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# Performance Analysis of Prediction Based Bandwidth Selection for Cognitive Radio Using Optimization Techniques

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**ABSTRACT**

Wireless networks and information traffic have grown exponentially over the last decade. Consequently, an increase in demand for radio spectrum frequency bandwidth has resulted. Recent studies have shown that with the current fixed spectrum allocation (FSA), radio frequency band utilization ranges from 15% to 85%. Therefore, there are spectrum holes that are not utilized all the time by the licensed users, and, thus the radio spectrum is inefficiently exploited. To solve the problem of scarcity and inefficient utilization of the spectrum resources, dynamic spectrum access has been proposed as a solution to enable sharing and using available frequency channels. In this paper we improve the rate of performance evaluation parameter using the optimization techniques than previous techniques.

**Keywords:-** Optimization Techniques, Neural Network, Spectrum Sensing, Wireless sensor network, Cognitive radio, Primary user, Secondary user.

## INRODUCTION

As demand for advanced wireless technologies continues to grow, the load on frequency bands for wireless communication is also increasing. Initially, the problem of accommodating the increasing load was mainly identified as a physical scarcity of the spectrum but an in-depth analysis showed the result is also due to inefficient utilization of the radio spectrum.

Research findings in [1-4] suggest that indeed in a specific location and time some frequency bands are heavily used while few are partially occupied and remaining bands are left unused. Under the fixed spectrum allocation policy, it was found that spectrum utilization only ranges from 15% - 85% in the United States [5].

Cognitive involves conscious intellectual activity as thinking, reasoning or remembering, and is based on or capable of being reduced to empirical factual knowledge, according to the dictionary [14]. A cognitive network is a network which has knowledge representation about the devices, systems, networks and events, and uses cognitive process/cycle that can perceive current network conditions, and then plan, decide, and act on those conditions. The network can learn from the consequences of the actions to make future decisions, all while following end-to-end goals.

A large number of licensed spectrum remains underutilized by the licensed or primary users (PUs), and cannot be accessed by potential radio spectrum users, secondary users (SUs). In order to address both spectrum scarcity and inefficient utilization of licensed spectrum, dynamic ways to share unoccupied channels can be employed. Unlike fixed spectrum allocation, dynamic spectrum sharing, also known as opportunistic spectrum sharing, enables sharing the channels between PUs and SUs. To pave the path to dynamic spectrum access by enabling spectrum sharing and reuse, Cognitive Radio (CR) technology stands to be a promising solution.

Cognitive Radio is an intelligent wireless communication technology, which will enable wireless radio systems to be aware of its surrounding radio frequency environment and adapt to any changes by reconfiguring communication parameters [7-8]. Amid active licensed users of frequency bands a cognitive radio detects the presence of available spectrum and is able to use the unoccupied licensed channels without interfering with PUs operations. Cognitive Radio technology is actively pursued as a next generation communication technology through the IEEE 802.11 standards that provide SUs the scope to use TV white space or available licensed TV spectrum [13]. Objectives of CR are to ensure faster and reliable communication at any time and location, and to efficiently utilize spectrum resources. Briefly, a cognitive radio cycle involves the three processes of sensing, deciding, and taking actions. To complete the cycle, a cognitive radio system goes through the three following phases of operation: Spectrum Sensing, Spectrum Analysis and Spectrum Decision.

## II PRIMARY USER DETECTION

To enable CR communications, SUs need real time knowledge of PUs' activity to identify available spectrum. Similarly, the sniffers are also required to detect PUs' activity in order not to waste time and energy listening on the primary-occupied channels. Primary user detection can be achieved by using either spectrum sensing or by querying a geo-location white space database over the internet. Spectrum sensing is expensive in cost, energy consumption and complexity of hardware. On the other hand, the database approach is easier to implement, which allows devices to report their locations to a web server that returns a list of available channels at that location. However, database approach suffers from utilization inefficiency, since it uses propagation models to decide the available spectrum, and hence, is conservative in the channels it returns for a given location. Either of these two approaches can be applied to our monitoring framework.

