Multiple Group Handling Cognitive Radio Network With High Accuracy

Prof. Dhaigude Nitin[1], Mr. Aniket Nale[2]

[1] *Professor, Dept. of Electronics & Telecommunication, SVPMs COE ,Malegaon(Bk) ,India*
[2] *Dept. of Electronics & Telecommunication ,SVPMs COE ,Malegaon(Bk) ,India*

---***---

Abstract - *In this paper, We can consider the multiple channels and group-based cognitive radio network, the secondary users having heterogeneous sensing ability in terms of highly accuracy for sensing. We use co-operative spectrum sensing(CSS) scheme for cooperating secondary users in multiple work group such that different work group are responsible for sensing different channel. The group-base CSS scheme use in work group we share channel in same cooperating users are in multiple rounds .In this work , we propose adaptively assigning that the heterogeneous Co-operating secondary users to different groups to maximize the throughput efficiency while maintaining a predefined sensing accuracy. In Cognitive Radio Network is detected by channel are use or not ,if not the avoid are there but sometimes lot of constraints & challenges , also issues are there it get amount of busy server. The PU users get not possible to provide network then use smartly SU .It is provide network to group-based with the help of different sensing round. The Heterogeneous group based channel shares CSS scheme. It is Adaptive Secondary Useres solve problem about Heterogeneous Group user and achieve that the maximize throughput efficiency & low computational complexity significantly that can be as compared with existing nonadaptive assignment and sequential CSS scheme.*

Key Words: Cognitive Radio ,Co-operative Spectrum Sensing(CSS) , sensing Accuracy, Sensing Overhead, Cognitive Radio Network(CRNs).

1.INTRODUCTION

Cognitive radio & application of them with trainable adaptive radio system to enable intelligent connection amongst various group user. Cognitive radio network are used for wireless communication with the help of node changing its transmission or sensing parameter to communicate Primary User (PU) & Secondary User (SU) for adaptive group, efficiently avoiding interference with authorized and unauthorized users[1],[2]. The change of parameter is based on active monitoring of various factors in both external & internal radio environment including radio frequency spectrum. The Cognitive radio network work as two-layer architecture , the second layer transmit the signal on the frequency band assigned to the first layer by sensing the radio frequency band in order to avoid the interference towards the first layer. Cognitive network enable user to focus on content and context rather than configuration and management of the network for group user. The Cognitive Radio Network (CRNs) use the several work group that can be channel get allocate . These channel is either be primary or Secondary. Firstly , PU channel allocate several user work group but these channel cannot be possible to allocate all users in that group then we help with SU channel allocation. The channel get allocate different sensing rounds by handling with non-adaptive grouping and sequential CSS scheme.

The non-adaptive grouping and CSS scheme, SU get assign random channel but not specifically sort in certain order in sequential scheme. The SU get sense same channel in each sensing period but mainly aim is to improve sensing accuracy of PU. The scheme is assign all user to each group at different each sensing round are there. In centralized Co-operative spectrum sensing identify vacant licensed band and communicate that some method for SU follow geo-location and beacons method states that PU register relevant data ,their location and transmit power in expected duration at centralized database ,these database called fusion center. These get to make combine decision for SU. The SU get transmit local decision to fusion center error occur then report to channel for power control and phase shifting technique detection performance of CSS based on OR fusion rule.

The SU have to access database to determine availability of vacant licensed band in their location and help with the user group. The SU by Identify data, Access data & Control data with the Beacons Method [2]. It will be use additional connectivity in different order for there. The SU can Automatically detect presence Primary signal & our channel will be are not used by PU. The SU spectrum sensing to determine vacant licensed frequency band and restrict their SU of empty band by helping nature SU also energy detection will be proper then transmission possible low computational and implementation complexity & priori knowledge of PU signal is needed [3]. To achieve the SU sensing result rise error affect accuracy ,then most important factor is improve network co-operative SU spectrum sensing measurement. Operation will be handle that scheduling for sensor node is ON/OFF order network [4],[5].

SUs improve co-operative spectrum sensing ability for network because it depends on accuracy. The SU fusion center is there for make the combine local decision ,error will be report to channel for regular propose efficient data fusion for power control and phase shifting detection performance of CSS base OR rule[7],[8].Channel can be sense one-by-one for CSS , order get maximize thought can achieve sort channel in descending order ratio to required sensing time. A sensing period will be sequential algorithm were develop to maximize discovery to spectrum access & minimum delay. The SU discover all available channel ,it allow to sense different channel that select randomly or through negotiation SU but identify maximum number of vacant channel. The number of group & number of CSS in SU in group the trade-off between sensing accuracy & efficiency achieve user group Trade-off between throughput efficiency and sensing accuracy [9].We design novel adaptive user-group assignment algorithms for group-based CSS to achieve a trade-off between the throughput efficiency and sensing accuracy[10]. In contrast to the work we consider that the cooperating SUs have heterogeneous sensing ability in terms of the sensing accuracy which introduces new challenges to the group-based CSS [11]. We analyse the scenario when channel state information is available and SUs can adapt their transmission rate according to the channel quality. Then we have to achieve better efficiency with low computational complexity without any interference.

