Advanced Studies in Pure Science and Applied Science

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ISBN No. 978-93-82995-25-8

Published by:
Anuradha Publications
Cidco-Nanded

Publication Year: 2018-19

Price- Rs. 250/-

Printed by
Gurukrupa Offset,
Near Police Station, Gangakhed

Typesetting by:
Simran Computers
Gangakhed Dist.Parbhani

Cover Designby:
Mr. Imran K. Mohammad

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A Review of Blur Image Restoration Using Soft Computing Techniques

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Abstract
Motivated by the problem of restoring blurry images via well-developed mathematical methods and techniques based on inverse procedures in order to obtain an approximation of the original image. The proposed algorithm maintains the reconstructed image's resolution at a very high level, but the main advantage of the method is its lower computational load when compared to other methods and techniques. The efficiency of the generalised inverse will be compared by the simulation outcomes. One of the most intriguing questions in image processing is the problem of recovering the desired or perfect image from a degraded version. In many instances, one has the feeling that the degradations in the image are such that relevant information is close to being recognizable if only the image could be sharpened just a little. Blurring is a form of bandwidth reduction of the image due to an imperfect image formation process. Orthogonal moments have demonstrated significant energy compaction properties that are desirable in the field of image processing, especially in feature and object recognition. They can be caused by relative motion between the camera and the original scene or by an optical system that is out of focus.

The present paper introduces blur image restoration, a blur image detection framework, and the international status of blur image restoration. Lastly, I focused on the significance of the blue image restoration study. There is a large scope for future research, and some points are highlighted.

Keywords Blur Images, Neural Network, Soft Computing, Computer Vision

Introduction

Image restoration deals with methods to improve the quality of blurred images. It especially deals with the recovery of information that was lost to the human eye during some degradation processes. The successful restoration of a blurred image requires an accurate estimation of PSF parameters images, which are blurred by the relative motion between the imaging system and the original scene. Thus, given a motion-blurred and

noisy image, the task is to identify the point spread function parameters and apply the restoration filter to get an approximation of the original scene. Parameter estimation is based on the observation that image characteristics along the direction of motion are different than the characteristics in other directions. The PSF of motion blur is characterised by two parameters, namely blur direction and blur length. We need an image to be restored here. Digital imaging devices and post-processing algorithms are very popular in many imaging areas, including consumer photography, microscopy, macro photography, aerial photography, astronomical imaging, medical imaging, etc. However, all these imaging systems suffer from two common distortions: blur and noise. Compared with noise, which is mainly caused by the sensor and circuitry of a digital camera and could be approximately described through some standard statistical models (e.g., Gaussian distribution, Poisson distribution), blur has more sources, and its form can be highly complicated. How to measure and remove various kinds of blur along with noise is a significant problem not only in the image and video restoration area but also in many other applications in the fields of image processing, computer vision, and computational photography.

According to its sources, image blur can be generally categorized into four groups: motion blur, lens blur, blur due to transmission medium (e.g. turbulence), and post processing blur (see examples illustrated in Figure 1). Either camera or object movement during the exposure period would lead to motion blur. This phenomenon is very common especially for consumer digital cameras. For example, cell phone cameras often cannot be held sufficiently steady, and thus it is easy to generate camera shaking blur. Fast exposure could reduce the blur amount to some degree. Factors could make motion blur spatially varying, which makes its estimation and removal highly difficult. Incorrect lens setting or limited depth of filed would produce defocus blur.

