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Research Article

Fast Channel Selection Strategy in Cognitive Wireless Sensor Networks

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In order to meet the practical requirement for Cognitive Wireless Sensor Networks applications, this paper proposes innovative fast channel selection algorithm to solve the shortcomings of original Experience-Weighted Attraction algorithm's complexity, higher energy consuming, and the nodes' hardware restrictions of real-time data processing capabilities. Research is conducted by comparing channel selection differences and timeliness with traditional Experience-Weighted Attraction learning. Though not as stable as traditional Experience-Weighted Attraction learning, fast channel selection algorithm has effectively reduced the complexity of the original algorithm and has superior performance than Q learning.

1. Introduction

Traditionally, the licensed radio spectrum allocations are regulated by official authorities. The public and government use of radio spectrum is managed by the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC) is in charge of commercial radio resources, respectively, in the USA. With more and more applications of wireless devices, the rapid increasing requisition for radio spectrum licensing has led to current shortage of radio spectrum allocations and put their governing bodies into trouble. In fact, FCC's recent research has shown that these fixed static frequency channels are always idle or not occupied most of the time. Spectrum bands are not efficiently used or under utilization either at a temporal or on a geographical level. By seeking "spectrum holes" (unused frequency channels), Cognitive Radio (CR) can greatly improve the use efficiency of spectrum resources and solve these problems presented above in a "secondary utilization" (with lower priority than legacy users) way. First introduced by Mitola III [1], Cognitive Radio (CR) is often considered as an extension and expansion of Soft Radio (SR), which is equipped by general hardware and capable of programming to transmit and receive various radio waves.

There has already been lots of research in many aspects of CR. In sensing, Panahi and Ohtsuki [2] present a Fuzzy Q Learning (FQL) based scheme for channel sensing in CR networks. Zhang et al. [3] proposed a novel detection algorithm in which the fractal box dimension is used when the Signal to Noise Ratio (SNR) is high, while the improved TCC algorithm is used when the SNR is low, and Khalaf [4] formulated the detection problem based on the eigendecomposition technique. Hossain et al. [5] evaluated the performance of cooperative spectrum sensing with the hard combination OR, AND, and MAJORITY rules. Bkassiny et al. [6] presented an autonomous CR architecture, referred to as the Radiobot, to detect and identify the sensed signals. Lunden et al. [7] also distributed multiuser multiband spectrum sensing policies for CR networks based on multiagent reinforcement learning while Reinforcement Learning-Based Cooperative Sensing (RLCS) method was proposed to address the cooperation overhead problem and improve cooperative gain in CR ad hoc networks. [8] In channel allocation, Gállego et al. [9] presented a game theoretic solution for joint channel allocation and power control in CR networks analyzed under