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Advanced Studies in Pure Science and Applied Science

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A Review of Blur Image Restoration, Features, and Types of Blur Images

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Abstract:

Image processing is a form of signal processing in which the input is an image and the output is either an image or a characteristic or set of parameters related to an image. Restoration and deblurring are required for digital image processing. Image blur occurs for a variety of reasons, and we use a variety of methods and techniques to remove blur and restore images.A comparative study is performed for different techniques like (FFT) fast fourier transfer, (HWT) Haar wavelet transform, and (LAP) laplacian transform using this deblurring technique to remove noise from images. An algorithm of guided filtering is used, which is most appropriate in computer graphics and vision processing.

The present paper introduces blurred image restoration, features of image blur, and types of blur. Lastly, I focused on the deblurring techniques for blurred image restoration. There is a large scope for future research, and some points are highlighted.

Keywords Blur image, Neural Network, images, soft computing, FFT, HWT.

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. In images which are blurred by the relative motion between the imaging systems and As a result, given a blurred and noisy motion, the task is to identify the point spread function parameters and apply the Restoration filter to approximate the original sense. However, all of the imagining systems suffer from two common distortions, which are blur and noise. Compared with noise, which is mainly

caused by the sensor and circuitry of a digital camera and could be approximately described by some standard statistical models, 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 or video destination area but also in many other applications in the field of image processing, computer vision, and photography. According to their sources, these kinds of blur can be generally categorized into four groups: motion blur, lens blur, blur due to the transmission medium, and post-processing blur. Either camera or object movement during the period would lead to motion blur. This is a very common issue, particularly with consumer digital cameras; for example, cell phone cameras cannot be held sufficiently steady, and it is easy to generate camera shake blur with them. Fast exposure could reduce the blur amount to the same degree, and other factors could make motion blur spatially varying, which makes its estimation and removal highly difficult. A correct lens setting or limited depth of field would produce the defocus blur.

Features of Blur Image

Singular value feature

Blur image region, detection, and classification use blur image features that are used for blur detection and classification techniques. The singular value feature is one of the most useful techniques in linear algebra and has been applied to different areas of computer science. Single-value features can be represented by $I = U \hat{} V^t$ where you have orthogonal matrices and a diagonal matrix that is composed of multiple singular values arranged in decreasing order.

Alpha channel feature Alpha channel feature identifies image blur type in which an image I is a combination of foreground F and image background B as follows:

$$I = \alpha F + (1 - \alpha)B$$

Where Alpha lies between zero and one in a clear image, most of the values used for Alpha are either one or zero, but in a blurred image, the foreground and background tend to mix together. As a result, automatic detection and classification of blurred image regions is critical for a variety of multimedia analysis tasks.

Restoration of Blurred images

The image was degraded during the capture process from mobile phones, cameras, and people. Who do not have sufficient experience in capturing images, this paper uses

guided filtering and the inverse filtering method to remove noise from that image. The input image has added noise; apply guided filtering according to the algorithm to that noisy image, then apply the inverse filtering method to that blood image to remove noise from that image. This is the proposed method used in this paper.

Guided Filtering

Guided filtering is an edge-preserving smoothening light filter, and as with a bilateral filter, it can filter out noise or texture while maintaining sharp edges.

Edge: Preserving filtering

When the guidance image I is the same as the filtering input p the guided filter removes noise from the input image while preserving clear edges.

Gradient-Preserving filtering

This filtering uses a bilateral filter, and artefacts may appear on the edges. This is because the pixel values change the edges.

Structure-transferring filtering

Due to the local linear model, it is possible to transfer the structure from the guidance to the output. This property enables some filtering-based special applications.

Types of Blur

Average blur:

Average blur removes noise and specks in an image. Average blurring can be distributed in both horizontal and vertical directions.

Gaussian blur

Removes details and adds noise to an image; the pixel weights are not equal and decrease in a bell-shaped curve from the kernel center to the edges.

Motion blur

Motion blur is a filter that makes the image appear to be moving by adding a blur in a specific direction.

Atmospheric blur

Atmospheric blur occurs due to random variations in the reflective index of the medium between the object and the imaging system.

Out of focus blur when the camera images a 3D scene on the imagining plane, some parts of the scene are in focus. So we use different deblurring techniques to remove blur artefacts from images. Deblurring recovers sharp images from blurred images.

Deblurring techniques

Today's world uses different detection techniques to improve the quality of images, which is useful in solving the crime problem or restoring important information. Various researchers have done work in this field; some of the main techniques are as follows:

Fast Fourier Transform (FFT):

A fast fourier transform is an algorithm that computes the discrete fourier transform of a sequence or an inverse fourier analysis that converts a signal from its original domain to a representation in the frequency domain and vice versa. The DFT is obtained by decomposing a sequence of values into components of different frequencies. This operation is useful in many fields, but computing it directly from the definition is often too slow to be practical. Fourier transforms have applications in engineering, music, science, and mathematics.

Haar wavelet transform (HWT)

The Haar wavelet transform method splits images into N*N by iterating on each title of the two-dimensional HWT and grouping diagonally, vertically, or horizontally connected tiles into clusters containing images, which are then declared blurred.

Laplacian operator

The Leplacian operator is a derivative operator that is used to find image edges. The primary distinction between Laplacian and order operators such as Prewitt, Solomon, Robinson, and Kirsch is that these are all first-order derivative masks, whereas Laplacian is a second-order derivative laplacian operator with two classifications: positive and negative. So these are different image blur detection techniques under study.

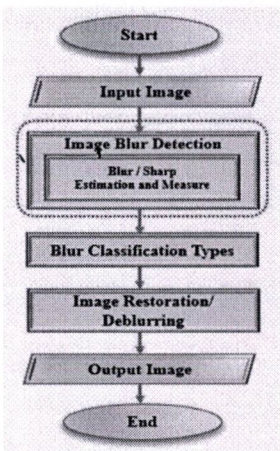

Figure 1: Flowchart of Image Blur Detection Framework.

Figure 1 shows the flowchart of the image blur detection framework. The research of Koik and Ibrahim (2014) is divided into three major processes: a) image blur detection, the first process in improving the quality of the image that suffers from blur, b) blur classification, the second process of the research related to 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 the figure. 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 analyses the existing techniques for identifying if the input image is blurred or sharp to achieve the best possible results.

Conclusion

The purpose of this paper is to solve blurred images using the provided deblurring and image restoration techniques. The goal of this paper was to compare various blurred types and deblurring techniques, as well as to analyses various FFT, HWT, and LAP. Fast Flourier Transform got the highest precision score, while Haar Wavelet Transform got the highest f-measure score, and Laplacian Transform got the highest recall score. For further processing, it is planned to conduct comparative analysis of different images. Restoration or deburring techniques also use algorithms like guided filtering for edge precision smoothing.

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