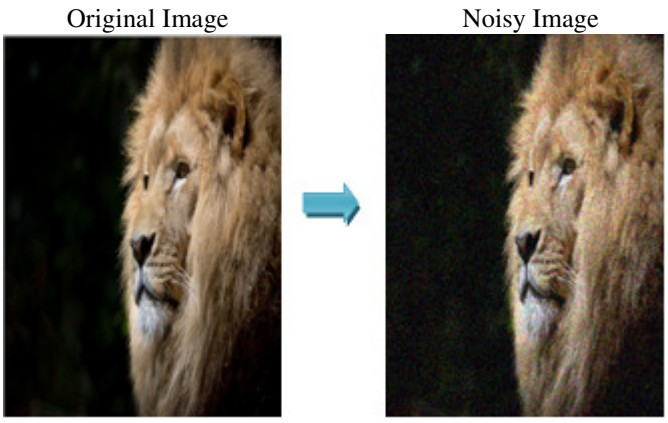

Figure 1: Acquisition of noise after transmission

Representation of figure1 shows that how noise can affect the actual quality of the signal after transmission from one end to another end. Thus it is required to remove the noise from the image for further processing.

2. Previous Work

Noise is one of the major factors that affect the quality of the image. An image is often corrupted by noise. Removal of noise from the image is known as image denoising, the noise that is present in the image degrades the quality. Basically noise entered into image during capturing instruments, data transmission media, image quantization and discrete sources of radiation. The main motive of the image denoising system is to remove the noise from the image while preserving the data that is present in the image. Several approaches have been proposed for the removal of the noise from the image each has its assumptions, advantages and limitations. All these factors degrade the image quality. Various techniques have been proposed for removing the noise from the image.

Traditional the Wavelet approach was used for removing the noise along with the median filter the wavelet would divide the image into component and than the median filtration was done. During this process, the filtration is applied on every part of image; the part of the image that is not affected by the noise is filtered too. In this way the quality of the image is degraded. So, there is need to find a new method for the image denoising so that the quality of the image is not degraded and noise is properly remove so that the information of the image is not lost.

3. Proposed Work

In this work, a new method is proposed for removing noise from the image. This method is considered to be better than the traditional approaches for removing noise from the images. The main logic that will be used for the updating of the proposed work is the mixing of Median and Gaussian filter, the main reason for using this technique for the proposed work is that the general noise which get effect RGB images is salt and paper but if we use the image to send on channel it has effect of Gaussian noise whose removal is much successful by Gaussian filter. So, a hybrid approach used proposal of work.

4. Methodology

As noise can disrupt the actual meaning of data thus removal of noise without being affected quality of the image is the important concern at present. Thus, in the present work, removal of noise has been done using hybridization in order to enhance quality. Methodology for the present work is discussed below:

1. Extract image considered as original image for the manipulation purposes. Image will be loaded in MATLAB.
2. Next step is to add noise to the original image. Firstly, Gaussian and then speckle noise added to the image. So, the generated image is the noisy image.
3. Next step is to convert the format of noisy image i.e. from RGB to YCBCR format in order to remove noise in layers. Conversion is done into YCBCR format as it is considered as good format for refining.
4. After separation of layer, perform Median filter on the noisy image. Median filter is helpful in removing the noise that has been added at the time of preprocessing. Acquired output from this stage is refined image but not completely.
5. Then convert image from YCBCR to RGB format for enhancement of quality. As RGB format is the original format of image and so should remain for the output thus refined image has been converted into original format.
6. Now apply Gaussian filter on the obtained image to remove Gaussian noise from the filtered image.
7. Lastly, filtered image is attained; calculated parameters like PSNR, BER are to check the performance of the proposed technique.

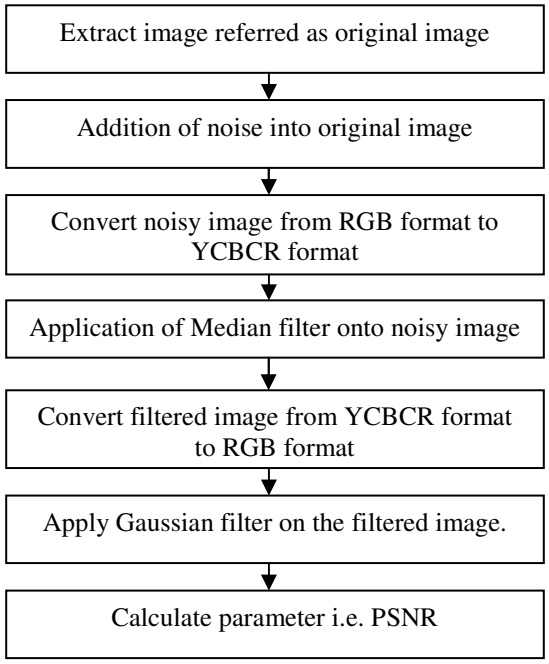

Figure 2: Flow diagram of proposed work

5. Results and Discussions

In this section of the paper, results have been evaluated after applying proposed approach in denoising of the image. Gaussian filter has been used to remove the Gaussian noise whereas median filter has been used to remove the speckle noise from the image. Traditional techniques were not able to remove Gaussian noise completely from the noise. Consequently, the new technique which used two filters i.e. hybrid filtration is able in removing of noise. Comparison graph shows that proposed technique performs exceptionally better and liberated noise from the image.

