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A noise-suppressing and edge-preserving multiframe super-resolution image reconstruction method

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Highlights

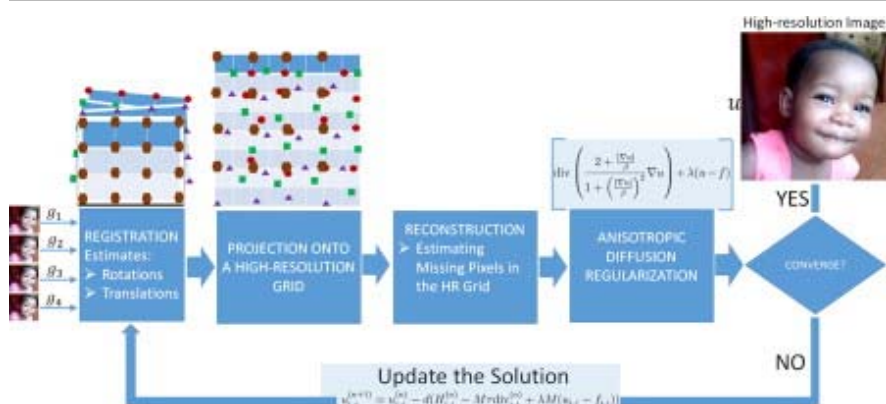
- We have proposed a diffusion-based regularizing functional to address the ill-posedness of the multiframe super-resolution problem.
- The new regularizer can effectively suppress noise, preserve critical image features, and enhance edges.
- The proposed regularizer contains a shape-defining parameter that is automatically updated to ensure that the corresponding energy potential is convex.
- The new super-resolution method can achieve higher resolution factors while maintaining stability and appealing results.

Abstract

Super-resolution technology is an approach that helps to restore high quality images and videos

usually saved using the L^2 norm and some regularization techniques. Most of the classical regularizing functionals are based on the Total Variation and the Perona–Malik frameworks, which suffer from undesirable artifacts (blocking and staircasing). To address these problems, we have developed a super-resolution framework that integrates an adaptive diffusion-based regularizer. The model is feature-dependent: linear isotropic in flat regions, a condition that regularizes an image uniformly and removes noise more effectively; and nonlinear anisotropic near boundaries, which helps to preserve important image features, such as edges and contours. Additionally, the new regularizing kernel incorporates a shape-defining parameter that can be automatically updated to ensure convexity and stability of the corresponding energy functional. Comparisons with other methods show that our method is superior and, more importantly, can achieve higher reconstruction factors.

Graphical abstract



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Keywords

Convex optimization; Super-resolution; Backward diffusion; Regularization

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