

短文与研究通讯

基于优化贝叶斯压缩感知算法的频谱检测

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摘要:

近年来, 压缩感知理论依旧是信号处理领域的研究热点之一。将压缩感知应用于频谱检测技术可以突破传统的奈奎斯特采样定理, 降低检测时采样率, 因此可以减轻硬件处理的压力。因此适合用在频谱检测技术中, 特别是宽带信号的频谱检测。本文对贝叶斯压缩感知理论(BCS, Bayesian Compressed Sensing)进行研究, 并将其引入频谱检测技术中。在BCS算法的基础上, 通过进一步减小高斯随机观测矩阵列向量的相关度, 实现对观测矩阵的优化, 得到一种优化的贝叶斯压缩感知算法(称其为OBCS算法, 即Optimized BCS)。在MATLAB仿真中, 本文提出将数零法作为频谱检测判决规则, 并使用BCS和OMP算法作为对照, 验证了OBCS算法无论在重构误差、检测概率还是虚警概率等指标上都具有最佳的效果。

关键词: 认知无线电; 频谱检测; 压缩感知; 优化贝叶斯压缩感知算法; 数零法

Spectrum Detection from Optimized Bayesian Compressed Sensing

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Abstract:

In recent years, the Compressed Sensing (CS) theory remains in the spotlight in the signal processing field. Combining with the Compressed Sensing Theory, the spectrum detection technology could break through the limit of the Nyquist Sampling Theorem to slow down the sampling rate, and release the pressure for the hardware to deal with. So it is very useful for the spectrum sensing technology, especially for wideband spectrum sensing. This issue focuses on the Bayesian Compressed Sensing (BCS) algorithm, which given the prior of the original signal to purchase the maximum a posteriori estimation of the reconstructed signal. Then we improves it by reducing the relevance among the columns of the random Gaussian measurement matrix. After the optimization, we call the improved algorithm OBCS (Optimized-BCS) for short. The stimulations use Zero-Counting method for the judgment, and use BCS and OMP algorithm for comparisons. The results show that OBCS algorithm has the best performances in the targets of reconstruction error, detection probability and false-alarm probability.

Keywords: cognitive radio spectrum detection compressed sensing optimized Bayesian compressed sensing zero-counting method

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