Wavelet Algorithms for High-Resolution Image Reconstruction

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Abstract:

High-resolution image reconstruction refers to reconstructing high-resolution images from multiple low-resolution, shifted, degraded samples of a true image. In this talk, we analyze this problem from the wavelet point of view. By expressing the true image as a function in L_2, we derive iterative algorithms which recover the function completely in the L_2 sense from the given low-resolution functions.

These algorithms decompose the function obtained from the previous iteration into different frequency components in the wavelet transform domain and add them into the new iterate to improve the approximation. We apply wavelet (packet) thresholding methods to denoise the function obtained in the previous step before adding it into the new iterate. Our numerical results show that the reconstructed images from our wavelet algorithms are better than that from the Tikhonov least squares approach. Extension to super-resolution image reconstruction, where some of the low-resolution images are missing, is also considered.