Digital Image Restoration

Ankita Patil[#1], Sumedha Devasthali[#2], Seema Gujar[#3] Nikita Jadhav[#4]

[#]*Information technology Department, Atharva college of Engineering, Malad (w), Mumbai-400095, Maharashtra, India*

patilankita770@yahoo.com
devasthali.sumedha@gmail.com
seemagujar1992@gmail.com
Nj.ms1991@gmail.com

Abstract – **Image restoration is the operation of taking a corrupted/noisy image and estimating the clean and original image. Image restoration is an important issue in high-level image processing. Images are often degraded during the data acquisition process.it is also include the process that attempt to remove degradation and restore an image to previous state**

It is a used in the various fields such as photography image, satelight image, medical image, astronomical image, remot sensing, microscopy imaging, etc.

In this paper, we compering the three image restoration techniques namely inverse filter, wieners filter and Lucy Richardson algorithm.

Keywords- **Peak Signal to noise ratio, Image Restoration, Degradation model, Richardson-Lucyalgoritham, Wiener Filter, inverse filter**

i. INTRODUCTION

Images is used for storing useful information but in many time while capturing the image or while acquiring the image some distortion is appearing in the image so the image we get is distorted image, the store image is the degraded version of the original scene. The different degradation, which are come into the image are noise,geometrical degradations,color imperfections,and blur[1].the blurring is a unsharp image area it can be caused by relative motio between the camera and the original scene for for e.g. if we want to capture the the moving object with the camera in that case because of movement of camera it is possible that the image that capture will be blurred which is known as motion blur there are many other situation if the camera are not focus properly then also image is blur. In addition to these blurring effects, noise always corrupts any recorded image [8].the noise is any undesired information that spoil image. Digital image noise is aries during the acquisition and transmission process. There are various types of noise in image processing that is Gaussian noise, Rayleigh noise, Gamma noise, exponential noise, salt and pepper noise, periodic noise,etc. In the use of image restoration methods to restore blurred and noise image. And also aims at finding out the causes of image degradation and eliminating them to a maximum possible level.

A.Degradation Model

In the real world it is very difficult to get the exact image.in case of photography or imaging system these are caused by the emulsion, motion-blur, and camera focus problems. In fig 1 show the degradation process The input image f(x, y) is two-dimensional (2D).F(x, y) is degraded by the degradation functions H which is the operate on the f(x, y).after the addition of noise n(x, y), g(x, y) gives the degraded image which we want to recover the input image f(x, y) using image restoration filter. After applying Restoration filters we obtain restored image f'(x, y). [7]

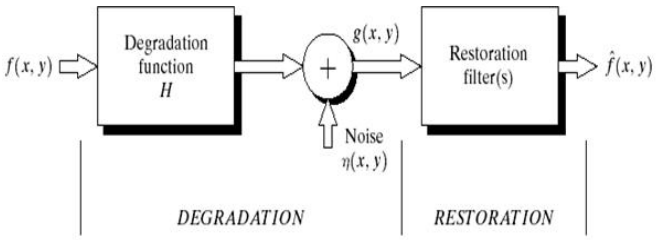


Fig: 1(a) Degradation Model

B. Blurring

This blurring may occur because of various reasons. May be, the camera setting is not proper or the lens is not focused properly. So, that leads to one kind of blurring. The other kind of blurring can be if we take a picture from a moving platform; say for example, from a moving car or from a moving train. In that case also you might have absorbed that the image that you get is not clear image.

C.Blurring Types:-

In digital image there are 4 common types of Blur effects:
1) Average Blur
2) Gaussian Blur
3) Motion Blur
4) Out of Focus Blur

ii. RELATED WORK

Image restoration used to recover or try to restore image which has been degraded by some knowledge of degradation method. It is widely used in various fields of applications, such as medical imaging, astronomical imaging, remote sensing, microscopy imaging, photography deblurring, and forensic science, etc. Often the benefits of improving image quality to the maximum possible extent for outweigh the cost and complexity of the restoration algorithms involved. We are going to implement three image restoration techniques namely inverse filter, Weiner filter and Lucy Richardson algorithm. Inverse filter is used to restore images which are degraded due to environmental conditions such as atmospheric turbulence .The main drawback of this filter is its incapability to handle noise .This is overcome by using the wiener filtering technique. As it is known that inverse filtering is incapable of handling noise we use the wiener filtering technique. It performs image restoration by combining the degradation function and statistical characteristics of noise. Lucy Richardson algorithm is a convolution algorithm which follows an iterative procedure for the recovery of the blurred image.

iii. CLASSIFICATION TECHNIQUES

For image restoration 3 techniques are used here to restore the image using SNR.
Techniques are
-Inverse filter
-Wiener filter
-Lucy Richardson Algo

A.Inverse filter

If we create a good model of the blurring function that corrupted an image, the quickest and easiest way to restore that is by inverse filtering. Unfortunately, since the inverse filter is a form of high pass filer, inverse filtering responds very badly to any noise that is present in the image because noise tends to be high frequency
F, G, N, H are in 2D-DFT domain.
$G(x,y)=F(x,y)H(x,y)+N(x,y)$ where $F(x,y)$ is the 2D-FT of an input image f'(x,y), $N(x,y)$ is a white noise with zero mean and unit variance, and $H(x,y)$ is a degradation function which is given by

$$H(x, y)=\exp [-K(x^2+y^2)^{5/6}] \quad (1)$$

2D-IFT of $G(x,y)$ is the blurred image (item 2 above) and is the output of inverse filter

