SPECTRUM SENSING IN COGNITIVE RADIO BY STASTATICAL MATCHED WAVELET

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ABSTRACT: *Cognitive radio draw lots of research attentions in recent years for its efficient spectrum utilization. In cognitive radio networks, the first cognitive task preceding any form of dynamic spectrum management is the spectrum sensing and identification of spectrum holes in wireless environment. Spectrum Sensing is an important functionality of Cognitive Radio (CR). Accuracy and speed of estimation are the key indicators to select the appropriate spectrum sensing technique. Wideband spectrum sensing has been introduced due to the higher bandwidth demand and increasing spectrum scarcity since it provides better chance of detecting spectrum opportunity. In this project, the application of wavelet transform used for wideband spectrum opportunity detection in CRs is documented. Conventional spectrum estimation techniques which are based on Short Time Fourier Transform (STFT) suffer from familiar problems such as low frequency resolution, variance and high side lobes/leakages. In this project we used statistical method wavelet algorithm to find the spectrum holes. This is the latest technology to sense the spectrum in the cognitive radio network.*

KEYWORDS: *Cognitive radio, efficient spectrum utilization, wavelet transform.*

1. INTRODUCTION

Wireless networks are faced in efficiency and security. The idea of cognitive radio is motivated by the observation that lots of licensed frequency bands in the spectrum are largely unoccupied or only partially occupied most of the time. This under-utilization of the electromagnetic spectrum leads to the thought that: spectrum utilization can be improved significantly by making it possible for a secondary user (SU) to access a spectrum hole unoccupied by the licensed primary user (PU). The cognitive radio highlights the power or capability of the individual radio devices. While each individual cognitive radio can make flexible decisions, the lack of user coordination and network control raises serious issues in security and efficiency. The essence of cognitive radio is real-time sensing and reuse of the PU's under-utilized spectrum on a non-interference basis. To do so, the SUs have to continuously monitor the spectrum usage of the PUs for spectrum utilization, which requires SUs to get full knowledge of the spectrum usage and behavior of the PUs. Spectrum sensing enables the SU to perform appropriate traffic analysis of the PU, including spectrum occupation, traffic volume, traffic pattern, and even traffic routing path. This is, in fact, a security compromise of the Puts on their spectrum utilization. By cognitive network, we mean an intelligent wireless system that can collect and analyze the current network conditions, and then make real time changes to network operating parameters (e.g., modulation scheme, carrier frequencies, coding schemes, and security mechanisms) for optimal network performance. The overall goal is to ensure spectrally efficient and secure information exchange among versatile wireless devices, including both the legacy devices and the powerful software-defined radios (SDRs). [1]

2. PROBLEM FORMULATION

We proposed the fast spectrum sensing algorithm as a coarse sensing for CR based on the proposed two stage sensing architecture. In this project wavelet is used to find the spectrum sensing in cognitive radio network which makes spectrum sensing fast. In cognitive radio there are secondary user can use the spectrum when primary users are not using the spectrum .These are the results given below in which the upper one is the original signal which created. And channel which have some bandwidth. Specifically, there exist 3 licensed (or primary) users that can sense the interested frequency band for CR users. We assume that each primary user's signal is band-pass signal with some bandwidth. In addition, the channel is additive white Gaussian noise (AWGN) channel with zero mean and $\frac{N_0}{2}$ variance.

3. ANALYSIS & RESULTS

CASE 1: Centre frequencies of 3 primary users' signals as 0.15, 1.15 and 2.4 MHz which are shown in the figure and their magnitude are fixed as 1.1, 0.95 and 1.15 respectively that shown in the figure 4.2 the original signal in the channel first pass through fast Fourier transform.

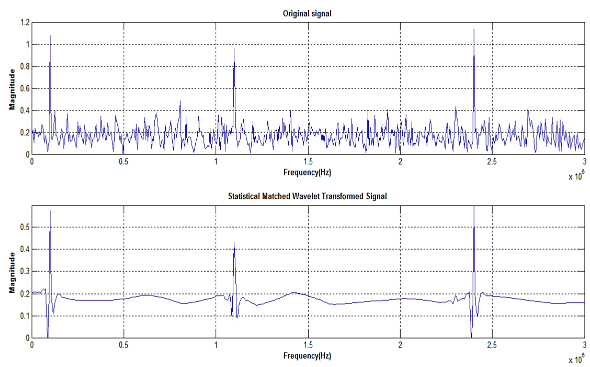

Figure.1 Three primary users and matched wavelet transformed signal

CASE 2: Centre frequencies of 4 primary users' signals as 0.2, 1.0, 1.8 and 2.7 MHz which are shown in the figure and their magnitude are fixed as 1.0, 0.95 , 1.18 and 0.9 respectively that shown in the figure 4.2. The original signal in the channel first pass through fast fourier transform. Since centre frequencies that shown in the figure so the magnitude of that frequencies are greater than the others so when pass these signal to matched wavelet so the result shown in the figure 4.2 so by these results we can see easily which part of the spectrum in unused. The matched wavelet transformed the signal in a way that the wavelet is matched to the original signal.

