International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

A Comparative Approach for Analysis of Image Restoration using Image Deblurring Techniques

Pooja Dhole†* and Nitin Chopde†

†Computer Science and Engineering, SGBAU, G. H. Raisoni College of Engg. and Technology, Amravati, India

Accepted 04 April 2015, Available online 10 April 2015, **Vol.5, No.2 (April 2015)**

Abstract

Image restoration is a very important factor in high level image processing which deals with recovering of an original, cleared sharp image using a various algorithms and techniques. Certain time during image capturing process degradation i.e image degradation occurs. Image restoration is used to get the original sharp image from the corrupted data. This research paper is aim to provide a comparative overview of most useful fast restoration of degraded image .Different types of image deblurring techniques are Wiener Filter, Neural Network Approach, Iterative Richardson-Lucy Algorithm, Laplacian Sharpening Filter described. The strength and weakness of each approach are identified and applications are also described so that the best fast image deblurring technique is comparatively sorted out.

Keywords: *Wiener Filter, Neural Network Approach, Iterative Richardson-Lucy Algorithm, Laplacian Sharpening Filter.*

1. Introduction

Image restoration is one of the essential techniques used in high level image processing in which it deals with recovery of sharp and clear original image from degraded sorts. Various algorithm have been design to achieve the original sort from this degrade one. Certain time there are various problem which make our important set of image to get blurred. To overcome from this sort various techniques have been introduced. Out of this some of most fast and efficient techniques have been comparatively elaborated here.
Image deblurring is the procedures that try to reduce the blur in this degrade set of image. It grant the degrade image an sharp and overall clear appearance to obtain the very significant view of it. In practical situation, however one may not be able to obtain this information directly from the image formation process. The aim of blur identification is to determine the attributes of imperfect imaging system from the observed degraded image itself prior to the restoration process (Anamika Maurya, 2014).

Varoius tools are provided for image processing one of it is natural image statistic. Some of the tasks like denoising, deblurring, deconvolution which is very important to apply to the set of images we have captured as well as that are corrupted by the fault of device, human or environment. This image statistic is one of the tools which use to yield high-quality set of clear images. The set of various deblurring technique is also embedded to recover and restore images (Vishakha Chourasia, 2014).

2. Literature Review

Image Restoration means the way to get the good form of image from the degrade one. This degradation may make the image to get blurred and thus the efficient view of it is difficult. Every sort of natural image have certain kind of degradation. this degradation may occur during (Anamika Maurya,2014):

- display mode
- camera stands in the acquisition mode
- processing mode

This unwanted blurring in image may be due to (Anamika Maurya, 2014):

- relative motion of object-camera
- sensor noise
- camera misfocus
- random atmospheric condition
- some other reasons also.

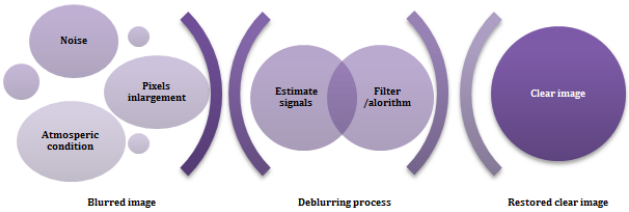
Image restoration result depends on:

- original image information contained
- degradation level

*Corresponding author: **Pooja Dhole**

- reason causing degradation
- working accuracy of restoration model

Image restoration model



2.1. Image restoration model

3. Blurring and PSNR

Blurring can be classified as:

- Gaussian Blur
- Motion Blurr
- Out-of-focus Blurr
- Average Blurr

PSNR

Peak signal-to-noise ratio, often abbreviated PSNR, is a digital engineering and mathematical term for the ratio between the biggest possible power of a signal and the power of degrading or corrupting noise that affects the actual its representation (Dejee Singh, 2013).

