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Quadtree Structured Image Approximation for Denoising and Interpolation

Abstract:

The success of many image restoration algorithms is often due to their ability to sparsely describe the original signal. Shukla proposed a compression algorithm, based on a sparse quadtree decomposition model, which could optimally represent piecewise polynomial images. In this paper, we adapt this model to the image restoration by changing the rate-distortion penalty to a description-length penalty. In addition, one of the major drawbacks of this type of approximation is the computational complexity required to find a suitable subspace for each node of the quadtree. We address this issue by searching for a suitable subspace much more efficiently using the mathematics of updating matrix factorisations. Algorithms are developed to tackle denoising and interpolation. Simulation results indicate that we beat state of the art results when the original signal is in the model (e.g., depth images) and are competitive for natural images when the degradation is high.