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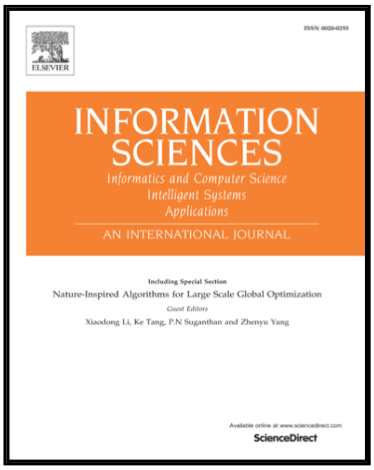

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Qingbo Lu, Wengang Zhou, Houqiang Li

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A No-Reference Image Sharpness Metric Based on Structural Information Using Sparse Representation

Qingbo Lu, Wengang Zhou, Houqiang Li

CAS Key Laboratory of Technology in Geo-spatial Information Processing and Application System, Department of Electrical Engineering and Information Science, University of Science and Technology of China, Hefei, Anhui, 230027, China

Abstract

As a ubiquitous image distortion, blur casts non-trivial influence on image visual quality. Many image sharpness assessment methods have been proposed in the views of edge information, gradient map, frequency spectrum, or other natural image statistics features. In this paper, we propose a no-reference image sharpness metric based on structural information using sparse representation (SR). We observe that the dictionary atoms learned by SR algorithm convey clear structural information. Considering the distinct sensibility of human visual system (HVS) to different structures, we use the learned dictionary to encode the patches of the blurry image. To embed the locality of the representation, a multi-scale spatial max pooling scheme is incorporated. The final sharpness score is given by an efficient linear support vector regression (SVR) model. We evaluate our approach on three public databases, *i.e.*, LIVE II, TID2008, and CSIQ. The experiments demonstrate that the proposed method achieves competitive performance compared with the state-of-the-art blind image sharpness assessment algorithms.

Keywords:
Image quality assessment, image sharpness assessment, multi-scale spatial max pooling, sparse representation.

1. Introduction

Images captured by handheld cameras usually suffer from blur due to shaking and out of focus. Generally, human prefer a sharp image rather than a blurry one in most time. The goal of image sharpness assessment is to quantitatively predict the human perceived quality score. Although HVS can evaluate the sharpness of one image effortlessly, it is still an open problem for computer vision. On the other hand, no-reference metrics for image sharpness are very useful for some image processing applications. For example, image sharpness assessment can provide additional information for deblurring algorithm to select the eligible parameters automatically [22].

Image sharpness assessment belongs to one sub-task of image quality assessment (IQA) for the specific blur distortion. According to the availability of pristine reference image, IQA methods can be divided into three categories [23]: full-reference IQA (FR-IQA), reduced-reference IQA (RR-IQA), and no-reference IQA (NR-IQA). For FR-IQA, such as PSNR, SSIM [41], and FSIM [52], the non-distorted reference image is required. Contrary to FR-IQA, the reference information is unavailable for NR-IQA. The state-of-the-art NR-IQA algorithms include DIIVINE [26], BLIINDS-II [30], BRISQUE [24], CORNIA [49], et al. The reference information required by RR-IQA lies in the level between FR-IQA and NR-IQA [44].

For image sharpness assessment, the previous work mainly focuses on edge information and coefficients in the transformed domain. The edge-based methods evaluate the sharpness of one image through detecting the spread of strong edges [8, 27]. Based on the observation that sharp patterns usually have stronger response in the high-frequency range, some researchers turn to coefficients in the transformed domain to estimate the image sharpness

*Corresponding author
Email addresses: zhwg@ustc.edu.cn (Wengang Zhou), lihq@ustc.edu.cn (Houqiang Li)