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Restoration and Deblured Motion Blurred Images

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Abstract—This paper attempts to undertake the study of Restored Motion Blurred Images. by using four types of techniques of deblurring image as Wiener filter, Regularized filter,Lucy Richardson deconvlution algorithm and Blind deconvlution algorithm with an information of the Point Spread Function (PSF) corrupted blurred image with Different values of Length and Theta and then corrupted by Gaussian noise. 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 deblurring image. also this paper 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 deblurring image of this techniques.

Keywords: Blur/Types of Blur/PSF; Deblurring/Deblurring Methods.

I. INTRODUCTION

The restoration image is very importing process in the image processing to restored the image by using the image processing techniques to easily understand this image without any artifacts errors in this case there are many studies are taken in that scope and this some of these studies:

In blind deconvolution, the goal is to deblur an image with (total of partial) lack of knowledge about the blurring operator to solve this problems he is proposed two alternative approaches to blind deconvolution: (i) simultaneously estimate the image and the blur (ii) perform a previous step of blur estimation and then feed this blur estimate to a classical non-blind image deblurring algorithm [1].the present a novel algorithm to estimate direction and length of motion blur, using Radon transform and fuzzy set concepts. This method was tested on a wide range of different types of standard images that were degraded with different directions (between 0° and 180°) and motion lengths (between 10 and 50 pixels). The results showed that the method works highly satisfactory for SNR >22 dB and supports lower SNR compared with other algorithms [2].For correct restoration of the degraded image; it is useful to known the point-spread function (PSF) of the blurring system. We are propose straightforward method to restore motion blurred images given only the blurred image itself, the method first identifies the PSF of the blur and then use it to restore the blurred image with Standard restoration filters [3].The conventional Lucy-Richardson (LR) method is nonlinear and therefore its convergence is very slow. We present a novel method to accelerate the existing LR method by using an exponent on the correction ratio of LR; we present an adaptively accelerated Lucy-Richardson (AALR) method for the restoration of an image from its blurred and noisy version. That proposed AALR method shows better results in terms of low root mean square error (RMSE) and higher signal-to-noise ratio (SNR), in approximately 43% fewer iterations than those required for LR method [4].

II. BLURRING

Blur is unsharp image area caused by camera or subject movement, inaccurate focusing, or the use of an aperture that gives shallow depth of field. The Blur effects are filters that smooth transitions and decrease contrast by averaging the pixels next to hard edges of defined lines and areas where there are significant color transition.

A. *Blurring Types*

In digital image there are 3 common types of Blur effects:

1. Average blur

The Average blur is one of several tools you can use to remove noise and specks in an image. Use it when noise is present over the entire image.

This type of blurring can be distribution in horizontal and vertical direction and can be circular averaging by radius R which evaluated by the formula:

$$R = \sqrt{h^2 + v^2}$$

Where: h is the horizontal size blurring direction and v is vertical blurring size direction is the radius size of the circular average blurring

2. Gaussian blur

The Gaussian Blur effect is a filter that blends a specific number of pixels incrementally, following a bell-shaped curve. The blurring is dense in the center and feathers at the edge. Apply Gaussian Blur to an image when you want more control over the Blur effect.

3. Motion blur

The Motion Blur effect is a filter that makes the image appear to be moving by adding a blur in a specific direction.

The motion can be controlled by angle or direction (0 to 360 degrees or –90 to +90) and/or by distance or intensity in pixels (0 to 999), based on the software used.

III. DEBLURRING

A. Deblurring Model

A blurred or degraded image can be approximately described by this equation:

$g(x,y) = PSF*f(x,y)+ \eta(x,y)$,

Where: g the blurred image, PSF distortion operator called Point Spread Function, f the original true image and η Additive noise, introduced during image acquisition, that corrupts the image

1. Point spread function (PSF)

Point Spread Function (PSF) is the degree to which an optical system blurs (spreads) a point of light. The PSF is the inverse Fourier transform of Optical Transfer Function (OTF).in the frequency domain,the OTF describes the response of a linear, position-invariant system to an impulse.OTF is the Fourier transfer of the point (PSF).

B. Deblurring Methods

Our paper applying four methods deblurring image:

1. Wiener filter deblurring method

Wiener filter is a method of restoring image in the presence of blur and noise. The frequency-domain expression for the Wiener filter is:

$W(s) = H(s)/F^{+}(s)$, $H(s) = F_{x,s}(s)\, e^{as} / F^{-}_{x}(s)$

Where: F(s) is blurred image, $F^{+}(s)$ causal, $F^{-}_{x}(s)$ anti-causal

2. Regularized filter deblurring method

Regulated filter is the deblurring method to deblured an Image by using deconvlution function deconvreg which is effectively when the limited information is known about additive noise**.**

3. Lucy-richardson algorithm method

The Richardson–Lucy algorithm, also known as Richardson–Lucy deconvolution, is an iterative procedure for recovering a latent image that has been the blurred by a known PSF.

$$C_i = \sum_j p_{ij}\, u_j$$

Where

Pij is PSF at location i and j,u_j is the pixel value at location j in blurred image.

