Algorithm for best Relay Selection in Hybrid Relay Cooperative Cognitive Radio Relay Networks

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Abstract

The performance of the best relay selection on Hybrid relay mode in cognitive radio relay networks is studied. Some important factors, such as the bit error ratio (BER), the outage probability, and the average channel capacity, are analyzed in this paper. The impact of spectrum sensing process as well as the spectrum utilization efficiency of primary user on the performance of Hybrid selection-based cognitive radio relay networks is considered. The proposed scheme is validated by simulations by using MATLAB, and the analyses of closed-form expressions for some figures of merit, e.g., the outage probability, the BER, and the average channel capacity, are all consistent with the outcomes of simulations. The simulations also prove that the performance of the proposed scheme is impacted considerably by some other critical parameters, such as the number of relays. In this paper the hybrid decode and forward (DAF) and amplify and forward (AF) using Huffman coding is used for a single relay and multiple relays, the whole arrangement is done in MATLAB environment. It is noticed form the result and discussions that our proposed approach is able to achieve less bit error rates and high capacity to reduce the vulnerabilities in cognitive radio networks (CRN).

Keywords: cognitive radio, cooperative networks, relays, decode and forward.

1:- Introduction

There is a rapid development of wireless communication and it's a part of our life. Due to this, available resources like spectrum are becoming scantly. It is found that most of the time these licensed network remains underutilization. [2]Cognitive radio has been the solution of this underutilization of radio spectrum. Cognitive radio intelligently senses the unused spectrum. It means available spectrum cannot use by primary users.

The main functions of Cognitive Radio include [3]:

1. Spectrum sensing: In spectrum sensing, cognitive radio device senses the spectrum holes.

Holes means spectrum that is not being used by Primary Users (PU). If primary user arrival it can vacant that spectrum very fast it means it can analyze the spectrum band.

2. Spectrum decision: Cognitive radio decide the best spectrum hole which is sensed by spectrum sensing

3. Spectrum sharing: Spectrum sharing means to share the spectrum band. Working with spectrum sharing is to manage the collisions and interference among the SUs also interference to the primary user.

4. Spectrum mobility: After selecting appropriate spectrum band, secondary users start communication. Spectrum mobility main work is if a primary user starts communication in a same selected band, in that case, cognitive radio devices change their operations and functionalities according to the situations.

To increase the reliability, functionality, and security of the network, the "Hybrid Cognitive Radio Network" is useful. [7] Cooperative Transmission Channels: (1) Relay channels: In a relay channel the communication between a source and a destination done through the use of a relay node. (2) Multiple-access channels: In this two independent nodes wish to communicate to a single common receiver. (3) Broadcast channels: In this channel, a single transmitter wishes to communicate independent messages to two independent receivers.

2:- Proposed Work

The proposed work deals with hybrid relay selection scheme in cognitive radio network based on single and multiple relay approach for improving the security and reliability tradeoff. In this research work, we have used SNR ratio for the relay selection. As the signal receive strength and signal to noise ratio is high for the particular cognitive node then the multiple relays is selected as the routing node for sending packets from the single user to the destination. Packets sending are down by using a single relay and multiple relay hybrid approach. So that route also consists of the fewer path delays for the increasing the security and reliability issues. We have considered AWGN (additive white Gaussian noise) and Rayleigh fading channel for data transmission. Path loss deals with the decrease in power density.

Path loss is expressed in decibels. The path loss can be evaluated as

$PL = 10t \times \log10 (d) + C$

Where PL is the path loss, t is the exponent for path loss, d is the distance among the source and destination, regularly measured in meters, and C is system losses [10] [14].

So that single relay and multiple relay hybrid cognitive radio network are used for improving security and reliability trade-off. Some parameters i.e. bit error rate, channel capacity, outage probability can show that how much signal is reliable and secured during signal transmission

3:- Algorithmic Flow Steps

Step 1: Initially the user locations are evaluated and then the deployment of the secondary users is taken place.

Step 2: The process of deployment of cognitive radios is initialized.

Step 3: Distances among the cognitive radios are evaluated to achieve high signal strength to achieve routing in the cognitive radios.

Step 4: The hybrid approach for decode and forward and amplitude and forward approach is achieved to obtain high security and reliability tradeoffs is done for a single relay and multiple relays.

Step 5: The evaluations from each end of the channel such as from relay to the base station, from a mobile station to the base station is taken place based on a single relay and multiple relay approach.

Step 6: The performance of single relay and multiple relays are evaluated in terms bit error rate, channel capacity, and outage probability.

Step 7: Compare the result performance of single relay hybrid and multiple relay hybrid approach.

4:- Result and Discussions

The whole scenario is taken place in MATLAB 2016a. We have used MATLAB because it is one of the efficient computing tools to achieve high-end analysis in an effectual manner.

