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A STUDY ON IMAGE RECONDITIONING TECHNIQUES BASED ON NOISE CALCULATION USING FILTERS

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Abstract- Image restoration is the process of attempting to restore the degraded image. In other words, Image restoration is the process of bringing a corrupt/noisy picture and acquire the image that is as close as possible to the original image. Corruption in any image means the image that captured will be in the form of a blurred image, noisy or camera mis-focus. Sometimes a picture can also get corrupted or degraded because of diverse climatic change [1]. As the images play a prominent role in various areas such as medicine, science and research image acquisition and restoration is one of the important technique used. In this paper, different imagerestoration methodsbased on noise calculation using different filters such as inverse filter, Weiner Filter,Geometric Mean Filter and Blind De-convolution are discussed.
Keywords– Image restoration, image acquisition, degraded image.

1. INTRODUCTION

Image restoration was started in the year 1950's. There is two steps in image restoration, first we need to understand which degradation method has to be used and try to reverse it. Image restoration uses a priori knowledge of the degradation.Image restoration algorithms differentiated themselves from image enhancement techniques, in that they are based on models for the degrading process and for the ideal image. In image enhancement the picture features are extracted rather than restoration of degraded image [1]. Image enhancement is the process where the degraded image is handled and the visual appearance of the imageis improved.Image restoration problems can be measured very precisely, whereas enhancement process is difficult to represent in mathematical form compared to the image restoration. There are a several application of image restoration such as, legitimate examinations, logical reason, film making and recorded, picture and video coding and translating and photography reason.

2. DEGRADATION AND RESTORATION PROCESS

The goal of the restoration process is to remove the degradation from the image and to obtain the resulting image which is close to the original image. The degradation process can be designed as follows:

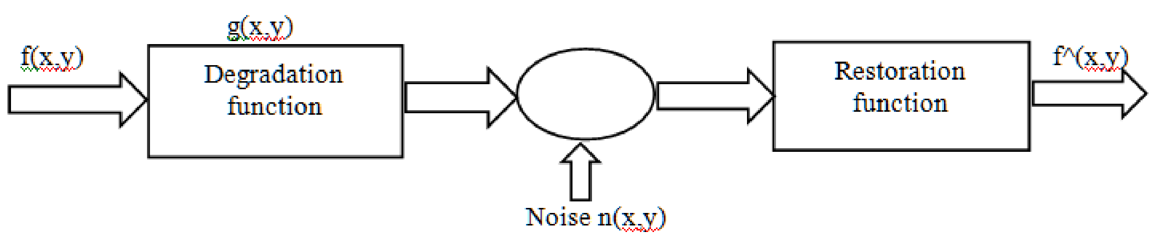

Fig 1: Degradation and Restoration Model [1]

In the above figure fig:1, f(x,y) is the original image, the noise n(x,y) that operates on the input image is calculated and added to the original image in order to produce degraded image g(x,y).The main aim of image restoration is to obtain the output that is as same as possible to the original image. We can represent this mathematically as follows,

$$g(x,y) = h(x,y) * f(x,y) + n(x,y) \quad (1)$$

The symbol * represents that convolution from claiming h(x, y) for f(x, y). Looking at fig 1, it's clear that the original image f(x,y) gets convolved with the corrupted image using the degradation function h(x,y). To change over the convolutions under duplication take DFT of above condition in the recurrence space.

$$G(u,v) = H(u,v).F(u,v) + N(u,v) \quad (2)$$

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To compute (x, y) take IDFT of condition (2)

$$G(u,v) = \frac{h(x,y)}{M.N.} + n\,(x,y) \quad (3)$$

The condition (3) is called as Degradative drive reaction. To diminish the impact of noise from degraded image a straightforward.

3. RESTORATION TECHNIQUES

There are several image restoration algorithms such as Inverse filter, Pseudoinverse filter, Wiener filter, Blind image restoration algorithm, Recursive algorithm etc. Some of them are given below,

3.1 Inverse Filter–

Inverse filter is simplest among restoration filters. In this method, the equation (2) is divided by the degradation frequency component H(u,v) and then solve for the F(u,v).

$$F(u,v) = \frac{G(u,v)}{H(u,v)} - \frac{N(u,v)}{H(u,v)} \quad (4)$$

The above equation holds good for two conditions i.e. if N (u, v) is known and H (u, v) is not equal to zero. Then F (u,v) for noise free image is,

$$F(u,v) = \frac{G(u,v)}{H(u,v)} \quad (5)$$

This condition is called as Inverse Filtering. There is no real way to reestablish the picture segments if G (u, v) = H (u, v)=0. So opposite sifting strategy gives poor outcome if there should arise an occurrence of quiet and boisterous obscured picture. Sensor of picture might be influenced by natural conditions or unsettling influence in climate. Amid the digitization procedure commotion might be added to unique picture. There are more opportunities to degenerate a picture because of transmission process. Henceforth to keep away from the clamor condition (4) can be used as,

$$F(u,v) = G(u,v).M(u,v) - N(u,v).M(u,v) \quad (6)$$

Where, $M(u,v) = \frac{1}{H(u,v)}$ for $u^2 + v^2 w_o$

= 1 for $u^2 + v^2 w_0$

Steps in Inverse Filtering:

1. Take DFT of debased picture g(x, y) to acquire G (u, v)
2. Take DFT of debased model H (u, v)
3. Register F (u, v)
4. Take IDFT to get restore picture f^(x, y).

