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A Review on Variety of Modulation Signal can be Detected and used for Cognitive Radio

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ABSTRACT

The requirement for higher information rates in remote correspondence has expanded exponentially. The range get to arrangement has limited the developing interest of remote gadgets. Out of the aggregate given range just a little segment is given for open client and an expansive part is given for authorized client. In any case, the unlicensed range is utilized more than the authorized range, which constrained the FCC to plan a strategy so that the restricted range can be utilized effectively. The phantom inhabitance of authorized range is less when contrasted with the unlicensed range. Intellectual radio has developed as an answer for this wasteful use of authorized range; it recognizes the unused bit of authorized range which is called void area and makes them accessible for unlicensed client.

Before giving the blank area to the optional client for transmitting the signs, it is required to distinguishes and group the signals, so that the cognative radio can work effectively. So to group the approaching signs numerous technique are utilized like element extraction technique and neural system strategy. In highlight extraction technique, first we need to discover the element esteem from every one of the signals then by contrasting that and the limit esteem we can discover the balance kind of the signals. In neural system technique, we need to give the element incentive to a neural system and that system will discover the kind of the signal.

I. INTRODUCTION

Cognitive Radio

From the most recent couple of decades the utilization of wireless communication has been expanding exponentially, on account of the expansion in the quantity of user in electronic application. The spectrum that is accessible is stay steady, yet the users are expanding. so it will prompt spectrum shortage. The accessible spectrum is partitioned among two sort of user i:e:authorized user and unlicensed user. The inaccessibility of spectrum is because of the wasteful use of the authorized spectrum, it is watched that around 80-85% of the authorized spectrum is not in use whenever. Presently to defeat the wasteful usage of the spectrum and to satisfy the request, another idea called "Cognitive-radio "comes into the photo.

The Cognitive Radio is an innovation which productively uses the authorized spectrum without making any mischief the authorized users. It looks the authorized recurrence bands for unused spectrum, and utilizations

them effectively. The unused authorized spectrum is otherwise called 'white spaces'.

1.1 Cognitive Radio Concept

Cognitive Radio gets its name from "cognitive" which implies procedure of getting information by the utilization of thinking, instinct or observation. It is another innovation which examines the radio spectrum and looks for white spaces in it. It empowers the unlicensed user to utilize the authorized bands without making any noteworthy impedance the authorized user. The authorized user is otherwise called primary user (PU). The users which are having no rights to get to the authorized bands are known as secondary users (SU)

1.2 Characteristics of Cognitive Radio (CR)

CR is an intelligent radio system which check the availability of the spectrum andutilized them efficiently. CR has the following characteristics which help in achieving this goal

1. ***Flexibility***: Cognitive radio should able to change its parameter like data rate, modulation technique, etc.
2. ***Agility***: CR should be able to operate in several spectrum bands in order to utilize white spaces observed in different frequency bands.
3. ***Sensing***: CR should be able to sense the RF environment and internal working parameters in order to sense the existence of spectrum holes and to provide an overview of the radio spectrum utilization.
4. ***Networking***: CR should be able to communicate between different nodes of the wireless communication to bring synergy in using the radio resources. Sharing of information and cooperatively passing decisions on the radio resources.

1.2.1 Terms related to Cognitive Radio Network [9]

Following are some important terms related to cognitive radio network

1. ***Primary user-*** A licensed user is called as a primary user who has the authority to use the licensed band.
2. ***Secondary user-*** A user who has no right to access the licensed spectrum is called as a secondary user. It is also known as CR user, because the CR detect the white space in the licensed band and the secondary user transmit the data in that white space..
3. ***White spaces-*** The licensed spectrum which are not in use is known as white space. It provides opportunity for secondary users to access that unused spectrum with the help of CR technology. One of the main aims of CR is to search for white spaces. It is also known as spectrum holes.

1.3 IEEE 802.22- An Exclusive Standard For Cognitive Radio [9]

It has been observed by FCC, spectrum scarcity is an artificial result of the way the bands are regulated. Large part of the licensed radio spectrum is used inefficiently by the licensed user adds to the problem of growing demand for additional spectrum. The commercial achievement of unlicensed bands has constrained FCC to give more unlicensed spectrum. With a specific end goal to expand the spectrum usage of authorized bands, FCC has enabled unlicensed users to get to the authorized bands without influencing the PU.IEEE 802.22 is a standard which gives the chance of using the abandoned TV bands for CR

users without making any critical obstruction the authorized user. This standard is moreover known as WRAN standard [6]. It focuses for the most part on VHF/UHF TV bands due to their profoundly ideal proliferation attributes and overall move from simple to digital TV making spectrum openings called "White Spaces". IEEE 802.22 focuses on country ranges, which constitutes around 45% of the total populace where wireless is a suitable wellspring of communication. It indicates the PHY layer and MAC layer particular for various techniques and under various working conditions so as to adventure the unutilized authorized spectrum.