Figure 3: Original image for evaluation

Figure 3 represents original image that has been taken for the evaluation purpose. Furthermore, affects has been performed on this image and resultant image will be compared with initial image.

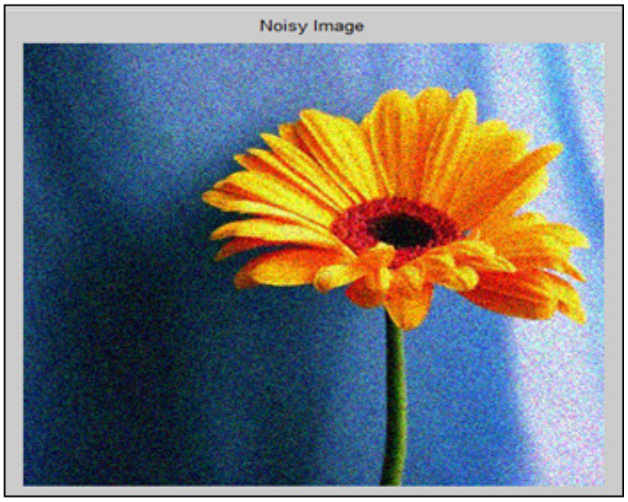

Figure 4: Noisy image after addition of noise

Noise is added to the original image and obtained image is shown above. On these image filtration techniques has been applied to check the performance of the proposed technique.

Figure 5: After performing hybrid filtration

After applying hybrid filtration on the noisy image acquired image is represented in figure5. With the help of new technique firstly median filter and then Gaussian filter has been applied on the image for obtaining better results. It can be seen that noisy image has been improved through the filtration process. Median filter is helpful in removing the noise at pre processing stage. In this filter edges of the image can preserve as deduction of noise.

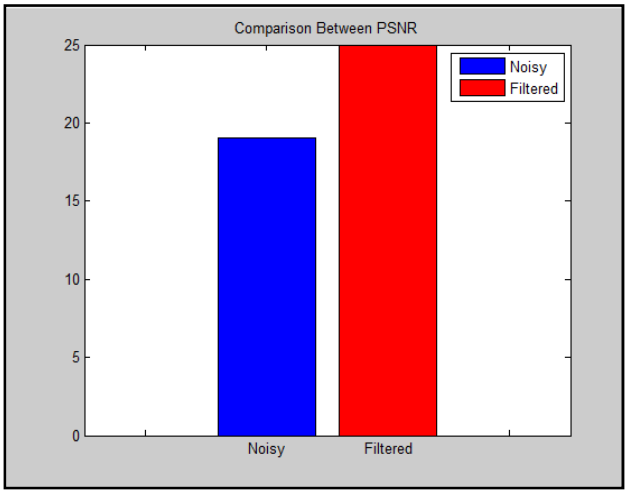

Figure 6: Comparison between noisy and enhanced image

Above figure represents comparison between the noisy image and the enhanced image after applying filtration on the image. As a result, it can be concluded that PSNR i.e. single to noise ratio is high in the filtered image. PSNR value shows that ratio of quality is high if PSNR is high and low if PSNR is low. As a result, filtered image is having high amount of image quality as compared to noisy image after application of hybrid technique for filtration.

6. Conclusion and Future Scope

Noise is fundamental difficulty in the path of image processing. Noisy image cannot be used for any purpose as it ruins the actual quality of the image and loss important information. Thus, it is required to propose a technique that can remove the noise from the image and can restore the quality. Existing image processing techniques are not capable enough in removing Gaussian noise due to which it has been stopped using. Proposed technique is able to remove the noise without losing edge information.

In this paper, hybridization technique is applied on the noisy image in which Median filter and Gaussian filter have been used. Channel noise can be removed effectively through the Gaussian filter and general noise can be removed by the median filter. Evaluations have been performed that has proven the fact aimed in the proposed work. Resultant parameters show that PSNR after applying proposed technique is better alternative in noisy image.

As there are number of image de-noising techniques used but still there is lot to happen. Further studies can be done in this field to provide more effective methodologies. For future, more filter techniques can be used that provide optimum solution to the noise.

7. References

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