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ℓ1-norm dictionary learning for noisy image super-resolution

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Conventional coupled dictionary learning approaches are designed for noiseless image super-resolution (SR), but quite sensitive to noisy images. We find that the cause is the commonly used ℓF-norm coefficients transition term. In this paper, we propose a robust ℓ1-norm solution by introducing two sub-terms: LR coefficient sparsity constraint term and HR coefficient conversion term, which are able to prevent the noise transmission from noisy input to output. By incorporating our simple yet effective non-linear model inspired by auto-encoder, the proposed ℓ1-norm dictionary learning achieves a more accurate coefficients conversion. Moreover, to make the coefficients conversion more reliable in the iterative process, we bring the non-local self-similarity constraint to regularize the HR sparse coefficients updates. The improved sparse representation further enhances SR inference on both synthesized noisy and noiseless images. Using standard metrics, we show that results are significantly clearer than state-of-the-arts on noisy images and sharper on de-noised images. In addition, experiments on real-world data further demonstrate the superiority of our method in practice.

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