ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

Analysis of Image Restoration by Non Blind Technique using MATLAB

Avinash Srivastava[1], Dr. Pankaj Sharma[2]

M.Tech Scholar, Department of Computer Science, Scahdeva Institute of Technology, Mathura(U.P.) India[1]

Professor, Department of Computer Science, Scahdeva Institute of Technology, Mathura(U.P.) India[2]

ABSTRACT: In the modern era of communication, the retrieval process of digital images by a computer is become crucial in the field of digital image processing. Human visual system is most trusted source for the perception of information, and image is the basic pictorial information representation in 2-dimension. Image de-blurring is usually the first process that is used in the analysis of digital images. The improvement of pictorial information for human interpretation and processing of scene data using automated machines observation are the key applications in the field of image processing areas. Image de-noising area has various methods for removing different type of noises form images for machine processing and interpretation like filtering approach such as averaging, mean, and median filters. In this research paper author has done comparison of numerous methods for the non- blind image de-blurring, few of them are Horizontal de-blurring algorithm, Vertical de-blurring algorithm, combination of both algorithms and SALSA (Split Augmented Lagrangian Shrinkage Algorithm) in Matlab.

KEYWORDS: PSF, PDE, SALSA, ALM, TV, KL, PSNR, AL, FISTA, De-blurring, Non Blind Image.

I. INTRODUCTION

Vision is the foremost trusted source of information compare to other human perceptions. And image is the basic container of any pictorial information. The process of retrieving and analyzing the pictorial information by a digital computer is known as digital image processing. The improvement of pictorial information for human interpretation and processing of scene data for autonomous machine perception are the root application areas that had shown the interest in image processing field decades ago[7].

A blurred or degraded image can be approximately described by this equation k = Hf + n, where the k is the blurred image, the H is the distortion operator also called the point spread function(PSF), f is the original true image, n is the additive noise, introduced during image acquisition, that corrupts the image.

Image de-blurring is usually the first process that is used in the analysis of digital images. In any image de-noising technique it is very important that the de-noising process should not have any blurring effect on the image, and makes no changes on the preserving of images to image edges. There are several methods for image de-noising; these are averaging filters, mean filters, and median filters [2] which are used in digital image processing for such purposes. But these filters have adverse effects on the sharp edges which make softening of the image and provide better smoothing the image.

The softening of sharp images can be overcome using the partial differential equations (PDEs)[5] –based methods and SALSA which have been introduced in the literature [3,4]. The partial differential equation is used to describe the implementation details of the Horizontal de-blurring algorithm, Vertical de-blurring algorithm, combination of both algorithms and SALSA (Split Augmented Lagrangian Shrinkage Algorithm). The relative motion of camera in vertical direction and the joint effect of the motion in two directions by introducing blur component in horizontal and vertical directions. SALSA can be used with different types of regularization, is based on a variable splitting technique which yields an equivalent constrained problem.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

II. OBJECTIVE

The objective of research paper is to compare various de-blurring techniques for the non- blind image de-blurring. The various techniques are Horizontal de-blurring algorithm, Vertical de-blurring algorithm, combination of both algorithms and SALSA (Split Augmented Lagrangian Shrinkage Algorithm) in Matlab. We are also considering relative motion of camera in vertical direction and the joint effect of the motion in two directions by introducing blur component in horizontal and vertical directions. SALSA can be used with different types of regularization, is based on a variable splitting technique which yields an equivalent constrained problem. Then results are compared for various de-blurring techniques on the calculated PSNR.

III. RESEARCH WORK

The median filtering, mean filtering and other image de-noising techniques are used for the better smoothing the image but PDE and SALSA have proven a significant improvement over these techniques. In this section we introduce the different techniques of image de-blurring.

3.1 Weiner Filter

The method is founded on considering image and noise as random process and objective is to find an estimate of de-blurred image of the uncorrupted image such that mean square error between them is minimized. The simplest approach is to restore the original image simple by dividing the transform of degraded image by degradation function.

$$F'(u,v) = F(u,v) + {N(u,v)}/{H(u,v)}$$

These are the frequency transform of de-blurred image, original image, noise density and degraded function.

3.2 Order Statistics Filters

These are the spatial filters whose response is based on the ordering of the pixels contained in the image area and compassed by the filter. The response of the filter at any point is determined by ranking result.

$$F1(x,y) = median\{g(u,v)\}$$
$$F1(x,y) = max\{g(u,v)\}$$
$$F1(x,y) = mean\{g(u,v)\}$$

3.3 PDE De-blurring

A generalized PDE [5] based image model is proposed to model the phenomenon of blurred image formation due to relative motion between camera and the object and further the recovery of original image in spatial domain. Lax scheme is used to discretize the resulting PDE which is mathematically stable and produces good result. Therefore, with the use of Lax method for discretizing the proposed PDE that was initially a flux conservative equation transforms to a ID flux conservative equation with an added diffusion term which is in the form of Navier-Stokes equation. The, additional diffusion term contributes towards further smoothing of image.

