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Image De-Blurring using Blind De-convolution Technique

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Abstract: In this paper we have presented blind de-convolution method to deblur an image. The objective of the image deblurring using blind de-convolution is to reconstruct the original image from a degraded observation without the knowledge of either the true image of the degradation process. Here we have used various blurring techniques like motion blur, average blur, Gaussian blur filter to blur an image and a variation approach to solve blind de-convolution problem. This technique has many application in field such as astronomical imaging, medical imaging of remote sensing. The fruitfulness of any restoration method depends on their amount and it is tough to find the proper balance in order to ease of the restoration technique.
Keywords: Image restoration, Blind de-convolution, Image de-gradation, PSF, De-blurring.

I. INTRODUCTION

Image de-blurring at its basics is taking any image that is not sharply focused and processing it to make it more clear to the observer. There are different kinds of distortion which occur when you take a picture: noise, incorrect focusing, white balance error, exposure error, lens distortion. Most people would like their photos to come out sharp and focused, so that observer can easily see what the photo is about. To acquire good quality and clear image is always a challenging task. Therefore development of new and improved techniques for de-gradation always attracts the researchers. In blind de-convolution method sharp version of image is restore, without knowing the source of blurring and details of the clear image. Blind de-convolution approach is more suited for practical scenario. As in real imaging world while acquiring image or our image is corrupted by unknown parameter which can be Gaussian noise, atmospheric turbulence, motion blur etc. The image capturing process is usually modeled as the convolution of a blur kernel (PSF) *h* with an ideal sharp image (original image) *f*, plus some additive noise n: g = h * f + n where, g is the realization of random array with probability distribution resolute by ideal image f and kernel h or blurred image.

There are many researcher have been recently discusses about an iterative approach to the problem of restoration of blurred image [1-2]. By which the convolution c(x) of two functions, f(x) and g(x), can be expressed mathematically by the integral equation

$$c(x) = \int_{-\infty}^{+\infty} f(x_1).g(x - x1) \qquad [1]$$

If the Fourier transforms of these functions are represented by their corresponding uppercase letters, so that the Fourier-transform representation of Eq. (1) becomes

$$C(u) = F(u).G(u) \qquad [2]$$

The process of convolution arises frequently in optics, 1 and if one of the functions f or g is known, methods such as Weiner filtering 2 and iterative restoration 3 can recover the other function. The problem of de-convolution becomes more difficult if neither of the functions f(x) and g(x) is known, i.e., only the output signal, c(x), is available. The problem is now termed blind de-convolution. The purpose of this proposed work is to describe briefly a simple method for realizing blind de-convolution that has produced some promising results. The method is analogous in concept to various iterative image-processing techniques. Evaluation of Blind image Restoration to get the true image from a degraded image is briefly discussed by [2-3]. A prior blur identification method is the class of methods that perform the blind de-convolution by identifying the PSF prior to the restoration. Motion blur is an inevitable trade-off between the amount of blur and the amount of noise in the acquired image. The effectiveness of any restoration algorithm typically depends on their amounts and it is difficult to find the best balance in order to ease of the restoration technique. In proposed work we describe the concept of PSF identification, image restoration using various blind de-convolution algorithms. Phase and TV Based Convex Sets for Blind De-convolution of Microscopic Images is already presented by [4]. They were explained two closed and convex sets for blind de-convolution problem, for most blurring functions in microscopy are symmetric with respect to the origin. Therefore, they do not modify the phase of the Fourier transform (FT) of the original image.

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As a result, blurred image and the original image have the same FT phase. Therefore, the set of images with a prescribed FT phase can be used as a constraint set in blind de-convolution problems. Another convex set that can be used during the image reconstruction process is the Epigraph Set of Total Variation (ESTV) function. This set does not need a prescribed upper bound on the total variation of the image. The upper bound is automatically adjusted according to the current image of the restoration process. Both the TV of the image and the point spread function are regularized using the ESTV set. Both the phase information set and the ESTV are closed and convex sets. Therefore they can be used as a part of any blind de-convolution algorithm. Simulation examples are presented by [5] using blind de-convolution deblurring Technique.

