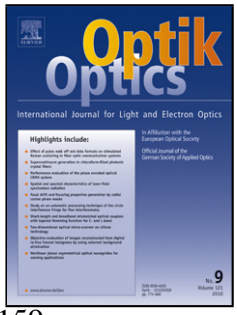

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Image quality metric based on regular structure features

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The objective assessment of image quality has been extensively studied in recent years, and a large number of evaluation algorithms have been presented. The existing evaluation algorithms of image quality has already exhibited satisfactory performances in many common image distortion models, such as additive noise, grayscale adjustment, low pass filter, motion blurring, lossy compression, etc. However, most of them have no effect on the geometric distortion, which is widely existed in the digital images. In view of geometric distortion, a full-reference image quality assessment method is presented in this paper. The core idea of this method is that only the geometric distortion acting on regular structure features of image can have significant impacts on the perceptive quality of the image, and the physical strength and spatial irregularity of geometric distortion are the main factors causing the decline of image quality. According to experimental data, the proposed assessment method can be well applied to geometric distortion model, the evaluation results are better than most of the existing methods, and it has showed significant correlation with MOS.

Keywords: image quality assessment, geometric distortion, regular structure features, displacement vector field

OCIS codes: 100.2810, 100.2960, 100.3010, 110.3000.

1.Introduction

The objective assessment of image quality has been widely used in image quality on-line monitoring, automated image classification, performance evaluation of image watermarking and other areas, and has made great achievements [1, 2, and 3]. The objective assessment is designed to find suitable evaluation criteria, by which we can make a quality evaluation index that matches with subjective perceptive quality for various degraded images. These degraded images are usually derived from a variety of degradation models, such as additive noise, grayscale adjustment, low pass filter, motion blurring, lossy compression and so on. A good objective assessment should adapt well to these degradation models.

It is generally known that geometric distortion is one of the most common image degradation models, and it is widely existed in digital images. In digital imaging process, geometric distortion is often caused by many factors, such as atmospheric disturbance, lens aberration, the spatial non-uniformity in image scanning device, the two-dimensional representation of three-dimensional information in remote sensing imaging process, etc. [4, 5]. In recent years, image watermarking has been given abroad attention, and the watermark embedding and watermark attack based on geometric transformation has also become the focus of discussion and research. Therefore, the effective evaluation on geometrically distorted images is of great significance, it is an important complement to the objective assessment of image quality.

However, MSE, PSNR, Modified PSNR [6], UQI [7], SSIM [8] and other existing image quality assessment algorithms can only applied to common image distortion models, such as additive noise, grayscale adjustment, low pass filter, motion blurring, lossy compression, etc. Most of those assessment algorithms can only get false evaluation results when applied to geometrically distorted images. Four images are presented in Fig.1, (a) Reference image, (b) The degraded image with geometric distortion (c) The degraded image with Gaussian Blurring (d) The degraded image with a certain number of Gaussian noise. By visual inspection, we can see that