

认知无线电中基于特征值检测的频谱感知算法

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摘要:

频谱感知的任务在于利用感知节点(无线传感器或者认知用户)采集的数据判断频谱空洞是否存在。基于最大特征值检测(MED)和最小特征值检测(SED)的方法最近被应用到频谱感知当中。这两种算法在检测实际应用当中普遍存在的相关信号时表现出良好的检测性能。然而, MED和SED算法对应的判决门限求解非常复杂, 从而限制了它们在实际的认知无线电频谱感知中的应用。该文利用取样协方差矩阵的所有特征值, 提出了一种新的基于特征值检测(ESD)的算法。利用多元统计理论获得了相应的判决门限。ESD算法无需主信号和无线信道信息参与感知过程。与此同时, 它保留了与MED和SED相同的计算复杂度。更重要的是ESD算法对应的判决门限可以通过一个简单的闭合表达式进行求解, 其计算复杂度低。仿真结果验证了新算法的有效性。

关键词: 认知无线电; 频谱感知; 特征值检测; 最大特征值检测; 最小特征值检测; 取样协方差矩阵

Eigenvalues detection based spectrum sensing algorithm for cognitive radio

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Abstract:

The task of spectrum sensing is to use the data collected by the sensing nodes (wireless sensors or cognitive users) to decide whether the spectrum holes exist or not. Recently, the maximum eigenvalue detection (MED) and the smallest eigenvalue detection (SED) methods have been proposed for spectrum sensing. Both of them perform well for the correlated signals, which is usually the case in realistic applications. However, the determinations of the thresholds for both the MED and the SED are quite involved, which limits their applications in practical sensing situations in cognitive radio (CR). Using all eigenvalues of the sample covariance matrix (SCM), a new algorithm based on the eigenvalues detection (ESD) is introduced in this paper. Multivariate statistical theories are used to obtain the decision threshold. The proposed ESD method can execute spectrum sensing without the information about the primary signal and the wireless channel. Meanwhile, it keeps the same computation complexity as that of the MED and the SED methods. More importantly, the ESD method relaxes the calculation requirement of the decision threshold by using a simple closed-form expression. Simulation results verify the effectiveness of the proposed method.

Keywords: cognitive radio (CR); spectrum sensing; eigenvalues detection (ESD); maximum eigenvalue detection (MED); smallest eigenvalue detection (SED); the sample covariance matrix (SCM)

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