International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970)
Volume-3 Number-3 Issue-11 September-2013

Implementation of Fast Deblurring Process on Segments of Image by Blind Deconvolution Algorithm

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Abstract

The objective of image restoration is a process of reconstruction the primitive scene from degraded image. In this work we have emphasised an idea about the parallel computing for image restoration which is not done yet in literature survey through conventional image restoration approach. In conventional linear image restoration process, the blurring function is given, and the degradation course is improved through one of the many known restoration algorithms. Blind image is a process of deliverance of estimating the primary image from the degraded image by using partial information about the imaging system. And we also apply "row" and "column" method for portioning grey scale image in six parts and individually blurring each part, than we apply blind deconvolution algorithm in each part parallel by creating six tasks. By this approach we obtain deblur image rapidly from highly blur image. The blur point spread function (PSF) is assumed uniform in all parts of gray scale image.

Keywords

Blind Image Deconvolution, Degradation model, ringing effects, Point spread function (PSF), IP algorithm and parallel and distributed computing.

1. Introduction

In this age the use of imaging technology is a significant part of scientific research, recovering an approximation of an original image is the process of image deblurring. To obtain true image it is essential by removing the effect of blur and noise on a corrupted image. In this paper consider the commonly used post processing technique of image deblurring with a spatially invariant blurring operator (i.e., deconvolution). This process plays an important role in numerous scientific applications including biomedical imaging, seismic imaging biology, medicine and astronomy.

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Deconvolution is a process which performed for image restoration in many areas such as remote sensing medical imaging in most of the cases the PSF (Point spread function) must be known prior to the deconvolution procedure. Non-blind deconvolution process is also referred to classical image restoration problem. There are some methods used for deconvolving for this situation such as inverse filtering, least squares filtering, recursive kalman filtering, wiener filtering and constrained iterative deconvolution methods. The true image is identified by using partial or no information about the PSF (blur function). There are some situations, where the PSF (blur function) unknown, and little amount of PSF is available about true image [1].

Such an estimation problem, are known as blind deconvolution. Expression shows that in practice some information is needed to successfully restore the image [2].The expression is as follows:

$$K(x, y) = g(x, y) * f(x, y) + \eta(x, y) \quad \ldots\ldots\ldots (1)$$

2. Degradation model

In the model of image degradation figure 1, [3] the observed image k(x, y) can be characterized by its degradation function f(x, y). The noise η (x, y) is assumed to be a Gaussian white noise with zero means. If the degradation function f(x, y) is linear and space invariant function, then the observed blurred/noisy image in spatial domain is given by: -

$$K(x, y) = g(x, y) * f(x, y) + \eta(x, y) \ldots \quad (2)$$

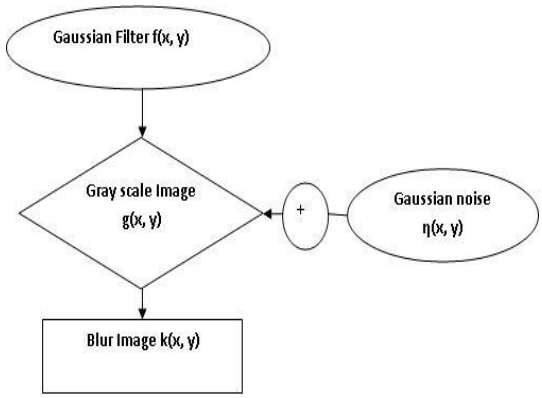

Figure 1: Image Degradation Model

3. Image partitioning

The goal of image partitioning is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects. Image partitioning is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. In this paper we use IP Algorithm to perform image partitioning, as following: -

IP (Image Partitioning) algorithm
Step 1: Read original image I.
Step 2: Convert image I into gray scale image N.
Step 3: Store the value of Row Column of image N.
[R, C] = size (N);
Step 4: Applying partition on image N into six parts A, B, C, D, E, and F.
A = N (1: r/2, 1: c/3)
B = N (1: r/2, c/3+1: c/1.5)
C = N (1: r/2, c/1.5+1: c)
D = N (r/2 + 1: r, 1: c/3)
E = N (r/2 + 1: r, c/3 + 1: c/1.5)
F = N (r/2 + 1: r, c/1.5 + 1: c)
In above IP algorithm we store row and column value of gray scale image in variable N. Then we assign four points on column and three points on row of gray scale image and assign each part to individual variable. By this method IP algorithm divide gray scale image into six parts with equal intensity values.

