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**An additive convolution model for fast restoration of nonuniform blurred images.** (English)

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Summary: Nonuniform blurring would be introduced during imaging by many inevitable factors, such as defocus, camera shake, or motion. Fast restoration of nonuniform blurred images, however, remains a challenging problem. The sparse blur matrix-based approach models nonuniform blurring as the multiplication of a high-dimensional sparse blur matrix and an image vector, and suffers from the high computational and memory complexity problems. To tackle these, we propose an additive convolution model (ACM) which models nonuniform blurring as the space variant weighted sum of the convolution images of a set of basis filters. We further propose a principal component analysis-based method to learn the basis filters and weight matrices. Finally, we incorporate ACM with the total variation-based restoration model, and adopt the generalized accelerated proximal gradient algorithm for the restoration of nonuniform blurred images. Numerical results show that the proposed method is effective for the restoration of nonuniform blurred images caused by defocus or camera shake, and is superior to the sparse matrix-based approach in terms of computational and memory complexity.

**MSC:**

62H25 Factor analysis and principal components; correspondence analysis

62H35 Image analysis in multivariate analysis

68U10 Computing methodologies for image processing

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**Keywords:**

image restoration; nonuniform blurring; principal component analysis; total variation; generalized accelerated proximal gradient

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