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Abstract

The defocus of imaging can be modeled as a heat diffusion process and represented mathematically by a diffusion equation, where the image blur is corresponded to the diffusion of heat. To improve the quality of observed images, we propose an algorithm of multi-focus image fusion based on the depth extraction. The optical imaging of two multi-focus images is simulated by the heat equations of positive regions, where the scene depth is estimated by the inhomogeneous diffusion equation. An adaptive initialization of image depth estimation is proposed to improve the simulation accuracy of inhomogeneous diffusion process. Image depth is approximated by an iterative solution of the partial differential equation. According to the depth information, the target images are adaptively divided into three types of regions: clear regions, fuzzy regions and transition regions. Finally, the fusion of multi-focus images is achieved by not only extracting the pixels of clear regions but also merging the pixels of transition regions. Theoretical analysis and experimental results show that the proposed algorithm can avoid the blocking artifacts, and outperform the state-of-the-art methods both subjectively and objectively in most cases.

Keywords: Image fusion, multi-focus, depth extraction, partial differential equation

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