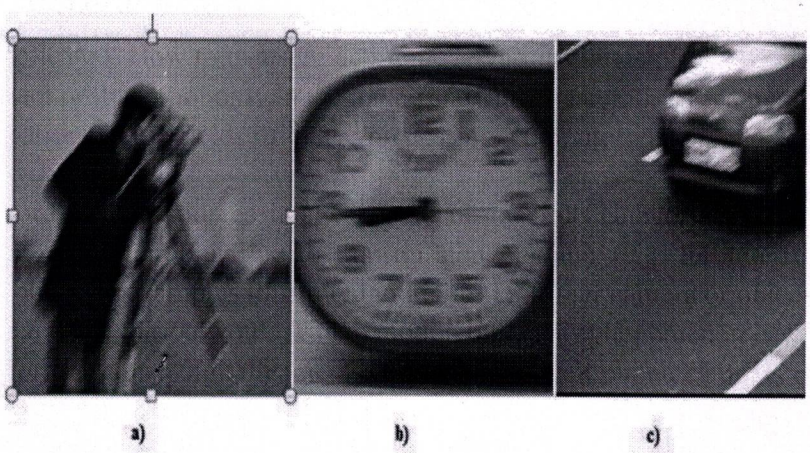

Figure 1 a) uniform motion blur caused by camera shaking; (b) non-uniform motion blur caused by object movement; (c) defocus blur in the background;

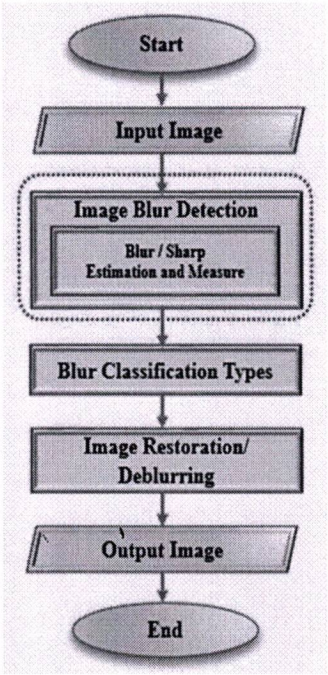

Figure 2: Flowchart of Image Blur Detection Framework.

Figure 2 shows the flowchart of the image blur detection framework. The study of Koik and Ibrahim (2014) narrows down the research available in the public domain about blurred images into three major processes: a) image blur detection, the first step in improving the quality of a blurred image; b) blur classification, the second step in the research on blurred images. The goal of this process is to classify the blur areas according to their characteristics or types, and the third process, image restoration, performs a deblurring process based on their characteristics. This paper concentrates only on the stage of image blur detection that considers the blur/sharp estimation and measure, which are enclosed in red-dotted lines in figure 2. This paper focuses on the different blur detection techniques and aims to compare the performance of each one in terms of accuracy rate and execution time. Also, compare and analyse the existing techniques for identifying if the input image is blurred or sharp to achieve the best possible results. The project's long-term goal is to maintain a comparable number of extracted feature points with a sharp image and increase the number of correctly matched feature points in an input blur image. The project's groundwork lies in computer vision, and image processing notably features point detectors. Blur detection techniques are useful in image blur detection because they are used as the preliminary process to detect specific regions that need image restoration or deblurring. As the primary step towards achieving the goal of the project, we conducted a review and analysis of the different blur measure operators or state-of-the-art image blur detector techniques. This paper has been organised as follows: Blur detection techniques, experimental methodology, and dealing with the results and discussions; the last section is the conclusion of the study.

Literature Review

It is critical to understand the type of distortion as well as the parameters of the corresponding distorting operator in order to restore the distorted image. The testing results were very successful in recognising the variation of Gaussian blur and the horizontal motion blur parameter. The learning set of each neuron consisted of images from one class and images from each other class. A conversion of the learning process has been achieved in a few minutes for both networks; all the testing images have been clarified correctly. It means that successful recognition of the blur parameter has been achieved [1]. The focus on the number of digital images increases quickly, which raises the demand for image quality assessment in terms of blur. Based on the edge type and sharpness analysis using the wavelet transform, a new blur detection scheme is proposed in this paper that can determine whether an image is blurred or not and to what extent an image is blurred. Experimental results demonstrate the effectiveness of the proposed scheme [2]. It proposed detection and classification techniques. Many digital images contain blurred regions that are caused by motion or defocus. Automatic detection and classification of blurred image regions are very important for different multimedia analysis tasks. This paper presents a simple and effective automatic image blurred region detection and classification technique. In the proposed technique, blurred image regions are first detected by examining singular value information for each image pixel. The blur types (i.e., motion blur or defocus blur) are then determined based on certain alpha channel constraints that require neither image de-blurring nor blur kernel estimation. Extensive experiments have been conducted over a dataset that consists of 200 blurred image regions and 200 image regions with no blur that are extracted from 100 digital images. Experimental results show that the proposed technique detects and classifies the two types of image blurs accurately.