3.4 The Vertical De-blurring Algorithm

The Algorithm for this scheme is as follows:-

1. Read the original image s of size [m x n].
2. Introduce the motion blur in y direction to get s(y, x, t) or alternatively we can directly have the blurred image s(y, x, t).

Id =s(y, x): Initial Image

3. Set dy=0.1, dt = 0.1
4. for t=1: n iterations

    Display the image

3.5 SALSA

The SALSA is based on the technique known as variable splitting. Since the objective function to be minimized is the sum of two functions, the idea is to split the variable x into a pair of variables, say x and v, each to serve as the

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

argument of each of the two functions, and then minimize the sum of the two functions under the constraint that the two variables have to be equal, so that the problems are equivalent. Although variable splitting is also the rationale behind the recently proposed split- Bregman method. The constrained optimization problem resulting from variable splitting is then dealt with using an Augmented Lagrangian (AL) scheme, which is known to be equivalent to the Bragman iterative methods recently proposed to handle imaging inverse problems. The term SALSA (split augmented Lagrangian shrinkage algorithm), comes from the fact that it uses (a regularized version of) the Hessian of the data fidelity term of, that is, AH A, while the above mentioned algorithms essentially only use gradient information.

IV. PERFORMANCE PARAMETER

In this section we discuss the two performance measuring parameters on which the above discussed techniques are based.

Technique used	Performance	PSNR values
SALSA	Very Efficient	40.001
PDE_ Vertical	Efficient	38.8836
Weiner_Vertical	Worst Results	11.1457 +13.6438i
Median_Vertical	No Result	06.6929

Table-1 Performance parameter table

4.1 MMSE(Minimum mean square error)

In statistics and signal processing first error metrics, a minimum mean square error (MMSE) estimator is an estimation method which minimizes the mean square error (MSE) of the fitted values of a dependent variable, which is a common measure of estimator quality. Let x be a n*1 unknown (hidden) random vector variable, and let y be a m*1 known random vector variable (the measurement or observation), both of them not necessarily of the same dimension. An estimator $\hat{x}(y)$ of x is any function of the measurement y. The estimation error vector is given by $e = (\hat{x} - x)$ and its mean squared error (MSE) [6] is given by the trace of error covariance matrix

$$MSE = tr[E\{(\hat{x} - x)(\hat{x} - x)^T\}]$$

the expectation is taken over both x and y. When x is a scalar variable.

4.2 PSNR (Peak Signal to Noise Ratio)

Second of the error metrics used to compare the various image de-blurring technique is the (Mean Square Error and PSNR) Peak Signal to Noise Ratio (PSNR) [7]. The MSE is the cumulative squared error between the compressed and the original image, whereas PSNR is a measure of the peak error.

V. EXPERIMENTAL RESULTS

To compare the performance of the above described techniques in image de-noising, they have been implemented using Matlab. In these experiments, to make the images noisy, the Gaussian noise has been used with 64 as the average value for both of the noises, and a variance of 400 for the Gaussian noise, respectively.
We have done comparison of various de-blurring techniques for Gaussian noise

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

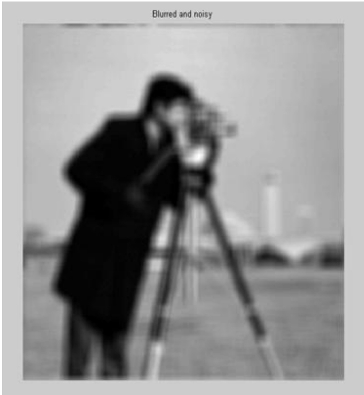
International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

5.1 Results for Image de-blurring using SALSA



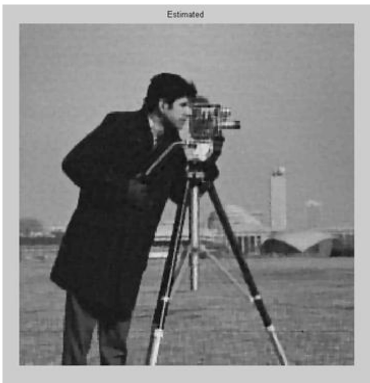


Fig-1: Original Image   Fig-2: Blurred and Noisy Image   Fig-3: Estimated Image using SALSA