C_i is the observed value at pixel location i.

Iteration process to calculate u_j given the observed c_i and known p_{ij}

$$u_j^{(t+1)} = u_j^{t} \sum_i \frac{C_i}{c_i} p_{ij}$$

Where

$$c_i = \sum_j u_j^{(t)} p_{ij}$$

4. Blind deconvolution algorithm method

Definition of the blind deblurring method can be expressed by:

$g(x, y) = PSF * f(x,y) + \eta(x,y)$

Where: g (x, y) is the observed image, PSF is Point Spread Function, f (x,y) is the constructed image and η (x,y) is the additive noise term [1].

(a)

(b)

Fig. 1

Four types of deblurring methods are implemented: Wiener Filter Deblurring Method, Regularized Filter Deblurring Method, Lucy-Richardson Algorithm Method and blind Algorithm Method applying with PSF is known in the two cases:

(i) When no add noise to the image (ii) with add noise to the image. Also same four methods are applying with no information about PSF.

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IV. SIMULATION RESULTS

The performance results applied by two cases of the PSF function:

A. Deblurring with Known PSF

The performance evaluations of the deblurring operation with known PSF can be implemented by two categories: the first category is a known amount of blur, but no noise, was added to an image, and second category is a known amount of blur and noise add to the image then the image was filtered to remove this known amount of blur and noise using Wiener, regularized, Lucy-Richardson and blind Algorithm deblurring methods.

In the first category the regularized,Wiener and blind techniques produced what appeared to be the best results but it was surprising that the Lucy-Richardson technique produced the worst results in this instance see this result in the figure(2)

Fig. 2: Deblurring Image without add Noise When PSF Known, Image Blurred by Motion Blurred Length =10 and Theta=50

Fig. 3: Deblurring Image without add Noise when PSf Known, Image Blurred by Motion Blur Length= 20 and Theta=150.

In second category when Gaussian noise was added to the image in addition to blur the Lucy-Richardson algorithm actually performed the best results from the Wiener, Regularized and Blind techniques. These results can be seeing in the figures (4).

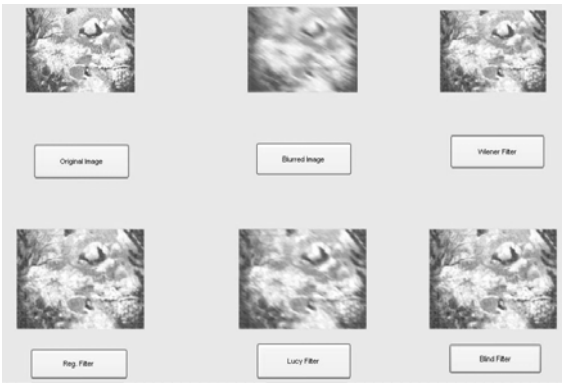

Fig. 4: Original Image with add Gaussian Noise Alfa=0.5 when PSF Known

B. Deblurring with no PSF Information

When no information about the original PSF the above techniques is not very useful techniques to Deblurring images. In this case applied another technique is called Blind deconvlution technique after execute the guess of the PSF, the number of iterations and the weight threshold of it.

Fig. 5: Deblurring Image with no Information of PSF

After much experimentation, it turned out that the weight threshold should be set between 0.10 and 0.25, the PSF matrix size should be set to 15x15, and the number of iterations should be any number more than 30.in this paper the best result is get when the PSF size is 15*15, iteration is 80 and weight threshold is 0.2 which illustrated in the figure (5)

V. CONCLUSION

In this paper, the comparative studies take two case of :the first case with an information about PSF an second case with no any information about PSF.in first case a comparative studies are explained & experiments are carried out for different techniques Wiener filter, regularized filter is the best techniques to deblurring of image sensing when don't noise in image see this in the figure(2)and (3). But when noise is presented with blur the Lucy-Richardson algorithmic technique is the best techniques see in the figure (4).second case of the

comparative study is explained & experiments are carried out for different techniques blind deconvelution algorithmic technique is the best techniques when the PSF size is 15*15, iteration is 80 and weight threshold is 0.3 which illustrated in the figure (5).

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