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A Survey on Major Approaches for Image Restoration Techniques

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ABSTRACT

Image deblurring and restoration is quintessential in digital photo processing. Picture deblurring is a system, which is used to make graphics sharp and useful with the aid of utilizing mathematical model. Photo deblurring have vast purposes from client pictures, for example dispose of movement blur as a result of digicam shake, to radar imaging and tomography, e.g., do away with the outcome of imaging approach response. There were many ways that had been proposed in this regard and in this paper we can examine distinct methods and tactics of Deblurring.

Keywords: Blur Types, Image Restoration, Neural Networks, BPN (Back Propogation Network), Deblurring.

I. INTRODUCTION

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. An image is nothing more than a two dimensional signal. It is defined by the mathematical function f(x,y) where x and y are the two co-ordinates horizontally and vertically and the amplitude of f at any pair of coordinate (x, y) is called the intensity or gray level of the image at that point. When x, y and the amplitude values of f are all finite discrete quantities, we call the image a digital image. The field of image digital image processing refers to the processing of digital image by means of a digital computer. A digital image is composed of a finite number of elements, each of which has a particular location and values of these elements are referred to as picture elements, image elements, and pixels. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps:

- Importing the image with optical scanner or by digital photography
- Analysing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
- Output is the last stage in which result can be altered image or report that is based on image analysis.

II. METHODS AND MATERIAL

A. Blur Types

1) Gaussian Blur: In image processing, a Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen. The equation of a Gaussian function in one dimension is.
2) Out-of-focus Blur: When a camera images map a 3-D scene onto a 2-D imaging plane, some parts of the scene are in focus while other parts are not. If the aperture of the camera is circular, the image of any

point source is a small disk, known as the circle of confusion (COC). The degree of defocus (diameter of the COC) depends on the focal length and the aperture number of the lens, and the distance between camera and object.

3) Motion Blur: The Many types of motion blur can be distinguished all of which are due to relative motion between the recording device and the scene. This can be in the form of a translation, a rotation, a sudden change of scale, or some combinations of these. The Motion Blur effect is a filter that makes the image appear to be moving by adding blur in a specific direction
4) Average Blur: The Average blur is used when noise is present over the entire image. This type of blurring can occur in horizontal and vertical direction and can be circular averaging by radius R which is represented by the formula:

$$R = \sqrt{g^2 + f^2} \qquad (1)$$

5) Where: g is the size of blur in horizontal direction and f is size of blur in vertical direction and R is the radius of the circular average blur.

B. Image Restoration Process

Restoration improves image in some predefined sense. It is an objective process. Restoration attempts to reconstruct an image that has been degraded by using a priori knowledge of the degradation phenomenon. Restoration refers to a class of methods that aim to remove or reduce the degradations that have occurred while the digital image was being obtained. All natural images when displayed have gone through some sort of degradation:

a) During display mode
b) Acquisition mode, or
c) Processing mode

The degradations may be due to

a) Sensor noise
b) Blur due to camera miss focus
c) Relative object-camera motion
d) Random atmospheric turbulence
e) Others

Degradation Model

The block diagram for our general degradation model is:

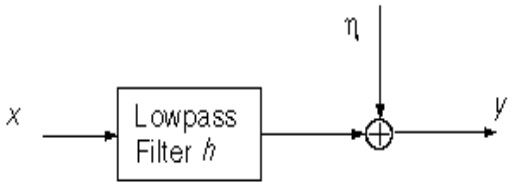

Figure 1: Image Degradation

Where *g* is the corrupted image obtained by passing the original image *f* through a low pass filter (blurring function) *b* and adding noise to it. One of the major image restoration methods is Blind Deconvolution algorithm method .The current approach tries to apply Blind Decon- volution Algorithm Method for detecting blur when size of PSF is unknown the formale for approach is:

$$g(x,y) = PSF * f(x,y) + n(x,y) \qquad (2)$$

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 .

C. Types of Deblurring Techniques

Some of the major Deblurring techniques are as given below:-

1) Lucy-Richardson Algorithm Technique: 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.The technique is represented by:-

$$Ci = \Sigma j\ pijuj \qquad (3)$$

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

$$uj = uj\ t\ \Sigma j\ pij \quad (4)$$

Where

$$Ci = \Sigma j\ uj\ t\ .\ pij \quad (5)$$

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

2) Neural Network Approach: Neural networks is a form of multiprocessor computer system, with simple processing elements, a high degree of interconnection, adaptive interaction between elements, When an element of the neural network fails, it can continue without any problem by their parallel nature. Here we are using Back propagation neural network approach for image restoration. This approach is capable of learning complex non-linear functions is expected to produce better structure especially in high frequency regions of the image. We used a two-layer Back propagation network with full connectivity.

III. RESULTS AND DISCUSSION

Related Work

(Dr.P.Subashini, Ms.M.Krishnaveni, Vijay S, 2011) [1] Used a model that supports Back Propagation Neural Network. In the restoration process first multiple images can be selected from multi source to initiate the processing. After image is been selected preproccessing step is been done and image is tested for noises and blur that are predominant and uses filters which is suited for removing the noise and blur to enhance the image for the best output for next process. Once the neural network is trained, images can be restored without having prior information about the model of noise /blurring with which the image is corrupted.

(Yan.R, Shao.L, 2013) [2] Used a method that attempts to identify the blur type from mixed input of various blurs with different parameters, rather than blur estimation based on the assumption of a single blur type in current methodology. First, for the input image patches with different blurs, the DBN is used for identifying the blur type; second, different samples with the same blur type will be sent to the corresponding DBN blocks for further parameter estimation. It has been found that current approaches that use blur features that are optimized for a certain type of blur, which is not applicable in real blind Deconvolution application when the Point Spread Function (PSF) of the blur is unknown.

According to (Neeraj K, Rahul N, Amit S, 2012) [3] various image Deblurring algorithms have appeared in the recent times. However, all these methods require prior information about blur kernel, which is difficult to obtain. So, the performance of these algorithms depends on the choice of blur kernel.

(Saxena.S and Rajeev K Singh, 2014) [4] Sometimes we need to deblur only some portions or segments of the image by which the time complexity of image restoration system has been reduced. In the used approach segments of blurred image are extracted using segmentation algorithm.PSNR values are then calculated between each segment of input and blurred image. Fuzzy based clustering is applied on the calculated PSNR values for extracting blurred segments.

According to (Mr. Salem S.A, Dr. N.V. Kalyankar and Dr. Khamitkar S.D, 2010) [5] For removing blur in case of blind Deconvolution algorithmic technique there is a requirement of certain assumptions about the kernel size weight threshold etc.The approach uses a straightforward method for restoring Gaussian Blurred then use it to restore the blurred image with Standard re storation filters.

IV. CONCLUSION

The last few years have seen a change in attitude towards ANNs, so that now ANNs are not anymore automatically seen as the best solution to any classi1cation or regression problem. The 1eld of ANNs has to a large extent been reincorporated in the various disciplines that inspired it: pattern recognition, psychology and neurophysiology. ANNs are interesting as tools when there is a real need for an adaptive approach or a fast, parallel solution, but one should remain open to new Interesting developments, such as the recently proposed support vector machine.

Future scope involves as suggested in [A. S. Mane, M. M. Pawar, 2014] other different algorithms have to be studied namely Wiener Filter Deblurring Method, Regularized Filter Deblurring Method, Lucy-Richardson Algorithm Method for obtaining better performance in a neural network for Deblurring images. Also as given in (Leila F.A & Mohammad R.A, 2009) edge detection techniques can also be combined with neural networks for better performance.

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