4. Deblurring Technique

- *Wiener Filter*

The Weiner filter is one of most general technique used for deblurring the degrade image. This technique was proposed by Nobert Weiner in 1940(K. M. Pimple Km Pimple, 2014).It helps to remove out the Gaussian blurr from the images. Generally linear time invariant filtering technique is used for removing out the corrupted sort of signals.

The Wiener filter reduces the mean square error (MSE) between the estimated process and the desired process. Its main aim is to compute a statistical estimate of an unknown supplied signal using a related signal as input and filtered that known signal to produce the estimate of signal as an output. It filter out the noisy corrupted signal from the estimate supplied to have clear and noise free sharp image.

As it is statistical approach, pervious knowledge about the signals and image is required. A statistical account of the technique is given in the minimum mean-square error (MMSE) which helps to enhance the estimator quality. It is an non-blind technique comparatively slow to apply (Anamika Maurya, 2014; K. M. Pimple Km Pimple, 2014).It provide the full rank performance in interference suppression (Zohair Al-Ameen,2012).It basically used to perform inversion of blurring and remove additive noise (Amandeep Kaur,2012).

The Weiner filter has variety of application:

- Signal processing
- Image processing
- DE convolution
- Noise Reduction

4.1. Weiner Filter Example

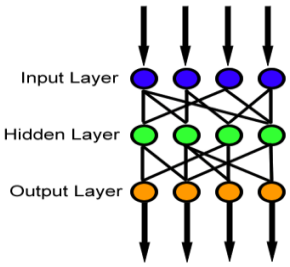
- *Neural Network Approach*

Neural networks are a combinations of different types of learning algorithms which are inspired and taken by biological neural networks and are used to calculate or approximate functions that can depend on a huge number of inputs and are actually unknown. Artificial neural networks are usually presented as systems of interconnected sets or unique "neurons" which can computing values from inputs, and are capable of performing machine learning as well as pattern recognition. Warren McCulloch and Walter Pitts (1943) created first time a computational model for neural networks which was actually based on mathematics and algorithms. To determine organization and control of the function involved in it systems use algorithms in their programming.

The Neural network doesn't require any prior knowledge as it used to know the blurred in learning phase in hidden layer. Actual knowledge of signals, pixels and blurred patch is known by estimating actual relationship between degraded pixel in supplied blurr image and corresponding pixels in original image. Establishment of functional mapping is done nonlinearly (Vishakha Chourasia, 2014).

The neural network has variety of applications:

- Micro-machining
- Neuroscience
- Real life application



4.2. Working model of neural n/w filter

- *Laplacian Sharpening Filter*

The Laplacian filter is an very well-known example of a second order derivative method of image enhancement which is used for image sharpening means indirectly for image deblurring. It is significantly good at finding the fine specifications in a blurred image. Any feature with a sharp discontinuity will be enhanced by a Laplacian filter which smoothened the image by deblurring it.

Laplacian Sharpening highlights regions of rapid intensity change and therefore highlights or enhances the edges. The result is an image that appears more in focus.The output of a Laplacian filtering techinique is not an actual clear image but we have to do somewhat more work so that we get our final image. Basically the mathematical operation like subtract or add the actual Laplacian output from the original image to give out our final sharpened enhanced restored image as per we are using positive or negative laplacian (Neeraj Kumar, 2012).

The laplacian sharpening filters have variety of application:

- Image processing where it is known as the Laplace filter
- In machine learning for clustering
- Semi-supervised learning on neighborhood graphs

4.3. Laplacian Filter Example

- *Iterative Richardson-Lucy Algorithm*

The Richardson-Lucy iterative algorithm is the deconvolution technique which is most popular used in the field of image processing. The most important feature is that it do not concern the type of noise affecting the image (Amandeep Kaur,2012). The **Richardson–Lucy algorithm**, also known as **Lucy–Richardson algorithm** does not need any information of the original image. But here the amount of noise get increased as we raise the numbers of iteration otherwise it works in presence of noise also. It actually helps to recovering a degrade image that has been blurred by a known point spread function. William Richardson and Leon Lucy(1974), put it independently in this field and so this technique was called by his name (Pradeepa Natarajan, 2014).It uses Bayesian Based Iterative Method of image restoration.