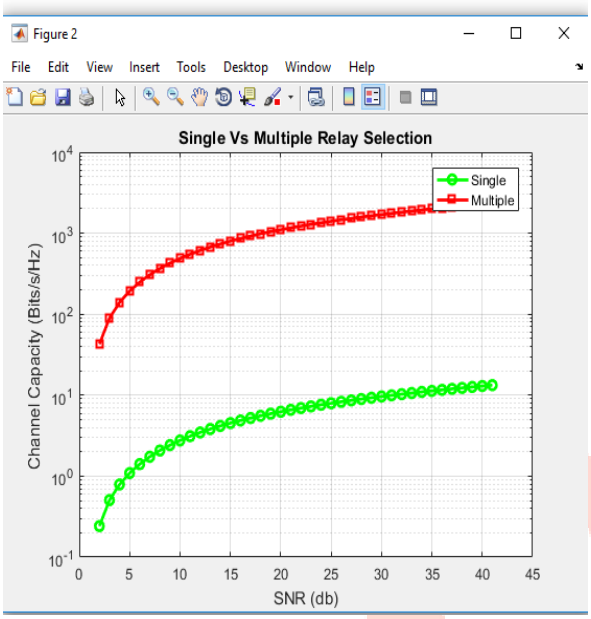

Fig 1: Channel capacity comparison between a Single relay and multiple relays

The Fig. 1 shows the channel capacity comparison between a single relay and multiple relays cognitive radio network and the multiple relay selected network in which secondary users are deployed with cognitive radios. As shown in fig. channel capacity of multiple relays is better than single relay.

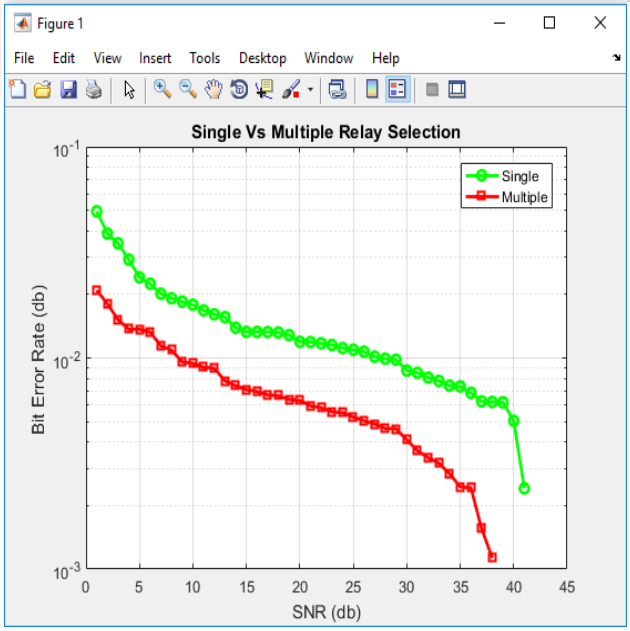

Fig 2: Bit error rate comparison between a Single relay and multiple relays

The fig. 2 shows the Bit error rate comparison between a Single relay and multiple relays and shows that our proposed approach is able to achieve fewer bit errors which must be low for high reliabilities

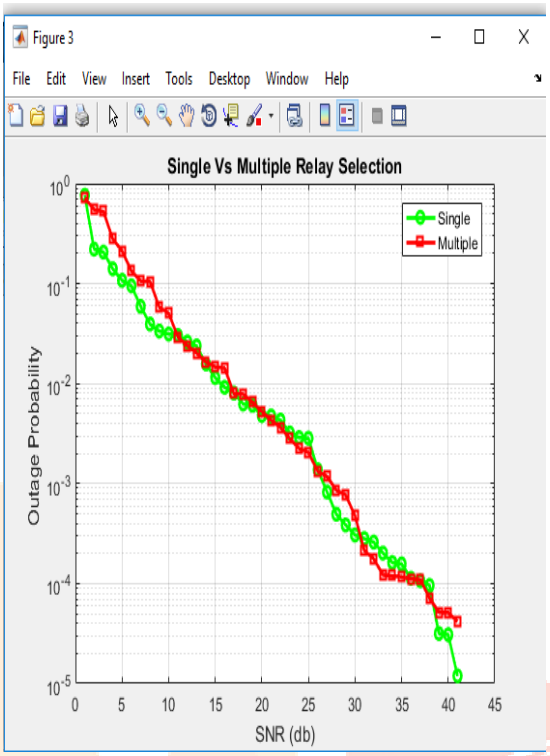

Fig 3: Outage probability comparison between a Single relay and multiple relays

The fig. 3 shows the Outage probability comparison between a Single relay and multiple relays which deal with the probability distribution that the rate of the information is not supported which shows the network reliability. It is one of the main concerns in the cognitive radio. Outage probability is well known with the capability that the stability rate will become less than the threshold rate.

5:- Conclusion

This paper deals with the hybrid decoding and amplification approach for the single and multiple relay selection approached to increase the security and reliability of the communication system. From the above result and discussions, we can notice that the proposed developed scheme is able to meet all the factors and is well efficient to increase the system efficiency with less error rate probabilities and high capacity to carry information at large distances.

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