IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015.
www.ijiset.com
ISSN 2348 – 7968

Comparative Quality Analysis of Color Image De-Noising Algorithm

[1]Priyanka and [2]Randhir Singh
[1]M.Tech Scholar, ECE Department, SSCET, Badhani, Punjab, India
[2]HOD, ECE Department, SSCET, Badhani, Punjab, India
Email: priyankakhokhar59@gmail.com, errandhir81@gmail.com

Abstract —
Images are often corrupted with noise during acquisition, transmission, and retrieval from storage media. Many dots can be spotted in a Photograph taken with a digital camera under low lighting conditions. A noise is also introduced in the transmission medium due to a noisy channel, errors during the measurement process and during quantization of the data for digital storage. In this paper we evaluated the quality metrics of color as well as black and white image de-noising algorithm.

***Index Terms* –Image De-noising, SNR, filtering.**

I. INTRODUCTION

Image de-noising involves the manipulation of the image data to produce a visually high quality image. Therefore the goal of image de-noising is to recover the true or best approximation of images from the noisy images. Image de-noising is the technique of estimation of the uncorrupted image from the distorted or noisy image [1]. Image de-noising finds applications in fields such as astronomy where the resolution limitations are severe, in medical imaging where the physical requirements for high quality imaging are needed for analyzing images of unique events, and in forensic science where potentially useful photographic evidence is sometimes of extremely bad quality. A very large portion of digital image processing is devoted to image restoration. This includes research in algorithm development and routine goal oriented image processing. Image restoration is the removal or reduction of degradations that are incurred while the image is being obtained. Degradation comes from blurring as well as noise due to electronic and photometric sources. Blurring is a form of bandwidth reduction of the image caused by the imperfect image formation process such as relative motion between the camera and the original scene or by an optical system that is out of focus. When aerial photographs are produced for remote sensing purposes, blurs are introduced by atmospheric turbulence, aberrations in the optical system and relative motion between camera and ground. In addition to these blurring effects, the recorded image is corrupted by noises too.

Image de-noising is often used in the field of photography or publishing where an image was somehow degraded but needs to be improved before it can be printed. For this type of application we need to know something about the degradation process in order to develop a model for it. When we have a model for the degradation process, the inverse process can be applied to the image to restore it back to the original form. This type of image restoration is often used in space exploration to help eliminate artifacts generated by mechanical jitter in a spacecraft or to compensate for distortion in the optical system of a telescope.

II. IMAGE DE-NOISING METHODS

There are many different kinds of image de-noising algorithms.

(i) Mean Filter

Mean filter is an example of a linear filter. This filter replaces each pixel value in the images with the average value of its neighbors including itself. We select an odd size window with center element as the processing pixel & then replace the processing pixel with the average of the window pixels. This filter is mainly used for removal of Salt & Pepper noise but results some blurring at the edges [2].

(ii) Median Filter

Median filter is an example of a non-linear filter. Median filtering is quite useful in getting rid of Salt and Pepper type noise. In median filter de-noising firstly select an odd size window with center element as the processing pixel & then store the elements in 1-D array. Then sorted the pixel value in ascending or descending order and then replace the processing pixel with the midpoint of the 1-D array. With Spatial filters tend to cause blurring in the de-noised image [3].

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015.
www.ijiset.com
ISSN 2348 – 7968

(iii) LMS Adaptive Filter

An adaptive filter does a better job of de-noising images compared to the averaging filter. The fundamental difference between the mean filter and the adaptive filter lies in the fact that the weight matrix varies after each iteration in the adaptive filter while it remains constant throughout the iterations in the mean filter.

Adaptive filters are capable of de-noising non-stationary images, that is, images that have abrupt changes in intensity. Such filters are known for their ability in automatically tracking an unknown circumstance or when a signal is variable with little a prior knowledge about the signal to be processed. In general, an adaptive filter iteratively adjusts its parameters during scanning the image to match the image generating mechanism [4,5]. This mechanism is more significant in practical images, which tend to be non-stationary.

Compared to other adaptive filters, the Least Mean Square (LMS) adaptive filter is known for its simplicity in computation and implementation. The basic model is a linear combination of a stationary low-pass image and a non-stationary high-pass component through a weighting function. Thus, the function provides a compromise between resolution of genuine features and suppression of noise.

IV. Bilateral Filter

Bilateral filter is firstly presented by Tomasi and Manduchi. It is mentionable that the Beltrami flow algorithm is considered as the theoretical origin of the bilateral filter, which produces a spectrum of image enhancing algorithms ranging from the L2 linear diffusion to the L1 non-linear flows. The bilateral filter takes a weighted sum of the pixels in a local neighbor-hood; the weights depend on both the spatial distance and the intensity distance. In this way, edges are preserved well while noise is averaged out. Paris and Durand [35] analyzed accuracy in terms of bandwidth and sampling, and derive criteria for down sampling in space and intensity to accelerate the bilateral filter by extending an earlier work on high dynamic range images. Their method approximates the bilateral by filtering sub-sampled copies of the image with discrete intensity kernels, and recombining the results using linear interpolation. In other words, this method treats the intensity image as a 3D surface, applies Gaussian smoothing to binary and intensity modulated surface, and divides them to determine the filtered intensity values at the original surface location.

