

A Survey on Sensing Methods in Cognitive Radio Networks

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Abstract— Wireless communication has led a drastic change in the field of communication. “Spectrum” is one of the most important factor which depends on the efficiency of wireless communication. As we think deeply about maximum and efficient utilization of spectrum, definitely we reach at the idea of cognitive radio networks. Cognitive radio network is one of the most efficient technique to solve the issue of spectrum scarcity. In order to identify the spectrum hole in a specific geographic location, different spectrum sensing methods are used. In this paper, a deep study on sensing methods is conducted.

Key words: Cognitive Radio, Spectrum Hole, Spectrum Sensing

I. INTRODUCTION

Cognitive radio network offers a highly reliable communication, whenever and whatever we needed. It deals with efficient utilization of radio spectrum. Spectrum management is the process of regulating the use of radio frequencies in an efficient way and gain a net social benefit. Since 1930s, spectrum was assigned through administrative licensing. Signal interference was one of the major problem of spectrum use.

In cognitive radio networks, users are classified into two groups, that is, primary users and secondary users. Primary user is the licensed one and secondary users are unlicensed. If primary user is not using a specific band of frequency, then that band of frequency can be used by the secondary user. Secondary user must give back that spectrum, if it is urgently needed by the primary user. This is the main concept of cognitive radio networks.

The utilization of electromagnetic spectrum in an efficient way, lead us to think about the term spectrum hole. Spectrum hole is the band of frequencies assigned to primary user and is not utilized by the user at a particular time and particular location. In order to identify the spectrum holes, different types of sensing methods are used. Generally Spectrum sensing is of two types, quiet and active sensing. In quiet sensing, cognitive transmitter first senses and then transmits. But in active sensing method, both sensing and transmission takes place simultaneously. In this paper a study about sensing methods such as energy detection, matched filter detection and cyclostationary feature detection are explained.

II. SENSING METHODS IN COGNITIVE RADIO NETWORKS

Matched filter detection is one of the previously introduced sensing method. This method provides a fruitful result in AWGN environment. In this detection, cognitive users know about the primary user’s signal structure. Coherent detection method is used for detection purpose. In matched filter detection, the received signal is passed through a channel and then it is given to a matched filter. Then original signal and the time shifted version of the signal is correlated. And finally

it is compared with a threshold value to get a final decision. This method offers more complexity.

Another sensing method is cyclostationary feature detection method. In matched filter detection, detailed information about primary signal is a necessary one. Cyclostationary feature detection method is used when there is no detailed information about the primary signal. It requires periodicity of the received signal to detect primary user signal. Periodicity relies on sinusoidal carriers, pulse train etc. Spectrum correlation and periodic statistics properties are included in the periodic characteristics signals. But noise signal does not contain these properties, since it is random in nature. Fast Fourier transform is performed in the signal. Then using correlation, periodic statistics features are extracted. It offers more computational time.

Energy detection method is one of the simplest and commonly used sensing methods. It does not require any prior information about the primary signal. Initially, energy of the received signal is calculated. Then energy of the received signal is compared with a threshold value and finally decision is taken. The performance of this method depends on the number samples taken.

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