In this proposed work, the process of image restoration technique has been also discussed. The process is based on Blind De-convolution approach with partial information available about true image. Advantage of using Blind de-convolution Algorithm is to dabbler the degraded image without prior knowledge of PSF and additive noise. The method differs from most of other existing methods by only imposing weak restrictions on the blurring filter, being able to recover images which have suffered a wide range of degradations. The advantage of the proposed Blind De-convolution Algorithm is to dabbler the degraded image without prior knowledge of PSF and additive noise. But in other algorithms, to process the image the prior knowledge of blurring parameter is must.

A. The steps of blind de-Convolution Algorithm For proposed work Consist of following Steps

1) *Step 1: Read in Images:* Images to be deplored are read into MATLAB environment.
2) *Step 2: Simulate Blur:* In this step a real life blur will be simulated using different types of filters
3) *Step 3: Restore the Blurred image using PSF of various sizes: This step involves the restoration of image using Blind De-convolution Algorithm by trying PSFs of different sizes.*
4) *Step 4: Improving the Restoration: There some ringing in the image, restored in previous step. To avoid this, we will exclude the pixels affected by the ringing.*

In [6] they attempt to undertake the study of Restored Motion Blurred Images by using four types of techniques of de-blurring image as Wiener filter, Regularized filter, Lucy Richardson de-convolution algorithm and Blind de-convolution algorithm with information of the Point Spread Function (PSF), corrupted blurred image with different values of length and theta and then corrupted by Gaussian Blurred. The same is applied to the remote sensing image and they are compared with one another. So as to choose the base technique for restored or de-blurring image [7] attempts to undertake the study of restored Motion blurred image with no any information about the Point Spread Function (PSF) by using same four techniques after execute the guess of the PSF, the number of iterations and the weight threshold of it. To choose the base guesses for restored or de-blurring image of this techniques.

II. PROPOSED WORK

In the iterative blind image de-convolution method of G.R Ayers and J.C. Dainty [1], image was not properly converge there were two main problem occurred. The concept of inverse matrix which used in their paper is ill defined. It is very critical to guess actual PSF and also the correct number of iterations to de-blurr an image So in this work we have extended this algorithm by using combined algorithm of Ayers and Dainty and Steepest descent method to converge an image.

III. METHODOLOGIES

A. Iterative Blind de-Convolution

In this method Ayers and dainty have given seven steps to reconstruct an image from degraded observation which had done by any blurring filter (average blur , motion blur , Gaussian blur filter etc.) is described in the fig.1 given below. The iterative loop is repeated until to positive functions with the required convolution c(x) has been found. Unfortunately, two major problems exist.

1) The inverse has associated problems because of the to invert a function that posseses regions of low Value. Defining the filter in such a region is Difficult
2) Zeros at particular spatial frequencies in either of the functions F(u) or G(u) result in no information at that spatial frequency being present in the convolution. The image-domain constraint of non negativity is commonly used in iterative algorithms associated with optical processing owing to the non negativity property constraint used in this research not only forces the function estimate to be positive but also conserves energy at each iteration. The latter condition is realized by uniformly redistributing the sum of the function's negative values over the function estimate. These processing steps can be represented by

