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RESEARCH ON WIDE-BAND SPECTRUM SENSING FOR THE COMMUNICATION SATELLITE BASED ON COMPRESSIVE SAMPLING

Abstract

The LEO communication satellites are usually confronted with interference in varying degrees during operation, which degrades the quality of satellite communications as well as affects the normal transmission and reception of data information, and even causes communication interruption in some cases. The core idea of cognitive radio is to make it feasible for unauthorized users to use the bands of licensed users by detecting which frequency bands are unemployed under the assumption that the licensed users are not interrupted, thus allowing for an efficient exploitation of spectrum resource. According to the theory of cognitive radio, the LEO satellite systems are capable of perceiving and communication networking in a self-organized manner, and the satellite nodes have to perceive such a wide frequency band that cognitive users need to use an ADC of much more high-speed together with a digital signal processor, leading to increased power consumption and costs. It follows that current attention ought to be focused on how to reduce the implementation complexity of broadband spectrum sensing. Currently, the thoughts of spectral estimation methods based on compressive sampling are generally similar to that of signal reconstruction, with its calculation amount and the detection performance equivalent to reconstruction algorithms. With the objective of directly estimating whether the frequency band is employed or not, this paper proposes an algorithm that is suitable for sparse signals and can be directly informed of the spectrum occupancy by utilizing the sparsity of broadband cognitive signals in spectrums. Firstly, we use the perception matrix to perform the multi-drop compressive undersampling, and multiple signals to perform Bayesian detection. Then the spectral estimation is accomplished through multiple windows spectral estimation combined with singular value decomposition. Through simulation, it is validated that this method can obtain the same verdicts as the original one for the majority of sub-channels in most of time. Meanwhile, it can lower the sampling rate and reduce the amount of data that needs to be stored or processed, resulting in less storage space required for each CR node. Experiments demonstrate that the proposed algorithm has good applicability to spectrum sensing for broadband signals in the context of satellite communication, and also provides a basis for subsequently optimal design of CR engineering applications in satellite communication systems.