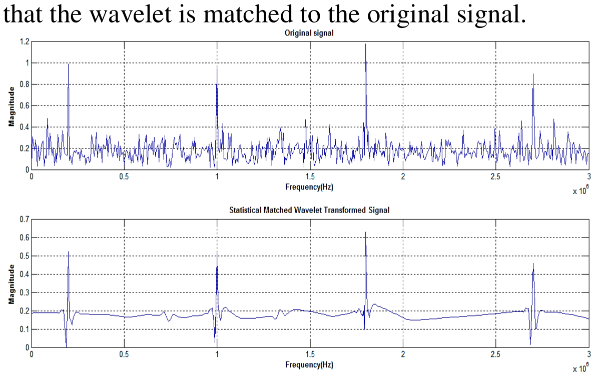

Figure .2 Several primary users and matched wavelet transformed signal

CASE 3: The figure 4.3 given below is for the channel in which there are several primary users are using the frequency band. Centre frequencies of these primary users' shown in the figure 4.3 and their signal to noise ratio (SNR) are also fixed as shown. But in this case the number of users are very large and by matched wavelet transformed we can also sense the unused part of spectrum but we have to define the some threshold level in which according to value of SNR so we can say that part of the spectrum is not used. In this case the channel is of 0-1MHz and according to a threshold level on SNR those spectrum have greater than this level so we can detect that part of the spectrum which is unused.

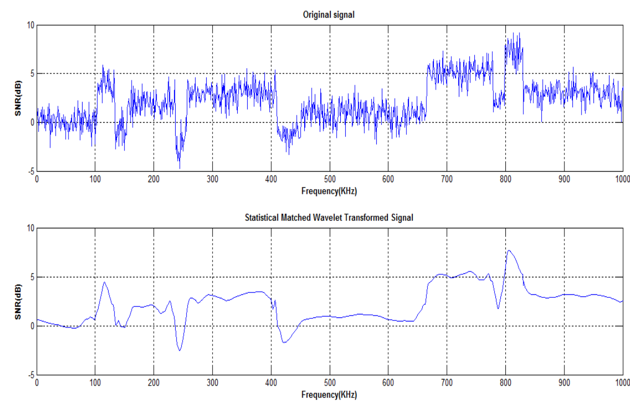

Figure.3 Three primary users and matched wavelet transformed signal

4. CONCLUSION

Spectrum is an incredibly precious reserve in wireless communication systems, and it is an important point of discussion, research and development efforts over the last many decades. CR, which is one of the hard works to employ the available spectrum more ingeniously through opportunistic spectrum usage, has turned into an electrifying and talented concept. The available spectrum opportunities are one of the significant elements of sensing in CR. In this Thesis studies the performance of matched wavelet based spectrum sensing algorithm. Thesis explores various types of spectrum sensing techniques and discusses the performance of spectrum sensing techniques.

The main purpose of the thesis was to study the performance of matched wavelet based spectrum sensing algorithm for spectrum sensing in cognitive radio. First we implemented the matched wavelet transform with the help of MATLAB plate form and simultaneously we generated non periodic signal comprises of more than one frequency which is also incorporated with the additive white Gaussian noise .Each frequency describing a primary users .now with the help of wavelet matched transform it is being matched with the original non periodic signal comprising of noise as well. Now our aim is to reduce the noise and detect or sense the primary users and also find the unoccupied part of the channel which can be utilize by the secondary users. So that the whole channel can be efficiently utilized for communication.

5. SCOPE FOR FUTURE WORK

The success of the unlicensed band in accommodating a range of wireless devices and services consider opening further bands for unlicensed use. In contrast, the licensed bands are underutilized due to static frequency allocation. Realizing that CR technology has the potential to exploit the inefficiently utilized licensed bands without causing interference to compulsory users.

But this technology is not currently in use because of the unsecured communication if certain measure like encryption or the licensing of the secondary users could make the use of this technology popular among the recent communication technique.

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