IV. Results & Discussion

The Results of various image de-noising techniques are given in figure 1. The simulation results depict the performance of various techniques applied to noisy image. The noise taken for the result verification is salt and pepper noise and Gaussian noise. The Performance Comparison in terms of Signal to Noise Ratio (SNR) of various filters are shown in table 1.

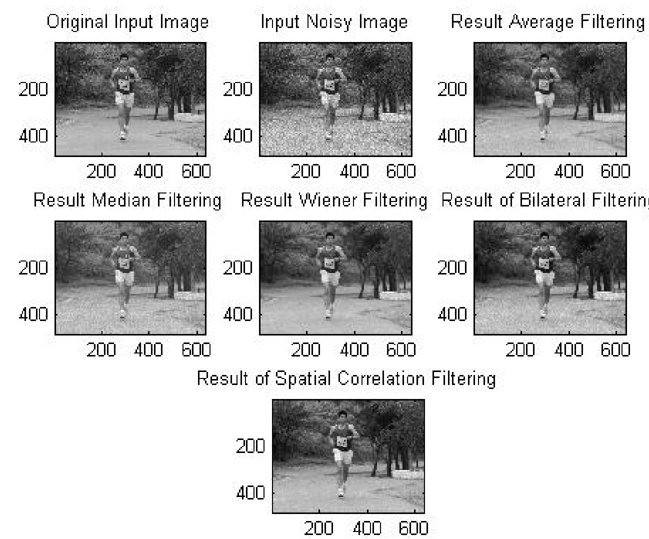

Figure 1: Various filters applied to noisy image 1.

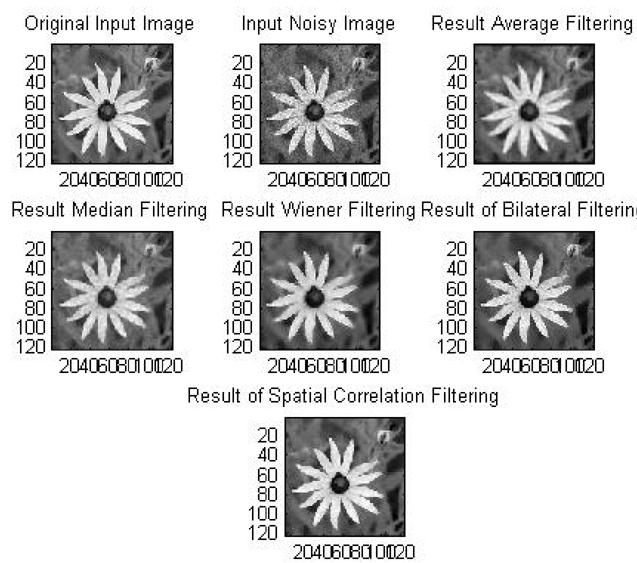

Figure 2: Various filters applied to noisy image 2.

Table 1: SNR values for filtering approach

Method	Image 1		Image 2	
	SNR of input Image	SNR of output image	SNR of input Image	SNR of output image
Mean filter			25.9255	

	25.4971	28.1308		25.9840
Median filter	25.4971	27.8785	25.9255	26.9379
Wiener filter	25.4971	29.0328	25.9255	27.4102
Bilateral filter	25.4971	29.3098	25.9255	28.7962
Spatial correlation filter	25.4971	31.0656	25.9255	30.3243

V. CONCLUSIONS

In this paper we evaluate the quality performance of various image de-noising algorithms. t is concluded that for salt and pepper noise, the spatial correlation filter gives better results as compared to others.

REFERENCES

[1] Kanika Gupta, S.K. Gupta, "Image Denoising Techniques – A Review paper", International Journal of Innovative Technology and Exploring Engineering (IJITEE), March 2013, Vol.2, Issue-4.

[2] M. Vijay, L. Saranya Devi, M. Shankaravadivu and M.Santhanamari "Image Denoising based on Adaptive Spatial and Wavelet Thresholding Methods", IEEE-International Conference On Advances In Engineering, Science And Management, (ICAESM -2012) March 30, 31, 2012.

[3] Shruti Bhargava, Dr. Ajay Somkuwar, Mini Gupta, "A survey Paper on Image Denoising Techniques" International Journal of Electronics Communication and Computer Engineering, Volume 3, Issue 3.

[4] R.C. Gonzalez and R.E. Woods "Digital Image Processing", 2nd ed. Englewood Cliffs, NJ: Prentice-Hall; 2002.

[5] Jappreet Kaur, Manpreet Kaur, Poonamdeep Kaur, Manpreet Kaur "Comparative Analysis of Image Denoising Techniques" International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 6, June 2012.

[6] Sachin D Ruikar, Dharampal D Doye, "Wavelet based image denoising technique", International Journal of Advanced Computer Science and Applications, March 2011, Vol.2, No.3.

[7] Rupinderpal Kaur* Rajneet Kaur, "Survey of De-noising Methods Using Filters and Fast Wavelet Transform", *International Journal of Advanced Research in Computer Science and Software Engineering Research*, Volume 3, Issue 2, February 2013