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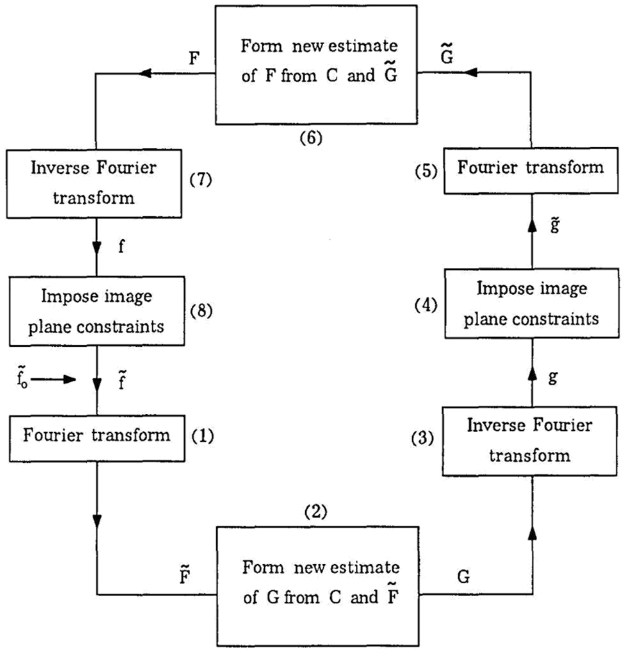

Fig. 1. General deconvolution algorithm.

$$\bar{f}_i(x) = f_i(x), \qquad f_i(x) \geq 0$$
$$\bar{f}_i(x) = 0 \qquad otherwise \qquad [3]$$

and

$$E = \int_{-\infty}^{+\infty} \left[f_i(x) - \bar{f}_i(x) = \right] dx \qquad [4]$$

Where E is the sum of the functions of negative values, and the redistribution:

$$\bar{f}_i(x) = \bar{f}_i(x) + E/N \qquad [5]$$

Where, N represents the number of pixels in the image data array when the processing is performed on a digital computer .If the function estimate still contain negative regions, when the processing repeated. Eventually a non negative constant function is formed with the total energy being conserved. The fourier –domain constraint can be described as follows:

If mod of C(u) is less than noise level

$$F_{i+1}(u) = F_i(u) \qquad [6a]$$

If mod of Gi(u) is greater or equal to mod of C(u)

$$F_{i+1}(u) = (1-\beta)F_i(u) + \beta \frac{C(u)}{G_i(u)} \qquad [6b]$$

and, if mod of Gi(u) is less than modof C(u)

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$$\frac{1}{F_{i+1}(u)} = \frac{1-\beta}{F_i(u)} + \beta\frac{Gi(u)}{C(u)} \qquad [6c]$$

Where $0 \leq \beta \geq 1$ and the constant β is set before algorithm is run,

B. Steepest Descent Method

This method also known gradient method is the simplest one among various techniques in the descent method. As Luenberger pointed out in his book; it remains to be fundamental method in the category for the following two reasons. First, because of its simplicity, it is used for solving a new problem. This observation is very true. This algorithm is firstly developed by Netravali and Robbins. Second, because of its existence of a satisfactory analysis of the steepest descent method it continuous to serve as a reference for comparing and computing various newly developed and advanced methods. Gradient descent is the first order iterative optimization algorithm used to find local minimum value of a function. To find a local minimum of a function by using this method we take steps proportional to negative of the gradient of a function at current point and we repeat the process. This algorithm will eventually converge where the gradient is zero (which correspondence to a local minimum). Basically gradient is the ratio of change in pixels intensity in Y direction to change in pixel intensity of X direction of an image.

1) *B.1:* In the steepest descent method, w^k is chosen as

$$w^k = -\nabla f(x^k)\ , \qquad [7a]$$

resulting in,

$$f(x^{k+1}) = f(x^k) - \alpha^k \nabla f(x^k) \qquad [7b]$$

where, the step size α^k is a real parameter the sign ∇ , denotes the gradient operator with respect to x^k. Since the gradient vector point to the direction along which the function f(x) has the greatest, it is naturally expected that the selection of the negative direction of the gradient as search direction will lead to the steepest descent of f(x). This is where the term steepest descent originated.

