



Research Letters in Signal Processing

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Research Letter

Efficiently Synchronized Spread-Spectrum Audio Watermarking with Improved Psychoacoustic Model

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Abstract

This paper presents an audio watermarking scheme which is based on an efficiently synchronized spread spectrum technique and a new psychoacoustic model computed using the discrete wavelet packet transform. The psychoacoustic model takes advantage of the multiresolution analysis of a wavelet transform, which closely approximates the standard critical band partition. The goal of this model is to include an accurate time-frequency analysis and to calculate both the frequency and temporal masking thresholds directly in the wavelet domain. Experimental results show that this watermarking scheme can successfully embed watermarks into digital audio without introducing audible distortion. Several common watermark attacks were applied and the results indicate that the method is very robust to those attacks.