4. Blind Deconvolution Algorithm

The Blind Deconvolution Algorithm can be used effectively when no information about the distortion (blurring and noise) is known. The algorithm restores the image and the point-spread function (PSF) simultaneously. Images deblurring process is consist of two type's image that is non-Blind image and blind image. In non-blind image deblurring, the blurring operator is known through which the degraded image is restored. And in Blind technique, in which the blurring operator is unknown or little information is given about the blur function, blurring executes after guessing of PSF (blur function) and takes much iteration to give the best result.
The BDA steps are as follows [4]:-

Step 1: Read the original image (Input Image)
Step 2: Simulate a blur (PSF)(Create PSF)
Step 3: Restore the blurred image using PSFs of various sizes.(restore image)
Step 4: Analysing the restored PSF
Step5: Final deblured Image (Deblurred image)

5. Image deblurring through parallel computing

The following Fig. 2 represents the overall architecture of this paper. The grayscale image is divided into six parts than degraded or blurred each parts using degradation model to produce six blurred image. The blurred image should be an input to the deblurring algorithm. Various algorithms are available for deblurring. In literature survey blind deconvolution algorithm are used for deblurring image. After blurring process Jobmanager initialised local scheduler for call works and creates tasks than after apply blind deconvolution algorithm parallely on each parts [5]. After execution of each parts workers return each parts to jobmanager, than jobmanager assign it to client side. The result of this algorithm produces the deblurring image which can be compared with our grayscale image of original color image.

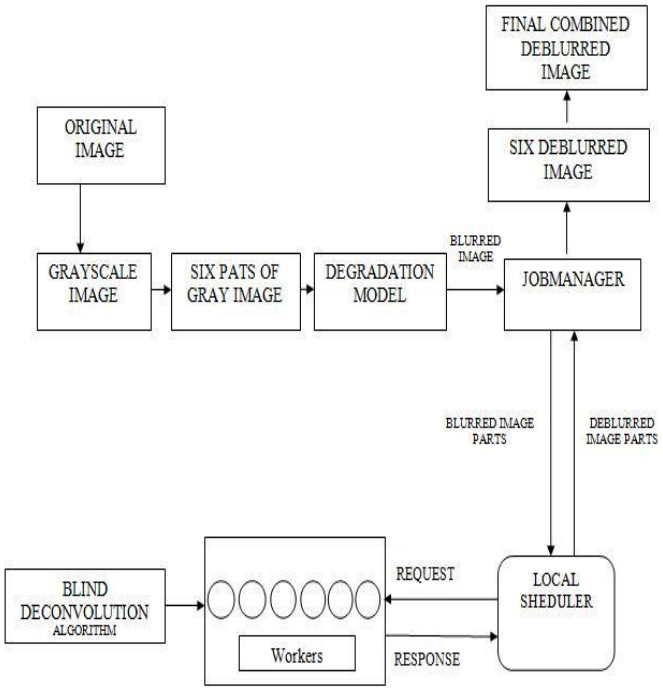

Figure 2: Overall Architecture

6. Literature Review

In 2011 Ms. S. Ramya, Ms. T. Mercy Christial, IEEE proceedings of icetect, pp.496-499, In this paper we found that authors first of all initializing length, theta values and adding noise for degradation model. Than after detecting edge of image and use edge taper

method to remove ringing effect at the edge of the image than apply blind deconvolution algorithm to deblurr image and use number of iteration for better picture quality these all process are time consuming. So we required to decreases the processing time for deblurring the blur image.

