ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)
Vol. 3, Issue 2 (Apr. - Jun. 2015)
International Journal of Advanced Research in Computer Science & Technology (IJARCST 2015)

Image Denoising with Various Filtering Techniques

[I]Ankita Malhotra, [II]Er. Deepak Kumar
[I]M.Tech Student, [II]Assistant Professor
[I,II]Dept. of Computer Science, PIET, Panipat, Haryana, India

Abstract
Image Enhancement through De-noising is one of the most important applications of Digital Image Processing and is still a challenging problem. Images are often received in defective conditions due to usage of Poor image sensors, poor data acquisition process and transmission errors etc., which creates problems for the subsequent process to understand such images. The present paper gives the detail of various noise effects on the images and also discusses the methods to remove the noise by using various filter methods such as median filter, enhanced median filter, Gaussian filter to enhance the image quality. The Experimental results performed on a set of standard test images for a wide range of noise corruption levels. The work is implemented on the MATLAB environment.

Keywords
RGB (Red, Green, Blue), Image Enhancement, Noise, MATLAB, Spatial Domain etc.

I. Introduction

Image De-noising and Enhancement are the key research fields in Image Processing as they are useful in several applications such as Feature Detection, Medical Image Processing, Remote Sensing, Machine vision etc., which improves the image clarity and visual perception of human beings. They modifies images to improve them (enhancement, restoration), extract information (analysis, recognition), and change their structure. It improves the clarity of the Image for Human Perception. Edge Enhancement, Sharpen (create more contrast between neighboring pixels), Soften (blend the edges of neighboring pixels), Blur removing (blend together pixels of the image), Raising Contrast, Medical Imaging (CT scan and MRI images) are some of the Image Processing functions. Grayscale images are distinct from one-bit black-and white images, which in the context of computer imaging are images with only the two colors black and white (also called bi-level or binary images). Grayscale images have many shades of gray in between 0 and 255. A 640 x 480 grayscale image requires over 300 KB of storage. Linear and Non Linear Filtering Techniques are used for Image De-noising and Enhancement.

On the other hand, image denoising from natural and unnatural images is still a challenging problem in image processing. Today's world is globe of Internet wherein information is needed to be exchanged across this globe, within fraction of second. This information may be composed of text, videos, or images. Images while transmissions over the communication media, are get corrupted due to insertion of noise. In order to recover the original image, the noise should be removed resulting as the concept of Image filtering**.** Following picture is an example of noisy picture and its denoised version after filtering.

Noise when get added to image destroy the details of it. Noise elimination is a key step in image processing, since much of the image post-treatment e.g. edge detection, pattern recognition, and image segmentation is depended effect and quality of the noise elimination. Image visibility restoration, these days, has become an active research area in the domain of Image processing

A. Different types of noises

There are several noises that may degrade the quality of an image

- Amplifier noise (Gaussian noise)
- Salt-and-pepper noise
- Poisson noise
- Quantization noise (uniform noise)

In our proposed work we have considered the effect of various noise and we have proposed a method to denoise the noisy image using Gaussian filter. The proposed work also considers the enhancement of the image using other filtering methods.

II. Related Work

[Golam Moktader Daiyan et al. (2012)] proposed a high performance decision based median filter is for removal of salt and pepper in image. This algorithm initially detects noise pixels iteratively through several phases and replaces the noisy pixels with median value. Detection of noise is done by expanding the

ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)

mask until 7×7 to maintain local information extraction. Moreover, the processing pixel is replaced by last processed pixel if the algorithm fails to detect noise free pixel at 7× 7. If the noise free median value is not available at 7×7 processing window, the last processed pixel take into consideration if it is noise free. If the last processed pixel is noisy, the algorithm select a window size with 15×15 dimension and calculate the number of 0's and 255's in the processing window. Then replace the processing pixel with 0 or 255 which is more in number in the selected window.

Monedero *et al* [7] proposed a spatially variant erosions/ dilations and openings/closings approach. Structuring elements (SE) can locally adapt their shape and orientation across the direction of the structures in the image. The process of extracting shape and orientation of the SE at each pixel from the image is under study. This method is useful in the enhancement of anisotropic features such as coherent, flow like structures. A general method based on fuzzy implication and inclusion grade operators have been discussed by Yee Htun *et al.*

A. Roposed Formulation

For the purposes of image analysis and pattern recognition there is always a need to transform an image into another better represented form. During the past five decades image-processing techniques have been developed tremendously and mathematical morphology in particular has been continuously developing because it is receiving a great deal of attention because it provides a quantitative description of geometric structure and shape and also a mathematical description of algebra, topology, probability, and integral geometry. It is mathematical in the sense that the analysis is based on set theory, topology, lattice algebra, function, and so on.

B. Median Filtering

Median filtering is done one neighborhood at a time; however the mask that it uses is not a linear function. A median filter replaces the pixel with the median of the neighborhood. This is useful in removing noise from a single image. The median filter does this by removing large noise spikes from the image.

1. Advantages of Median Filter

1. There is no reduction in contrast across steps, since output values available consist only of those resent in the neighbourhood.
2. Median filtering does not shift boundaries, as can happen with conventional smoothing filters.
3. Since the median is less sensitive than the mean to extreme values i.e. outliers, those extreme values are more effectively removed.
4. The median is more robust than the mean, as it is not affected by extreme values.
5. Since the output pixel value is one of the neighbouring values, new unrealistic values are not created near edges.
6. Since edges are minimally degraded, median filters can be applied repeatedly, if necessary

C. Gaussian Filtering De-Noising

The Gaussian filtering is an important space for the weighted mean filter. It is based on the shape of the Gaussian function to select the right value of linear smoothing filter. It usually uses the Gaussian function of discrete two-dimensional by zero-mean to be smoothing filter. The following equation as below:

$$g(x,y)=\frac{1}{M}\sum f(x,y)\exp\left[-\left((x-i)^2+(y-j)^2\right)/2\sigma^2\right]$$

In our proposed work we have compared the results of various filtering techniques after studying the effect of noise on an image. In this review paper we have studied different types of noise and find out the methods to remove such noise using different filters. In the final work we will show the enhanced results.

