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Xuewei Wang, Xiao Liang, Jinjin Zheng, Hongjun Zhou

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Fast Detection and Segmentation of Partial Image Blur Based on Discrete Walsh–Hadamard Transform

Xuewei Wang [a], Xiao Liang [b,*], Jinjin Zheng [a], and Hongjun Zhou [c]

[a] Department of Precision Machinery and Precision Instrumentation, University of Science and Technology of China, Hefei, Anhui 230026, China

[b] School of Mechanical Engineering, Shijiazhuang Tiedao University, Shijiazhuang, Hebei, 050043, China

[c] National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei, Anhui 230026, China

[*] Corresponding author: Xiao Liang

[*] E-mail address: jacloudy@126.com

Abstract:

Image signals can be blurred due to defocus or motion. Blur may be undesirable for image sensing, but may also contain useful information. Therefore, detecting the blurriness of each pixel and segmenting the partial blur regions in natural images are important and yet challenging in the field of machine vision. A concise no-reference method based on discrete Walsh-Hadamard transform is proposed to detect and segment partial blur in this paper. First, a re-blurring strategy is performed over multiple overlapping image patches extracted from the test image. Then, for both test image and re-blurred image, discrete Walsh-Hadamard transforms are utilized in each image patches to obtain the blur map. This blur map can characterize the blurriness of each pixel in test image. Based on it, combined with K-Means clustering and region-growing, the test image can be segmented into blurry/non-blurry regions. The experiments, performed on a public dataset, demonstrate the capability of the proposed metric in the detection and segmentation of the blur region. Comparative results with the state-of-the-art show the superiority of the proposed approach in image segmentation for both defocus and motion blur images. The proposed approach is compendious without data training and possesses a high time efficiency because of the fast sequency transform.

Keywords:

Segmentation, Partial blur, Re-blur, Walsh-Hadamard transform, Blur map, Blur detection.