Single image integrated deblurring algorithm in non-uniform environment

ABSTRACT

Motion blurriness in an image caused by camera shake during exposure is unavoidable. It could lead to information loss and degradation in the image quality. Therefore, many researchers are dedicated to developing image deblurring techniques to recover clear images from blurred images. During the deblurring process, structural edges in images play a vital part in estimating the blur kernels. For images with rich textures, fine-scale edges become more apparent. This will cause vagueness in the image's structural edges and affect the accuracy of the kernel estimation process. In this study, we propose a single-image motion deblurring by kernel estimation method combined with L0- Regularized Intensity and Gradient Prior, and enhanced Scale Aware Smoothing methods. Two types of non-uniform datasets are used, which are real and synthetic. While synthetic datasets are utilized to assess the consistency in performance across real and synthetic images, real datasets are used to portray the level of detail and variation of actual blurred images. The dataset is divided into five categories (people, nature, manmade, text, and night light). Two image quality metrics were selected: full reference assessment, including learned perceptual image patch similarity (LPIPS), peak signal-to-noise ratio (PSNR), and structural similarity indexing method (SSIM) for synthetic datasets, and no-reference assessments, including blind/reference-less image spatial quality (BRISQUE), natural image quality evaluator (NIQE) and perception-based image quality evaluator (PIQE) for real datasets. According to the findings, the fusion method performs best in the text category, followed by manmade and in nature, then night light and poor in people. The proposed method not only removes fine-scale edges and preserves the boundary sharpness, but also improved the estimated blur kernel.