Feature detection is one popular spectrum sensing method for the sniffers to detect PUs' appearance. The feature detection algorithms can be used to sample the UHF spectrum to detect the presence of TV broadcasts and wireless microphone signals, which can effectively differentiate between the SUs' and PUs' signals. Then, the sniffers can directly perform feature detection in the beginning of every slot to sense the availability of monitored channels.

## III PROPOSED WORK

To enhance the decision-making capabilities of CR systems, combined information on channel condition and its occupancy rate are necessary to develop a more accurate understanding of the adjacent radio frequency environment. Simultaneously, to select from a range of options provided by the decision-making process, a ranking mechanism or score based channel selection process is required to select the best channel. Ranks can be assigned to the list of channels by evaluating their usefulness in terms of channel condition parameters, such as signal-to-noise ratio (SNR), and spectrum occupancy rate. Utility models can characterize the channel condition parameters and occupancy, respectively. These models can then be used to estimate channel utility. Channel with the largest utility value is ranked highest and the rest of the channels follow with decreasing ranks.

Cooperative spectrum sensing is key to the success of CRNs. Recently, fully distributed cooperative spectrum sensing has been proposed for its high performance benefits particularly in cognitive radio ad hoc networks. The channel access/usage model capturing the patterns of secondary user activities are constructed using the sensing outcomes of the inspection sniffers thus is closely related to the duration of a sensing slot. A sensing slot is composed of channel sensing and channel switching time, whose length depends on the number of channels to be scanned.

PSO algorithm is based on stochastic global optimization techniques. Motivated by the social interaction of bird flocking and fish swarms, PSO was proposed by James Kennedy and R.C. Eberhart in 1995. When in search for food, birds share their respective positions and update the flock with the information on the best food source within the search space. In the case of adaptive noise cancellation, similar search pattern is used in PSO with the objective of minimizing residual noise by locating best weight coefficients for the adaptive filter, which is analogous to finding the best food source or positions.

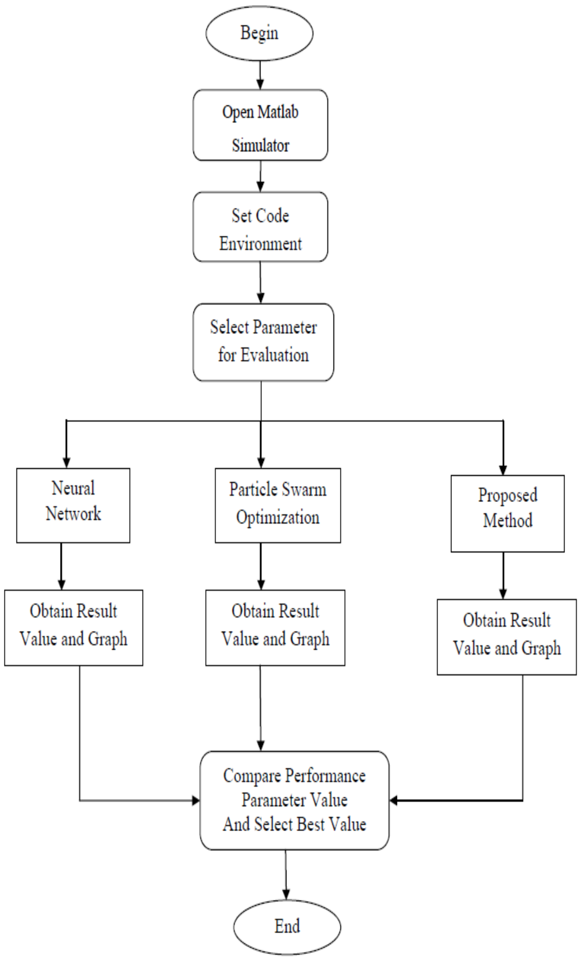


**Fig 1:** proposed flow grpah for spectrum sensning and utilization.

## IV EXPERIMENTAL WORK

Cognitive radio (CR) has emerged as a key technology to enabling the use of licensed spectrum bands from incumbents, also known as primary users (PUs), when they are idle. An important challenge in CR technology is reliable spectrum sensing [10], by which cognitive radio devices, also known as secondary users (SUs), detect and exploit a spectrum band when it is unused, but vacate the channel immediately upon detecting the presence of primary users. Cooperative spectrum sensing, which exploits the cooperation of multiple SUs and leverages the spatial diversity among those location-dispersed SUs, has shown significant advantages in achieving reliable spectrum sensing results. Cooperation in spectrum sensing can be achieved in two models: centralized or distributed.