5.2 Image de-blurring using PDE

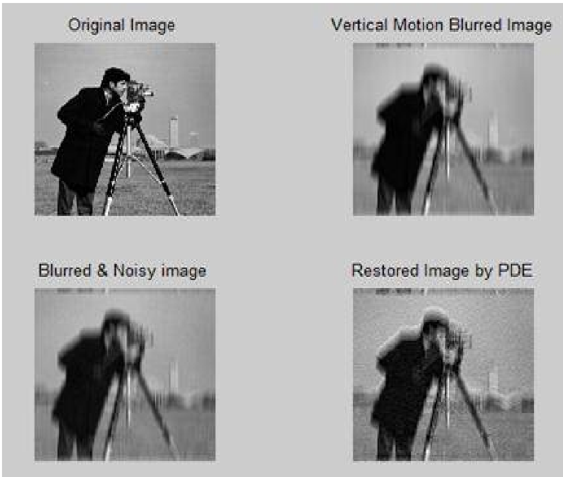


Fig-4: Results of Image de-blurring using PDE

5.3 Image de-blurring using Wiener filter

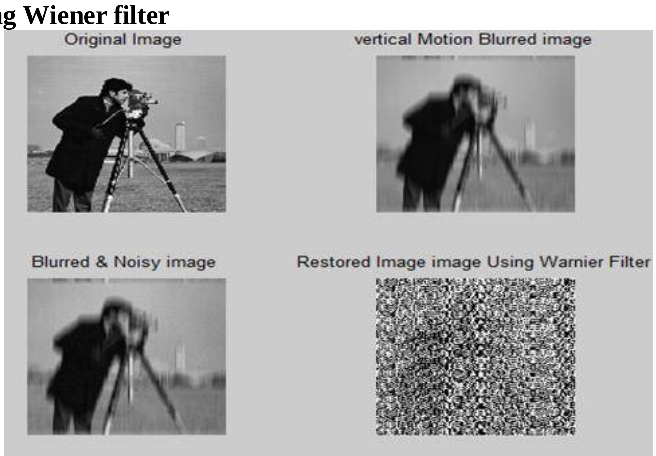


Fig-4: Results of image de-blurring using wiener filter

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

5.4 Image de-blurring using Median filter

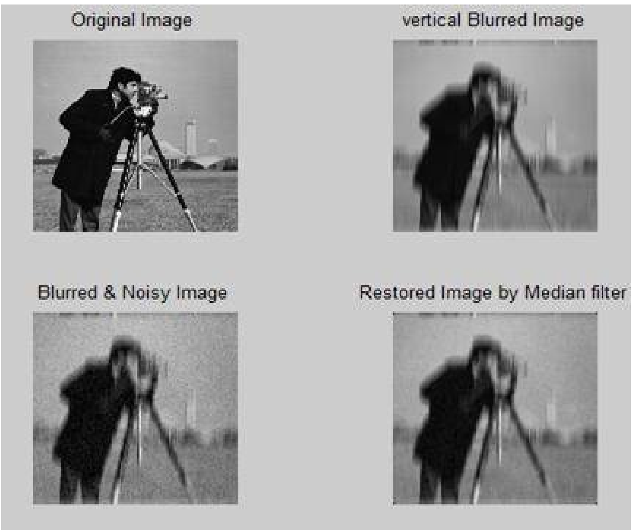


Fig-5: Results of image de-blurring using median filter

VI. CONCLUSION

In this research various methods for noise reduction have been analyzed. In the analysis, various well-known measuring metrics have been used. The results show that by using the SALSA noise reduction is much better compared to other methods. In addition, by using this method the quality of the image is better enhanced. Using SALSA the unconstrained image problem can be easily done regularized. The median, mean and wiener filters have low PSNR values for Gaussian noise. Weiner filtering is the worst case for such noises. The PDE technique is much efficient than these for the motion blurring. The vertical de-blurring shows the better results than horizontal and combined de-blurring in PDE but still it is less efficient than the SALSA.

REFERENCES

[1] A. C. Likas, N. P. Galatsanos. A Variational Approach for Bayesian Blind Image Deconvolution". IEEE Transactions on Signal Processing, Vol. 52, No. 8:2222,2233, 2004

[2] Gonzalez C.Rafeal,Woods Richard E., "DigitalImageProcessing",London:Pearson Education, 2002.

[3] Rajeev Srivastava, Harish Parthasarthy, JRP Gupta and D. Roy Choudhary, "Image Restoration from Motion Blurred Image using PDEs formalism", IEEE International Advance Computing Conference (IACC 2009),March 2009.

[4] M.D. Kostin, "Schrodinger-Fuerth quantum diffusion theory: Generalized complex diffusion equation", J. Math. Phys. 33 (I), 1992

[5] Manya V.Afonso, Jose M. Bioucas-Dias ,Mario A.T.Figueiredo, "Fast Image Recovery Using Variable Splitting and Constrained Optimization", IEEE Transactions on Image Processing,2010

[6] A. Chambolle "An algorithm for total variation minimization and applications," J. Math. Imaging Vis., vol. 20, no. 1-2, pp. 89–97, 2004.

[7] "Image Processing Science calculating RMSE and PSNR for color images". Retrieved 6 April 2011