III. Expected Results

Fig.1: Original image

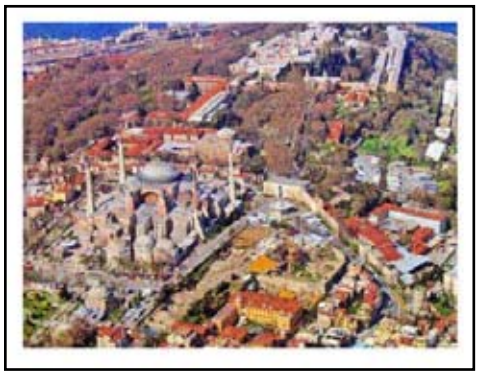

Fig. 2: Noise effected noise

Fig. 3: Gaussian Noise effected image

Fig. 4: Recovered image

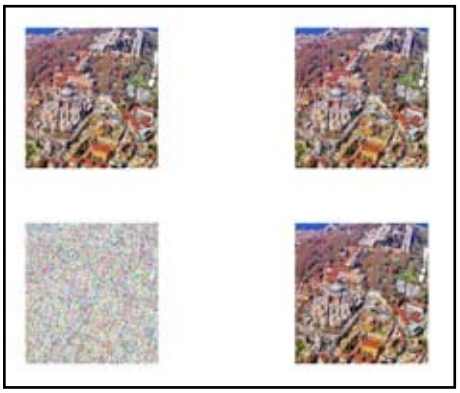

Fig. 5: Comparing the Four aspects of images

IV. Conclusion and Future Scope

Image filtering is the process of eliminating or reducing the noise from a noisy image with an aim to produce a filtered image that is closed to the original image i.e. the ground truth image. Noise is an eminence deprivation influence that is restrained as unsolicited/ unrelated material existing in the digital image. Several median based filters have been projected for the filtering of the noisy images polluted by different kind of noise. The proposed algorithm is implemented in MATLAB. This proposed algorithm is able to overcome the drawbacks of previous methods like thresholding, histogram equalization and fuzzy methods.

For future prospective the work can be extended using Neural network. The images can be tested with different noise with different parameters. Further the work can be included the part of mathematical calculations including different parameters.

References

[1] *Ayushi Jaiswal 1, J.P. Upadhyay 2, Ravi Mohan S.3,P. Bohre4 "A Novel Approach for Reduction of Poisson Noise in Digital Images" A. Jaiswal et al Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 3, Issue 5, Sep-Oct 2013, pp.1275-1279*

[2] *Balasubramanian, S., S. Kalishwaran, R. Muthuraj, D. Ebenezer, and V. Jayaraj. "An efficient non-linear cascade filtering algorithm for removal of high density salt and pepper noise in image and video sequence." In Control, Automation, Communication and Energy Conservation, 2009. INCACEC 2009. 2009 International Conference on, pp. 1-6. IEEE, 2009.*

[3] *Barney, Blaise. "Introduction to parallel computing." Lawrence Livermore National Laboratory 6, o. 13 (2010): 10.*

[4] *Chandra, Vivek, Sagar Deokar, Siddhant Badhe, and Rajesh Yawle. "Removal of High Density Salt and Pepper Noise Through Modified Decision Based Unsymmetric Trimmed Adaptive Median Filter." International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249-8958.*

[5] *Daiyan, Golam Moktader, M. A. Mottalib, and Muhammad Mizanur Rahman. "High Performance Decision Based Median Filter for Salt and Pepper Noise Removal in Images." Dagao Duan, Qian Mo, Yueliang Wan, Zhongming Han "A Detail Preserving Filter for Impulse Noise Removal" ICCASM 2010.*

[6] *D. C. Hanselman and B. Littlefield, Mastering MATLAB 6, A Comprehensive Tutorial and Reference, Prentice–Hall, Upper Saddle River, NJ, 2000.*

[7] *Deng, Xiuqin, Yong Xiong, and Hong Peng. "A new kind of weighted median filtering algorithm used for image Processing." In Information Science and Engineering, 2008. ISISE'08. International Symposium on, vol. 2, pp. 738-743. IEEE, 2008*

[8] *Dong, Fu-guo. "A novel fast algorithm for image median filtering based on improved sign test method." In Logistics Systems and Intelligent Management, 2010 International Conference on, vol. 2, pp. 1240-1242. IEEE, 2010.*

[9] *Ghosh, Mrityunjay, and Srabani Mukhopadhyaya. "Cache oblivious algorithm of average filtering in image processing." In Informatics, Electronics & Vision (ICIEV), 2012 International Conference on, pp. 149-154. IEEE, 2012.*

[10] *Juneja, Mamta, and Rajni Mohana. "An improved adaptive median filtering method for impulse noise detection." International Journal of Recent Trends in Engineering 1, no. 1 (2009): 274-278.*

[11] *Kanagalakshmi, K., and E. Chandra. "Performance evaluation of filters in noise removal of fingerprint image." In Electronics Computer Technology (ICECT), 2011 3rd International Conference on, vol. 1, pp. 117-121. IEEE, 2011.*

[12] *Kang, Xiangui, Matthew C. Stamm, Anjie Peng, and K. J. Liu. "Robust median filtering forensics using an autoregressive model." (2013): 1-1*