It has number of features as (K. M. Pimple Km Pimple, 2014):

- It requires a manageable amount of computer time.
- Conserving flux in both way globally and locally at every iteration it tries to restored image.
- Show robustness towards the point-spread function (PSF) small errors.

4.4. Iterative Richardson-Lucy Example

- *Comparison Of Different Deblurring Techniques*

This work makes a comparison between different deblurring techniques. Following are tabular results obtained after the comparison.

Table 1 Comparative parameters

Algorithms	Type of blurr	Rating	PSNR
Wiener filter	Gaussian	*	17.06
Neural Network	*Gaussian, Out-of-focus*	****	*31.10*
Iterative Richardson-Lucy Algorithm	Gaussian	**	19.65
Laplacian	Gaussian	***	31.02

*= Worst Result **=Good ***=Better ****=Best

Conclusion

After having a comparative analysis of image restoration using image deblurring technique we learnt about different sort of technique. Some algorithm belongs to Gaussian blurr which is the major one and some belong to the out of focus. Every technique when seen independently it is good in its own criteria. But when we have the comparative analysis of this sort it makes one better than order. Some algorithms are linear while some are non-linear. But still when taken all together neural network approach is much better. Having a higher value for PSNR is efficient and good because it means that the ratio of peak signal-to-noise is higher. The performance of neural network method is also very efficient and PSNR value is 31.10 while

Wiener filter method has Lowest PSNR value i.e. 17.06. In this sort it means neural is much better. Having certain prior knowledge about noise and blurr the iterative Lucy-Richardson Algorithm gives better results than wiener filtering In this paper, we come to conclude that method for image deblurring using neural networks is much good. This method assumes no prior knowledge of the blur and it is efficient and fast to apply.

References

Anamika Maurya, Rajinder Tiwari (July 2014), A Novel Method of Image Restoration by using Different Types of Filtering Techniques, *International Journal of Engineering Science and Innovative Technology (IJESIT)* ,Volume 3, Issue 4.

K. M. Pimple Km Pimple (2014), Image Restoration Techniques: A Comparative Study Based On Performance Parameters, *IJPRET*, Volume2 (9): 518-525.

Vishakha Chourasia, Sanjay Agrawal (June 2014), Critical Analysis of Techniques used for Image Deblurring, *IJRCSSE*, ISSN: 2277 128X Volume 4, Issue 6.

Dejee Singh, Mr R. K. Sahu (December 2013),A Survey on Various Image Deblurring Techniques, *International Journal of Advanced Research in Computer and Communication Engineering*(IJARCCE), Vol. 2, Issue 12

Neeraj Kumar, Rahul Nallamothu, Amit Sethi(2012),Neural Network Based Image Deblurring, *IEEE*, 11th symposium on Neural Network Applications in Neural 2012,faculty of electrical Engineering, University of Belgrade, Serbia.

Zohair Al-Ameen, Ghazali Sulong and Md. Gapar Md. Johar (July 2012), A Comprehensive Study on Fast image Deblurring Techniques ,*International Journal of Advanced Science and Technology* ,Vol. 44

Amandeep Kaur, Vinay Chopra (2012), A Comparative Study and Analysis of Image Restoration Techniques Using Different Images Formats, *International Journal for Science and Emerging Technologies with Latest Trends* 2(1): 7-14.

Michael L. Honig, J. Scott Goldstein (June 2002), Adaptive Reduced-Rank Interference Suppression Based on the Multistage Wiener Filter, *IEEE transactions on communications*, Vol. 50, No.6.

Pradeepa Natarajan (2014), Iterative Richardson-Lucy Based Improved Fast Image Deblurring and Denoising Approach, *International Journal For Advance Research In Engineering And Technology (*ICIRET*)*, ISSN 2320-6802.