B. Wiener Filter

The inverse filtering is a restoration technique for deconvolution, i.e., when the image is blurred by a known low pass filter, it is possible to recover the image by inverse Filtering or generalized inverse filtering. However, inverse filtering is very sensitive to additive noise. The approach of Reducing one degradation at a time allows us to develop a restoration algorithm for each type of degradation and simply combine them. The Wiener filtering executes an optimal tradeoff between inverse filtering and noise smoothing. It removes the additive noise and inverts the blurring simultaneously
For Wiener Filter

$$G(f_1, f_2) = \frac{H^*(f_1,f_2)\ s_{uu}(f_1,f_2)}{|H(f_1,f_2)|^2\ s_{uu}(f_1,f_2)+s_{nn}(f_1,f_2)} \quad (2)$$

C. *Lucy- Richardson Algorithm Technique[5]*

The Lucy-Richardson algorithm is an iterative technique originally used for the restoration of astronomical images in the presence of Poisson noise it is an iterative procedure in which the pixels of the observed image are represented using the PSF and the latent image as follows:

$$D_i=\Sigma p_{ij}u_j \quad (3)$$

where p_{ij} is the point spread function (the fraction of light coming from true location j that is observed at position i), u_j is the pixel value at location j in the latent image, and d_i is the observed value at pixel location i. The statistics are performed under the assumption that u_j are Poisson distributed, which is appropriate for photon noise in the data.
The basic idea is to calculate the most likely u_j given the observed d_i and known p_{ij}. This leads to an equation for u_j which can be solved iteratively according to

$$u_j^{(t+1)} = u_j^{(t)} \sum_i \frac{d_i}{c_i} p_{ij} \quad (4)$$

Where

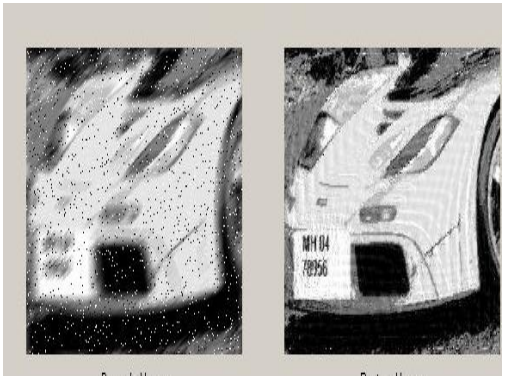
$$c_i = \sum_j p_{ij} u_j^{(t)}. \quad (5)$$

It has been shown empirically that if this iteration converges, it converges to the maximum likelihood solution for u_j

iv. EXPERIMENTAL RESULT

(a) (b)

(c) (d)



(e) (f)

Fig: 4(a**)** Degraded Image (b) Image after Lucy Richardson algorithm (c) Degraded Image (d) Image after Inverse Filtering (e) Degraded Image (f) Image after wiener Filter

To find SNR:

SNR	Angle	Length	Image Restoration Techniques		
			Lucy	Inverse	Wiener
10	45	6	11.8423	12.8899	14.5264
30	45	6	11.8441	12.8512	14.5329
50	45	6	11.8449	12.9172	14.5339

v.CONCLUSION

In this paper, this is going to implement the comparison between the three algorithms for searching better restoration technique. The Lucy Richardson that provide better restoration based on as compare to Inverse filter and Wiener filter

vi. FUTURE SCOPE

A digital image is a noisy realization of a scene. The SNR is limited by the quantum nature of light. The resolution is degraded by the finite lens aperture of the imaging system due to wave description of light.

Image restoration aims at:

A) Improving the image resolution beyond the systems bandwidth.

B) Improving the peak signal to noise ratio.

The purpose of image restoration is to produce the best estimate of the source image, given the recorded data and some apriori knowledge.Restoration allows recovery of the image, removing noise, enhancing brightness, color and details.

REFERENCES

1] Charu Khare, Kapil Kumar Nagwanshi, "Implementation and Analysis of Image Restoration Techniques".

[2]Charu khare and Kapil kumar Nagwanshi "Image Restoration Technique with Non Linear Filter"

[3]Mr. Ankur. N. Shah, Dr. K. H. Wandra"Introduction to noise, image restoration and comparison of various methods of image restoration by removing noise from image.

[4]EdmundY."Image resroration digital Photography"

[5]Amandeep Kaur, Dept. of CSE, EM, Kapurthala, Punjab, India."A Comparative Study and Analysis of Image Restoration Techniques Using Different Images Formats"

[6]Ali Said Ali Awed, "A Comparision between Previously known and Two Novel Image Restoration Algorithm

[7]K. R. castle man, "Digital Image Processing", International Edition,Prentice-Hall, Inc., 1996

[8]Aizenberg I., Bregin T., Butakoff C., Karnaukhov V., Merzlyakov N.And Milukova O., "Type of Blur and Blur Parameter". In: J.R. Dorronsoro (ed.) Lecture Notes in Computer Science, Vol. 2415, Springer-Verlag, Berlin, Heidelberg, New York (2002) 1231-1236.

