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A robust super-resolution method with improved high-frequency components estimation and aliasing correction capabilities ☆

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Highlights

- Correction of aliasing effects of an image using low-pass filtering behavioral aspects.
- Efficient estimation of high-frequency components using forcing operators.
- Convergence criterion determination using Mean Structural Similarity

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Abstract

In this paper, we have proposed a robust super-resolution high-frequency component estimation (RS-HFCE) method, which can efficiently estimate lost high-frequency components and correct aliasing effects of low-frequency components of an image. The fundamental principle of operation of the proposed method is based on the idea that, when a baseband band-limited image signal of known bandwidth in a high-resolution lattice is iteratively low-pass filtered in the frequency domain, the unknown values in the lattice can be interpolated, thus correcting the aliasing for the low-frequency components. If this process is done along with adjusting the amplitudes of the known pixel values, some high-frequency components of an image are automatically extrapolated. In order to provide simultaneous edge preservation and noise removal capabilities of the super-resolved images, an improved version of an adaptive Perona–Malik (PM) model is incorporated into the process. One of the characteristics of the proposed method is its high level of tolerance capabilities to reconstruction errors and noise caused by an increase in the reconstruction scaling factors. High quality images of higher resolution are still appreciably reconstructed when greater magnification factors are used. From a couple of experiments on real images, and using both subjective and objective image quality assessment measures, it is demonstrated that the proposed method outperforms most of other classical methods.

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