1.4 Problem Statement

As the wireless communication user is increments persistently, so the interest for the accessible spectrum is likewise increments however the radio spectrum that is accessible with us is consistent, so it is required to utilize that accessible spectrum productively. Two sorts of user are there in wireless communication, one is authorized user and the other is unlicensed user. The authorized user utilizes a substantial bit of the spectrum though the unlicensed user utilizes just a little bit. In any case, the authorized user uses that authorized spectrum wastefully which causes the spectrum shortage. So we require another innovation which uses that authorized spectrum proficiently. Cognitive radio is insightful radios which distinguishes the white space in authorized band and make them accessible for the unlicensed user. The secondary user transmit the date through cognitive radio in the white space, For the cognitive radio to work effectively, the arrangement and distinguishing proof of signals that will transmit is required.

1.5 WHY AMC

The main job of the cognitive radio is to use the available spectrum effectively. The cognitive radio first detects whether there is any primary user transmitting data in the licensed band or it is free. If the band is free, then it allows the other user to transmit their data in that vacant band. For detecting whether the band is free or not and utilizing that available band effectively, the cognitive radio required the AMC block. The AMC is placed between the demodulator and signal detector. it find out the modulation type of the signal. Modulation is the process in which one of the characteristics of the carrier signal varies according to the variation of the massage signal. For identification of signals, modulation type is used as main characteristics. AMC is use to find out the modulation type of the detected signal automatically.

Normally two methods are used to find out the modulation type of the signal

1. Decision theoretic
2. Statistical pattern recognition

Decision theoretic approach uses hypothesis and probability testing argument, based on probability and careful analysis it calculate the threshold value, and by comparing the feature value of the detected signal with this threshold value, it find out the modulation type of the signal.

However the pattern recognition approach do not required any probabilistic analysis for calculating the threshold value. This pattern recognition approach is divided into two subsystems.

(a) Feature extraction subsystem
(b) Recognition subsystem

Feature extraction subsystem is responsible for extracting the feature value from the

detected signals, and the recognition subsystem is used for classification of incoming signal based on feature value.

1.6 Classification of Analog Signals

Presently a days, regularly digital signals are in utilized, yet analog signals are additionally utilized as a part of numerous application, so we have to group the analog signal, here I have taken a portion of the analog adjusted signals like AM, FM, PM, DSB, VSB, LSB, USB. An automatic modulation classifier comprise of three phase:-

1. Pre processing
2. Key feature extraction
3. Modulation classification

The signals that are gotten by the accepting radio wire is given to the automatic modulation classifier piece. Presently the classifier extricates the key element from the given signal. All the adjusting signals have some individual component, which are extraordinary to that signal, so by extricating that element and contrasting that and an appropriate edge esteem, we can choose the kind of modulation, in analog modulation signal, all the data are put away either in sufficiency, stage, or recurrence of the bearer signal. On the off chance that we consider these three section, then we can choose the kind of modulation.

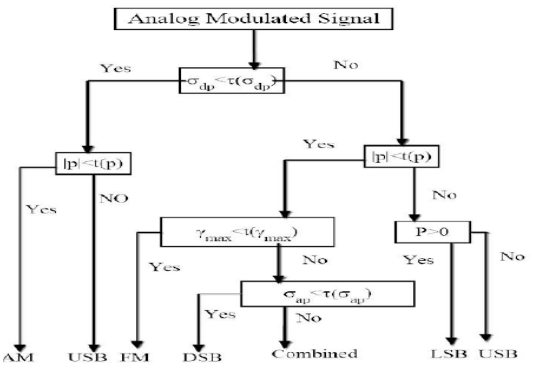

Figure 1. Signal flow graph for analog modulated signal

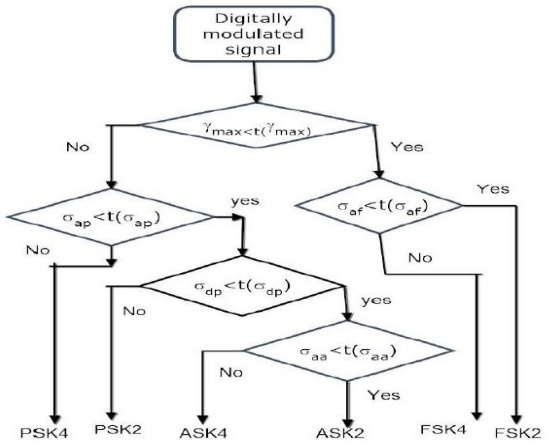

Figure 2. A flow graph for digital signal

II. Conclusion

The AMC using decision theoretic method and statistical pattern recognition method are two widely used methods for identification and classification of signals in cognitive radio. The decision theoretic method use probability and hypothesis for calculation of the threshold values, since it require very careful analysis for calculations, so its performance is less. On the other hand the statistical pattern recognition using ANN, does not require the calculation of threshold values, the ANN first optimize the network parameter and according to that parameter values, it identifies the modulation type of the incoming signal. Hence the performance of ANN network is very high. It is shown in the performance graph that, the accuracy of ANN system is very high even at low SNR. The mean square error vs the epoch graph shows that, if the number of epoch for training of the system is more than the MSE is less.

III. Future Work

Two hidden layer artificial neural network gives better performance for the identification and classification of signals for cognitive radio. The neural network methods can also be used for classification of other kind of signals like television

signals, IEEE 802.22 WRAN signals, universal software radio peripheral (USRP) signals. Many other methods are also there for the classification like, fuzzy logic, genetic algorithm, GNU radio.

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