PAPER NUMBER 1

TITLE: Signal Denoising Using Optimized Trimmed Thresholding

ABSTRACT:

The problem of recovering a desired signal from a recording corrupted by a background additive white Gaussian noise is considered. The undecimated wavelet transform of the noisy recorded signal is taken, and the resulting detail coefficients are thresholded for the purpose of extracting the desired signal. Simple techniques exist for performing the thresholding operation such as the hard, soft and trimmed thresholding methods. Donoho and Johnstone developed a method for selecting the threshold value at every resolution level by minimizing the Stein's unbiased risk estimator (SURE) function while adopting the simple thresholding rationale. They next contributed a hybrid scheme which either uses the last mentioned threshold or defaults to a universal threshold value if the wavelet coefficients are sparse. In the present paper a hybrid scheme is proposed where the trimmed thresholding rationale rather than the soft thresholding rationale is adopted. An expression is first derived for the SURE function for the case of trimmed thresholding before applying the optimization technique. Moreover, instead of using a fixed value of the trimming parameter alpha, a heuristic approach is followed for choosing an optimal value of this parameter. A comparative simulation study is carried out including both standard test signals and electrocardiogram signals. The simulation results testify to the merit of the contributed method. They show an improvement in the signal-to-noise ratio of the denoised signals extracted by the proposed scheme over those obtained by the universal threshold with hard thresholding and the hybrid SURE threshold with soft thresholding or any non-wavelet-based technique such as the short-time Fourier transform block thresholding, the spectral subtraction or the phase spectrum compensation.

CONTRIBUTION OF THE APPLICANT:

- Literature review.
- Ideas involved.
- The novelty of the proposed method.
- Analysis of the results.
- Writing up the manuscript.

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