Disadvantages of Inverse filter:

1. Properties of original picture are not utilized
2. Inverse filters might be difficult to constructed and that may not exist
3. Inverse filters are delicate to noise

3.2 Pseudo Inverse Filtering-

To overcome the drawbacks of the inverse filter given above Pseudo inverse filtering can be used. It is the modified form of inverse filtering[1]. Pseudo inverse filtering can be defined as,

If H (u, v) 0, then ➡

$F(u,v) = \frac{G(u,v)}{H(u,v)}$………..……… for H (u, v) 0,

= 0 ……...........……for H (u, v) = 0

Pseudo inverse filtering give preferable outcome over inverse filtering. The inverse filtering and pseudo inverse filtering are delicate to noise. This is the limitation of these two filtering technique for de-convolution.

3.3 Wiener Filtering-

The primary disadvantage of inverse and pseudo inverse filtering is that they are delicate to noise. As the wiener separating isn't sensitive to noise the disadvantages of inverse filter and pseudo inverse filter can be overcome in wiener filtering.It removes the added noise and transforms the blurring all the while. The Wiener filtering is ideal as far as the mean square error. In many images, nearby pixels are profoundly associated, while the dark level of generally isolated pixels are just loosely connected[2].

Consequently, the autocorrelation capacity of commonplace pictures decrease from the starting point. Power range of a picture is the Fourier change of its autocorrelation function, consequently we can contend that the power range of a image by and large reductions with frequency. Common noise sources have either a level power range or one that diminishes with recurrence more gradually than run of the mill picture control range[2].Hence, the normal situation is for the signal to command the range at low frequencies, while the noise rules the high frequencies.

$$w(f_{1,}f_2) = \frac{H*(f_1,f_2)S_{xx}(f_1,f_2)}{|H(f_1,f_2)|^2 S_{xx}(f_1,f_2)+S_{nn}(f_1,f_2)} \quad (7)$$

Where Sxx (f1,f2), Sηη(f1,f2) are separately control spectra of the original image and the added noise, and H(f1,f2) is the blurring filter. Wiener filter has two separate parts, an inverse filtering part and a noise smoothing part. It plays out the deconvolution by inverse filtering (highpass sifting) and evacuates the noise with a pressure operation (lowpass filtering).

Advantages of Wiener filter:

1. Simple to design.
2. Starts to exploit signal.
3. They are not delicate to noise.

Disadvantages of Wiener filter:

1. To appraise control range thickness earlier knowledge of noise and flag is required.
2. It gives fixed frequency reaction at all recurrence.
3. Results are regularly excessively blurred.

D. Blind image de-convolution-

Kundur [3] proposed „Blind picture de-convolution" Algorithm. At the point when point spread function (PSF) isn't known at that point blur image de-convolution technique is utilized to recoup the original image from its arrangement of blurred images [3]. On the off chance that blurred portion is obscure at that point blurred de-convolution is helpful to recover the sharpness of blurred image. PSF is reverse of Fourier change. When there is added noise, image spectral thickness it is possible to restore the image by using blind devolution method. Mathematically it can be composed as,

y=k x

Where x is sharp image and k is a non-negative blur piece.

In this method the first step is we need to make a calculate of the blurring operator i.e. PSF and at that point utilizing that estimate we need to deblur the picture. This strategy can be performed iteratively and in addition non-iteratively. In iterative approach, every emphasis enhances the estimation of the PSF [5] and by using that assessed PSF we can enhance the resultant image more than once by conveying it nearer to the original image. In non-iterative approach one application of the algorithm based on exterior data is extract the PSF and this separated PSF is utilized to reestablish the original from the corrupted one.

4. CONCLUSION

In this paper various types of image restoration filtersare studied and explained with their advantages and disadvantages.As compared to inverse filter wiener filter gives accurate as it is less sensitive on noise.The advantage of using Blind De-convolution algorithm is to deblur the degraded image without prior knowledge of PSF and additive noise. But in other algorithms, we should have the knowledge over the blurring parameters. Since assurance of the correct de-noising strategy plays a prominent part, it will be basic to test and consider the procedures. Different researchers attempted to enhance the productivity of the diverse algorithms. Mostly image restoration is done by using inverse filter, inverse and pseudo-inverse filter, Weiner filter, and Blind De-convolution algorithm. New algorithms can be developed to calculate the noise in an image using different filter or existingalgorithms can be modified to get the better result.

5. REFERENCES

[1] [1] BiswaRanjanMohapatra, Ansuman Mishra, Sarat Kumar Rout "A Comprehensive Review on Image Restoration Techniques" International Journal of Research in Advent Technology, Vol.2, No.3, March 2014 E-ISSN: 2321-9637

[2] [2] F.Jin, P Fieguth, L. Winger and E. Jernigan" Adaptive Wiener Filtering Of Noisy Images And Image Sequences" 0-7803-7750-8/03/%17.000 2003 IEEE

[3] [3].Kundur and D. H., "Blind image deconvolution," IEEE Signal Processing Magazine, 1996.

[4] [4] Mr. Firas Ali/ Al-Khwarizmi Engineering Journal, "Image restoration using regularized inverse filtering and adaptive threshold wavelet denoising" Vol.3, No. 1, PP 48-62 2007

[5] [5]AnamikaMaurya, Rajinder Tiwari" A Novel Method of Image Restoration by using DifferentTypes of Filtering Techniques" ISSN: 2319-5967ISO 9001:2008 Certified International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 4, July 2014

[6] [6] Reginald L. Lagendijk and Jan Biemond"Basic Methods For Image Restoration And Identification"Lagendijk/Biemond: Basic Methods for Image Restoration and Identification 15 February, 1999