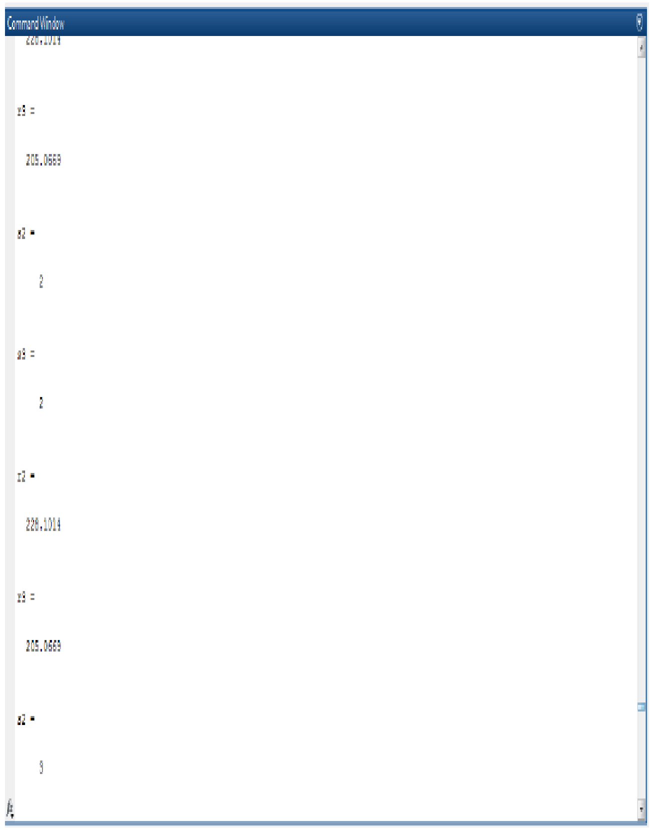


**Fig 2:** The above figure shows the experimental environment for the proposed techniques.

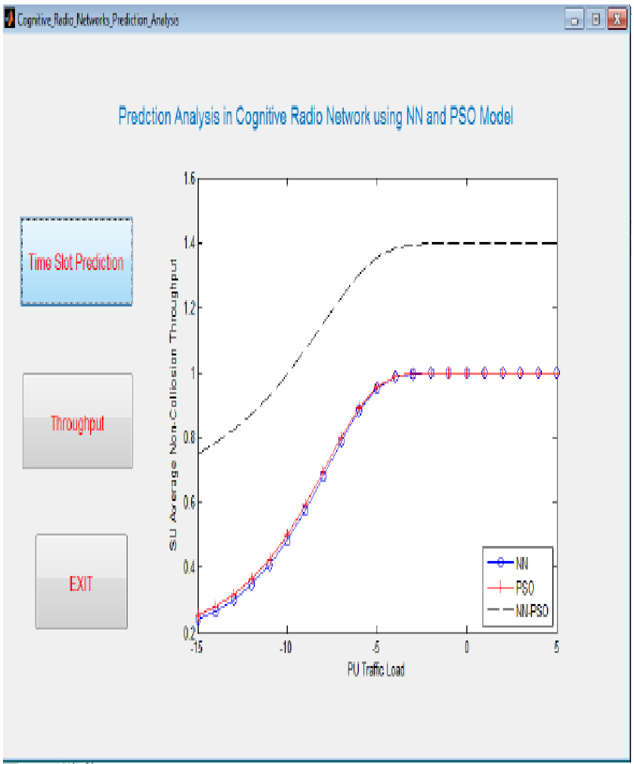


**Fig 3:** The above figure shows the experimental study between the proposed and existing techniques.

## V CONCLUSION AND FUTURE SCOPE

The area of data communication technologies is one of the fastest changing areas, with numerous service and applications having enormous impact on different aspects of modern society, including economic growth, inter-human relationship, scientific development, education and entertainment. Therefore, the development of a reliable and robust, yet flexible and extensible communication infrastructure is of almost importance to facilitate these human to- human as well as human-to-machine communications.

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