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A Fusion-based Enhancing Method for Weakly Illuminated Images

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Abstract

We propose a straightforward and efficient fusion-based method for enhancing weakly illumination images that uses several mature image processing techniques. First, we employ an illumination estimating algorithm based on morphological closing to decompose an observed image into a reflectance image and an illumination image. We then derive two inputs that represent luminance-improved and contrast-enhanced versions of the first decomposed illumination using the sigmoid function and adaptive histogram equalization. Designing two weights based on these inputs, we produce an adjusted illumination by fusing the derived inputs with the corresponding weights in a multi-scale fashion. Through a proper weighting and fusion strategy, we blend the advantages of different techniques to produce the adjusted illumination. The final enhanced image is obtained by compensating the adjusted illumination back to the reflectance. Through this synthesis, the enhanced image represents a trade-off among detail enhancement, local contrast improvement and preserving the natural feel of the image. In the proposed fusion-based framework, images under different weak illumination conditions such as backlighting, non-uniform illumination and nighttime can be enhanced.

Keywords: image enhancement, multi-scale fusion, weakly illumination, weights, illumination adjustment.

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