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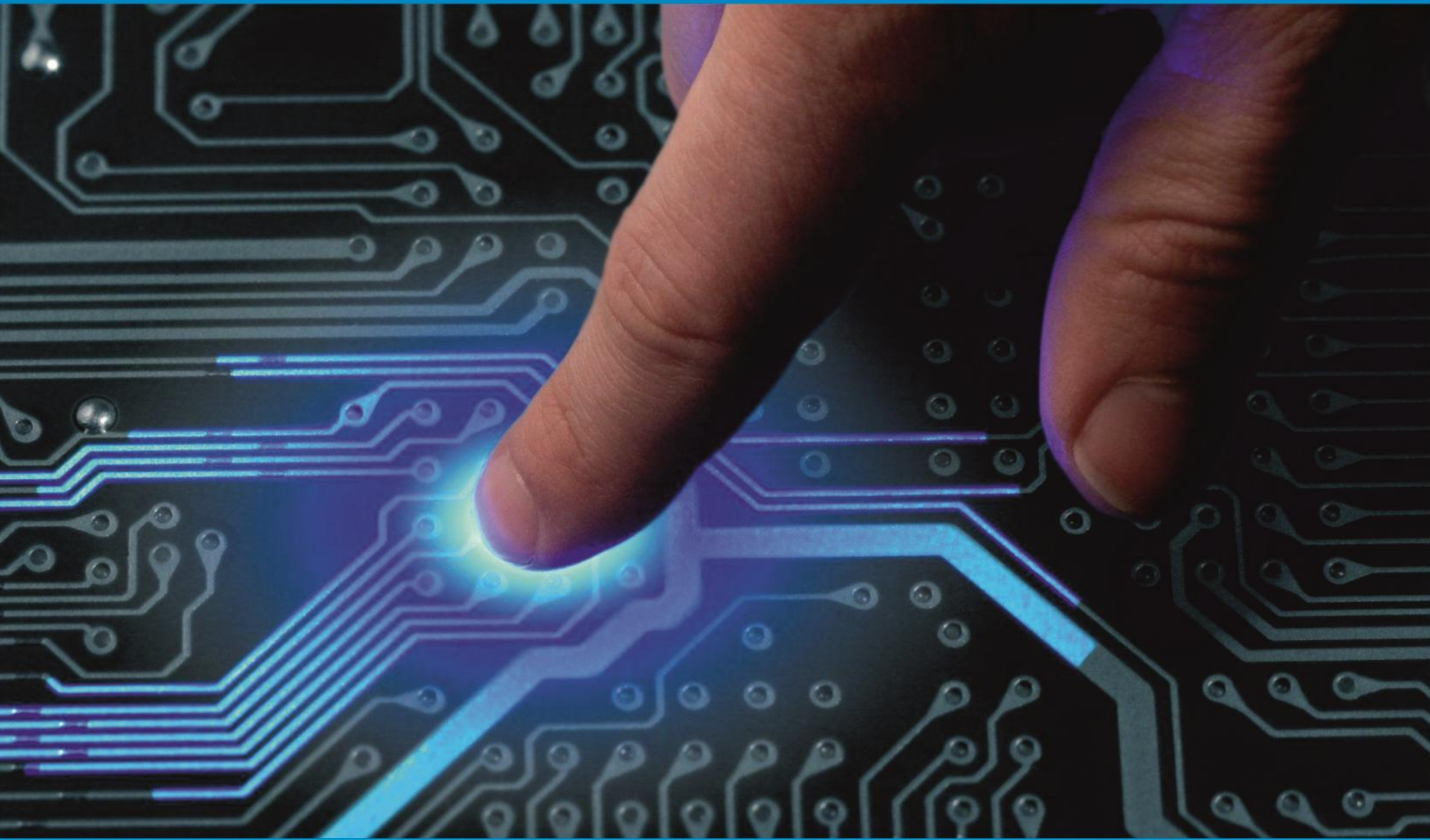

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A Review: Development of Combining Method Based Spectrum Sensing Mechanism

Poonam Kushwaha[1], Sandeep Dubey[2]