The proposed technique can be used in many different multimedia analysis applications, such as image segmentation, depth estimation, and information retrieval [3]. It focused on image blur kernel classification and parameter estimation, which are critical for blind image deblurring. Current dominant approaches use handcrafted blur features that are optimised for a certain type of blur, which is not applicable in a real blind deconvolution application when the point spread function (PSF) of the blur is unknown. It has been explained A two-stage system using Deep Belief Networks (TDBN) is proposed to first classify the blur type and then identify its parameters. To the best of our knowledge, this is the first time that the Deep Belief Network (DBN) has been applied to the problem of blur analysis. In the blur type classification, our method attempts to identify the blur type from a mixed input of various blurs with different parameters, rather than the current methodology's blur estimation based on the assumption of a single blur type [4]. It explained different blur detection algorithms. The development of blur detection algorithms has attracted much attention in recent years. The blur detection algorithms are found very helpful in real-life applications and therefore have been developed in various multimedia-related research areas, including image restoration, image enhancement, and image segmentation [5]. It has a simple, reliable, and fast

algorithm for image noise estimation. With the increased usage of digital cameras and picture-clicking devices, the number of digital images increases rapidly, which in turn increases the demand for image quality assessment in terms of blur.

This paper proposes an effective representation of blur image detection scheme based on edge type and sharpness analysis using the Laplacian operator, which can determine whether the image is blurred or not and the extent of blur through the variance of the Laplacian [6]. Based on the results of the comparative analysis of the different image blur detection techniques, HWT leads the best result in terms of accuracy rate based on the computed scores. FFT got the highest precision score, while LAP got the highest recall score, and HWT got the highest measure score [7]. It focuses on detecting and analysing partially blurred images and proposes a novel method to automatically detect blurred images, extract possible blurred regions, and further classify them into two categories: near-isotropic blur & directional motion blur. Several blur features, measures of image colour gradient, and spectrum information are utilised in a parameter training process in order to robustly classify blurred images in this method, which in principle provides a foundation for solving many blur-oriented and region-based image retrieval, image enhancement, high-level segmentation, and object extraction problems [8].

International Status

Over the last twenty years, image processing has become a popular area of research in computer vision and one of the most successful applications of image analysis and understanding. Because of the nature of the problem, not only computer science researchers are interested in it but also, neuroscientists and psychologists. It is widely assumed that advances in computer vision research will provide neuroscientists and psychologists with useful insights into how the human brain works, and vice versa.

Significance of the Study

Blur detection is one of the interesting research areas in computer vision and image processing, like in Most of the captured images usually contain two types of regions: blurred and sharp. Blur can be categorized into two types: a) defocus blur, also known as out-of-focus blur, which is caused by the visual imaging system, and b) motion blur, also known as camera shake blur, which is caused by the relative motion between the camera and the scene object. While in reviews, different blur detection techniques were discussed, such as the Laplacian operator, fast Fourier transform, and wavelet transform. In their study, a Laplacian operator was selected for testing and successfully identified if the image was blurred or sharp. In other literature, the Tenengrad technique is used to extract the degradation degree of each target part of the image. The Tenengrad technique was used by the operator to evaluate the iris image's definition.

Conclusion

It is our opinion that research on blurred image restoration is an exciting area for many years to come and will keep many researchers busy. The present paper can provide the readers with a better understanding of blur image restoration and also highlights the literature review, international status of blur image restoration, and significance of the study. The topic is also open to further research.

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