Our aim is to derive an iterative procedure for the minimization. So we want to find a sequence

$$x_0, x_1, x_2, x_3 \ldots\ldots\ldots\ldots x_u$$

[7c]

such that

$$f(x_0)>f(x_1)>f(x_2)> \ldots\ldots f(x_u)>\ldots. \qquad [7d]$$

and ,the sequence converges to the minimum value of f(x)

2) *B.2 Estimating the step size:* A wrong step size α^k may not reach convergence, so a careful selection of the step size important. Too long it will diverge too small it will take a long time to converge one option is to choose a fixed step size that will assure convergence wherever we start gradient descent. Another option is to choose a different step size at each iteration (adaptive step size).
3) *B.2.1 Adaptive step size:* There are method known as line search that make an estimate of what the step size should be taken at given iteration computing the gradient, this method choose a step size by minimizing a function of the step size(α^k) itself :

$$\text{Let } \alpha^k = b \qquad [7e]$$

$$b_p = h(b) \qquad [7f]$$

Each method defines its own function, based on some assumption. Exact methods accurately minimize h(b) inexact method make an approximation that just improves on the last iteration. An example given below:

4) *b.2.1.1 Cauchy* – One of the most obvious choices of α^k is to choose the one that minimizes the objective function:

$$b_p = \arg\min f\,(\,x_p - \alpha^k\, \nabla\, f(x_p)) \qquad [7g]$$

This approach is conveniently called the steepest descent method. Although it seems to the best choice, it converge linearly (error $\alpha\ 1/p$) and is very sensitive to ill-conditioning of problem.

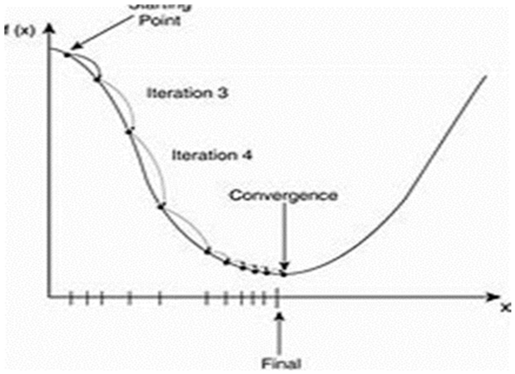

Fig 2. Steepest descent method

IV. RESULT AND CONCLUSION

This paper exhibited advancement of image processing for restoration of original image from blurred image that produced by using any blur kernel (PSF). It goes for helping in field of medical, astronomy etc. Here we had used combined approach of blind de-convolution and steepest descent method to converge an image. In blind de-convolution method conversion of an image was very difficult because of unknown parameters (PSF, original image).This drawback had been over comes by gradient descent approach that had given best result of conversion of an image.

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REFERENCES

[1] G. Ayers and J.C. Dainty, 'Iterative blind de-convolution method and its applications, "Opt. LETTER", vol. 13, no.7, pp. 547-549, Jul. 1988.
[2] Ms.Rajashri Vasawade, Mr.Moresh Mukhedkar, 'Blind De-convolution of Microscopic Images' "IJERT" pp. 4100-4102.
[3] H. Riyaz Fathima, K. Madhan Kumar, 'Evaluation of blind image Restoration' "International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)", Vol. 3, Issue 12, pp. 4210-4215 December 2014.
[4] Mohammad tofighi, Onur Yorulmaz, Kıvanc¸ K¨ose, Reng¨ul C 'Phase and TV Based Convex Sets for Blind De-convolution of Microscopic Images' "IEEE journal topic in signal processing, oct, 25, 2015.
[5] Pratibha Sharma, Jitendra Kumar 'Blind Deconvolution Deblurring Technique In Image Processing'.
[6] Dr. Salem Saleh Al-amri and Dr.Ali Salem Ali 'Restoration and De-blured Motion Blurred Images' "IJCSI International Journal of Computer Science Issues, Vol. 11, Issue 1, No 1, , pp. 168-172, January 2014.
[7] Yun Q. Shi Huifang Sun, 'Image and video compression for Multimedia Engineering second edition'.

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