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Translation-Invariant Denoising Using the Minimum Description Length Criterion

Israel Cohen, Shalom Raz and David Malah

**Department of Electrical Engineering
Technion - Israel Institute of Technology
Haifa 32000, Israel**

Abstract

A translation-invariant denoising method, based on the *Minimum Description Length* (MDL) criterion and tree-structured best-basis algorithms is presented. A collection of signal models is generated using an *extended* library of orthonormal wavelet-packet bases, and an additive cost function, approximately representing the MDL principle, is derived. We show that the minimum description length of the noisy observed data is achieved by utilizing the *Shift-Invariant Wavelet Packet Decomposition* (SIWPD) and thresholding the resulting coefficients. This approach is extendible to local trigonometric decompositions, and corresponding procedures to optimize either the library of bases or the filter banks used at each node of the expansion-tree are described. The signal estimator is efficiently combined with a *modified Wigner distribution*, yielding robust time-frequency representations, characterized by high resolution and suppressed interference-terms. The proposed method is compared to alternative existing methods, and its superiority is demonstrated by synthetic and real data examples.