M.Tech Scholar, Dept. of ECE., Rajiv Gandhi Proudhyogiki Mahavidhyalaya, Bhopal, India[1]

Assistant Professor, Dept. of ECE., Rajiv Gandhi Proudhyogiki Mahavidhyalaya, Bhopal, India[2]

ABSTRACT: Radio refers to any wireless transmission of electromagnetic waves between a receiving and transmitting terminal. The study of present day spectrum usage reveals that nearly 70% of available spectrum is underutilized which is a serious concern as the available spectrum is the most precious resource for radio communication. The concept of cognitive radio emerged as a very strong solution that employs Dynamic Spectrum Access (DSA) in contrast to the present day situation employing Fixed Spectrum Allocation (FSA). To combat the difficulties of hidden user node problem, SNR degradation and issues related to difficulties in non-cooperative spectrum sensing, the cognitive radio networks were upgraded to the cooperative spectrum sensing. Cooperative sensing acquires information from multiple secondary users for primary user detection. The idea behind spectrum sensing is that the cognitive radio needs to capture the best available spectrum to meet the user communication requirements.

KEYWORDS: SNR, FSA, DSA, CR, CRN, Spectrum Sensing, Co-operative Spectrum Sensing.

I. INTRODUCTION

The 21st century has seen an explosion in personal wireless devices resulting in the advent of high end technological devices calling for colossal data transmission capability and speed. Most of the available radio spectrum (ranging from 3Khz-300Ghz) has been already allocated to various sectors of service such as mobile communication, defense, microwave communication, television etc. Radio transmission starts at VLF (very low frequency) range extending to VHF (very high frequency) and UHF (ultra-high frequency) bands. Thus it is evident that different parts of the spectrum are used for different technologies and applications. The spectrum is composed of several frequency bands which are slotted into channels and each band is used for a special purpose. The radio spectrum is a very scarce and valuable asset for every radio engineer and so great emphasis has to be given on its optimum usage.

II. LITERATURE SURVEY

[1]Jaewoo So et al: In cooperative spectrum sensing, a multi-bit combination rule shows better sensing performance than one-bit hard combination rules at the sacrifice of the reporting overhead. In order to overcome the trade-off between the sensing performance and the reporting overhead, we propose a novel group-based multi-bit cooperative spectrum sensing scheme with a limited reporting overhead. The proposed scheme adopts contention based reporting in order to restrain the reporting overhead while achieving multiuser diversity with an increased number of secondary users (SUs).

[2]Younes Abdi Mahmoudaliloo et al: Presents the notion of dynamic spectrum sensing along with better spectrum sensing schemes for cognitive radio networks (CRNs). These schemes are developed by considering a diverse collection of different processes and parameters. The research focuses on centralized cooperative spectrum sensing where the sensing nodes report their findings to a Fusion Centre (FC), where a global decision about the availability of spectrum is made. The work proposes novel spectrum sensing structures. Techniques from the optimization theory are used to analyse the new structures in an effective and computationally affordable fashion. Optimisation techniques like standard convex optimisation, convex-over-convex fractional programs, stochastic programming and neural networks etc. are incorporated.

[3]Devender et al: It is explained that the non-cooperative spectrum sensing scenario involves every SU node sensing its environment and making its individual decision about the presence or absence of a PU on its own whereas in the cooperative scenario, every SU node shares the results of its detection with other nodes and the shared information is taken into consideration to arrive at a final decision .The study also reveals that, for low SNR scenario, cooperative spectrum sensing provides a better performance than the non- cooperative scenario. However, for higher SNR values (typically greater than 10 db), the probability of detection obtains an optimal value for both non-cooperative and cooperative scenario.

[4]Md. Shamim Hossain et al: This work presents a study on the performance of a cooperative spectrum sensing scheme that uses energy detection at every cooperating node and employs hard decision fusion at the FC, for the non-fading and fading scenarios. The non-fading environment is modelled by AWGN channel while for the fading scenario, Rayleigh, Rician and Nakagami channels are used. It is found that the process of spectrum sensing becomes harder in the presence of fading. It is observed that performance of energy detector degrades more in Nakagami channel than the Rayleigh and Rician channels. It is observed that in the Rician channel, because of the LOS signal, the sensing performance is better than in other channels.

