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Hidden Node Scenario: A Case for Cooperative Spectrum Sensing in Cognitive Radio Networks

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Abstract

Objective: Cognitive radio technology allows the opportunistic usage of licensed spectrum resources by unlicensed users. The most important function of the cognitive radio technology is spectrum sensing. In hidden node scenarios, cooperation among cognitive radio nodes is needed to improve the sensing performance. In this work, the benefits of cooperative spectrum sensing are illustrated in a hidden node environment. **Methods/Statistical Analysis:** The distributed cooperative sensing approach was adopted for the implementation. Universal Software Radio Peripheral was used in collecting spectrum data and results were analysed using MATLAB software toolkit. **Findings:** Cooperative spectrum sensing among cognitive radio nodes operating at the same frequency improves the probability of detection, and the overall efficiency of the system. Results shows that the cooperative sensing scheme outperforms the individual sensing approach keeping in mind the number of collected samples as the key performance indicator. **Applications/Improvements:** The results obtained show that the frequency spectrum is underutilised. There is a need to explore the present spectrum holes and improve on the available sensing techniques for the implementation of cognitive radio networks in the future.

Keywords: Cognitive Radio, Cooperative Spectrum Sensing, Hidden Node, Spectrum Sensing

1. Introduction

The increase in the use and development of wireless devices, technologies and services has created the issue of spectrum scarcity. There is an appreciable interest in the study of cognitive radio (CR), first introduced by[1]. As defined in ETSI 2013[2], a CR is capable to obtain the knowledge of radio operational environment and established policies and to monitor usage patterns and users' needs. Furthermore, it dynamically and autonomously adjusts its operational parameters and protocols. CR has been identified as an enabling technology that allows unlicensed (secondary) users to operate in the licensed (Primary) user bands. This can help to mitigate spectrum scarcity in wireless communications. Spectrum Sensing (SS) is a key function of cognitive radio systems for improving the spectrum's utilization. According to[3] SS enables the secondary usage of the spectrum resources, provided it does not cause any form of destructive interference with the licensed users of the spectrum.

Individual secondary user can conduct SS and make decision by itself. However, hidden node and receiver uncertainty degrades the sensing performance of cognitive radio. Previous works have suggested cooperation among sensing nodes as an effective method to improve the detection performance as discussed by[4]. According to ETSI 2013[2], Software Defined Radio

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