In 2010 Mr. Salem Saleh Al-amri, Dr. N.V. Kalyankar, International Journal on Computer Science and Engineering, Vol. 02, no. 03, 731-733,In this paper we found comparison among all deblurring algorithm i.e. wiener filter, Lucy Richardson, regularize filter and blind deconvolution. Author of this paper say that when we have little information about PSF than Lucy Richardson technique is best to deconvolve blur image. But in case of unknown or doesn't have any information about point spread function, blind deconvolution algorithm is best technique to deblurr a blurr image.

7. Results

In this work we have divided gray scale image in to four parts for deblurring process using parallel computing and also execute blur image in sequential manner in both cases the results was not so significant, therefore we have divided gray scale image into six parts it gives better result as compare to previous approach. Fig. 3 shows the true color satellite image.

Figure 3: Original Image of "satellite.png",

By using RGB 2 gray function we convert true color image into gray scale image because weight array can't be apply on true color image.

Figure 4: Gray scale Image of "satellite-.png",

With the help of degradation function we blur each part of gray scale image.

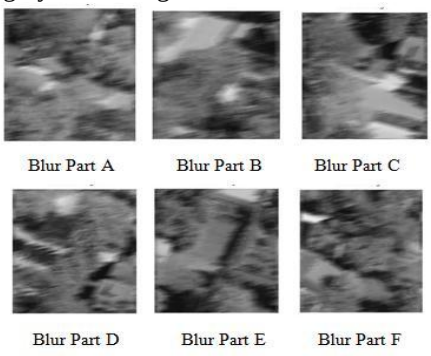

Figure 5: Six parts blurred image of "satellite.png",

By using distributed computing tool box in MATLAB and blind deconvolution algorithm we get six deblur images.

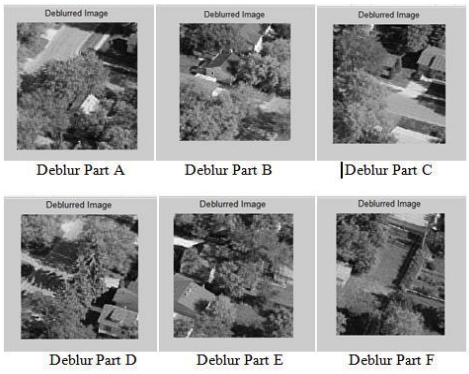

Figure 6: Six parts deblured image of "satellite.png",

Then after we combined all six deblur image to achieve final result.

Figure 7: Combined Deblured image of "satellite.png",

Table 1: Comparison Table of Sequential and Parallel Deblurring Process

Image for Deblurring	Sequential time consumption	Parallel time consumption
Flower.jpg	35.080817 seconds	29.673061 seconds
Neuro.jpg	46.310821 seconds	36.228040 seconds
Pepper.jpeg	88.337862 seconds	23.640764 seconds
House.jpg	147.561590 seconds	86.200792 seconds

8. Conclusion and Future Work

This report shows the blind image restoration problem, namely, given a number of different, blurred, and noisy PSF of a single ideal image, one wants to restore the original image. To solve this problem, a new parallel model is introduced. The restoration problem at hand in each of these approaches reduces to the problem of solving a multiple independent set of images on which algorithm is applied parallel. The algorithm is proposed that combines the benefits of the simple estimation and powerful parallel computation. An efficient iterative two-phase algorithm is presented for solving the defined problem, and convergence is assured to the optimal point.

The future work of this report is to enhance the picture quality of deblurr image by using more additional constraints and completely removing ringing effect at the edge of image. We also required to increase the deblurring process time in parallel computing by proper scheduling the task and increase the number of worker. We can also reduce the number of iteration in deblurring process for achieving improved image. If there exist number of images then in future the concept of neural network is applied to train the network.

Acknowledgment

I express my deep sense of gratitude to **Dr. Manish shrivastava, Professor and head,** department of **Information technology, Lakshmi Narayan College of Technology, Bhopal,** whose kindness valuable guidance and timely help encouraged me to complete this work. I wish to thank **my parents** for their undivided support and interest who inspired me and encouraged me to go my own way without whom I would be unable to complete my work.

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