[5]Chilakala Sudhamani et al: This work aims at calculating the total bit error rate (BER) for the traditional decision fusion rules viz. AND rule, OR rule and Majority rule with traditional energy detector. The observations reveal that as SNR increases, the noise level decreases and the detection probability increases, resulting in a decreased BER. It is concluded that for the improved energy detector, AND rule performs better than OR and Majority rules.

[6]Waleed Ejaz et al: This work puts forward the scenario of a CRN with heterogeneous sensing devices. Here, a CRN with sensing nodes employing different local sensing methodologies is described and a performance analysis of hard and soft combination for this network is proposed. It is concluded that if only a small number of SU nodes in a homogeneous network (employing a uniform local sensing method) are replaced by nodes employing improved sensing methodologies, a significant improvement in the detection performance can be obtained. The work also concludes that the soft fusion techniques outperform the hard fusion techniques for the heterogeneous CRNs which holds true for the homogeneous CRNs also.

[7]Ting Peng et al: This work proposes a novel hard decision fusion algorithm designed to combat the effects of the spectrum sensing data falsification (SSDF) attacks. SSDF attacks mislead the FC to make incorrect decisions about spectrum availability. SSDF attacks are launched by malicious users (MUs) hidden within the primary network, mimicking a PU. The work describes the attack modes of hidden MUs as always busy attacks (AB), always free attacks (AF) and always opposite report attacks (AO).To mitigate these attacks, a reputation based mechanism is adopted in which the SU nodes are classified on the basis of reputation and MUs are screened . It is observed that OR fusion rule has strong robustness under AF attacks whereas for AB and AO rules, the proposed algorithm outperforms traditional hard decision fusion rules.

[8]James D. Gadze et al: In this work the authors provide a detailed study of the energy detection(ED) technique. The study aims at assessing the performance of an energy detector for non-fading and fading channel scenarios. The authors suggest that ED performed over a Rayleigh channel exhibits a tough detection performance compared to that of AWGN channel. The concept of cooperative spectrum sensing is also studied and it is concluded that for both noon cooperative and cooperative scenarios, ED technique performs better in AWGN channel than in fading channels.

[9]Muthu meenakshi et al: This work provides a brief on the traditional energy detection scheme. The work suggests that the performance of energy detection degrades considerably in low SNR conditions also, that it cannot reliably detect PU signals under varying noise condition, signal fading and shadowing. The paper proposes a novel energy detection scheme, which is an optimised traditional ED having two thresholds instead of one. The performance analysis suggests that the proposed enhanced ED scheme significantly improves spectrum sensing accuracy under varying SNR conditions and outperforms the traditional ED without much increase in complexity.

[10]O. P. Meena et al: This work reviews information fusion methods employed in cooperative spectrum sensing and provides an analysis of the decision fusion rules along with the simulation results. The work put forwards the performance analysis the soft and hard combination rules and deduces that the soft combination technique outperforms the hard combination scheme but at the cost of increased reporting channel bandwidth. The findings of the work reveal that the AND & OR rules of the hard decision fusion scheme represent a very strict and a very relaxed condition respectively while the M out of N rule gives an intermediate performance. For the soft combination scenario, the work establishes the Weighted Gain combining (WGC) as a better performing scheme than the Equal Gain Combining (EGC) scheme.

III. PROBLEM STATEMENT

Based on the literature review in the above sections, the researcher found the following research: Most of the researchers working in the field of cooperative spectrum sensing (CSS) algorithms have shown interest in energy detection due to its simplicity. Hence this research focuses on improving energy detection scheme.

IV. CONCLUSION

In From the study done, it was observed that cooperative spectrum sensing has emerged as a strong concept to battle large number of issues. Hence this research work focuses on how cooperative spectrum sensing can be optimized further.

The appraisal of the diverse literature helped in the identification of the gap or problem in the selected area of interest. So, the problem statement has been formulated as: "Optimization of Centralized Combining Hybrid mechanism for Cognitive Radio Networks".

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