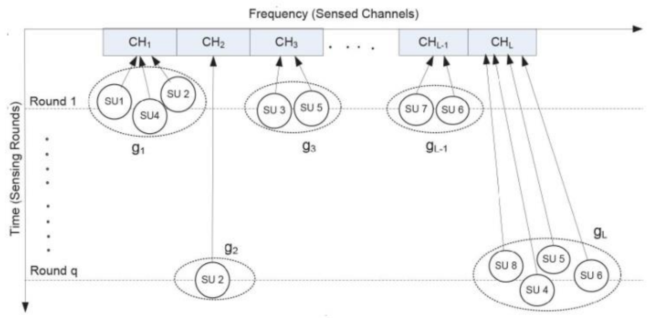

Fig-1:Group-based Cooperative Spectrum Sensing (CSS) With Different Sensing Round.

2.SYSTEM MODEL

A. ON/OFF Model

It get important model to ON/OFF for PU channel for public safety band is there. There are two mode ,ON is used for PU and another OFF mode is used for SU. The SUs can utilize the OFF period of the primary user channel to transmit their own data. We consider the operation of SUs on a frame by frame basis work done by proper management.

B. Discrete Rate Adaptive Modulation

It is need that time varying features of channel ,an SU can adapt transmission rate according to channel quality is there then use adaptive modulation. If some kind of noise detect the transmission rate SU determine physical layer and parameter is one-by-one mapping.The Transmission rate for SU according to Shannon's theory for channel rate and received rate the relationship by-

$$R_m = W \log_2(1 + SNR_m)$$

C. Energy Detection:

The information cannot be exchange about PU and SU ;each SU need to perform spectrum sensing non-cooperative.the energy detection require no information about PU signal ,which is more practical in energy model detect presence of PU is equivalent to distinguishing between two follow hypothesis-

$$Xk(n)=Vk(n) \quad ;H0$$

$$=hk(n)+Vk(n) \quad ;H1$$

3. PROBLEM FORMULATION

Adaptive group user will be use licensed channel in different group i.e. |G| is The set of group and 'gi' is distinct channel group .The channel allocation with different group user for vacant licensed band are use the number of sensing round. All the operation contain in centralized unit this unit is called as fusion center ,this fusion center for give make local decision of SU with error occur reporting channel. it sense one-by-one ,then SU of 'k' send and decision is 'dk'to fusion center observe absent or presence of PU signal. while decision making hypothesis is H1 use heterogeneous sensing ability to use counting rule reduce require system knowledge and complexity. Where the fusion center make global and final decision take 'do' follows-

$$d0 = \text{Decide } H1, \text{ if } \quad Kk=1\ dk \geq n$$

$$\text{Decide } H0, \text{ if } \quad Kk=1\ dk < n$$

Where,'n' represent minimum number decide favor PU signal order to fusion center. this relation get to use help with SU allocation to user Group. Also the main thing is important to next secondary transmission rate for good efficiency purpose.If ' R' is the achievable channel rate and its length 'M' .then according to secondary transmitter can select rate SNR on channel. where ,q is discover sensing round and achievable throughput of secondary user k' that secondary transmission during transmission time 'Tt' is given by-

$$C(q) = Ri,k \quad \frac{Tt}{qTs + Tt}$$

where Ts is the duration of the sensing period in each frame and the rate, $Ri,k\_$, is the channel rate achievable on the channel sensed by group gi for user $k\_$ when the sensed channel is free and is chosen for transmission and $Ri,k\_ \in$ R. Therefore, we can express the average opportunistic throughput in each channel, F, by-

$$F = E[C(q)]$$

$$=\sum(\text{pq(gi)})^{*}\ Ri,k \quad \frac{Tt}{qTs + Tt}$$

where $E[C(q)]$ is the expectation operator, q is the index of the sensing round and Q represents the total number of sensing rounds needed to sense the licensed channels until an idle channel is found where $1 \leq Q \leq |G|$.The adaptive group-based sensing scheme, it is possible to sense more than one channel at each sensing period. This possibility can increase the throughput efficiency which we define as the ratio of the average opportunistic throughput over the sum of the average opportunistic throughput and the average sensing overhead. Our objective is to optimally assign the non-identical cooperating SUs to groups and then assign those groups to the sensing rounds such that the throughput efficiency is maximized.We define the throughput efficiency, eff to be-

$$eff = \frac{F}{F + O}$$

To formulate the throughput efficiency maximization problem, we introduce the user assignment indicator, $\xi i,k$, and the group assignment indicator, $\eta i,q$, where i , k and q are the indices of the groups, users and rounds, respectively. The user assignment indicator $\xi i,k$ is equal to 1 if user k is assigned to group i and $\xi i,k = 0$, otherwise. Similarly, the group assignment indicator $\eta i,q$ is equal to 1 if group i is sensing in round q and $\eta i,q = 0$, otherwise. Therefore, we can express the average opportunistic throughput and the average sensing overhead incurred by the adaptive group-based sensing scheme as follows-

$$F=(Ri, k, ni, q)*Pq(gi) \frac{Tt}{qTs + Tt}$$

4. SYSTEM ANALYSIS

1.The Channel Selection Best User Assignment(CSBUA) ,Best User Assignment channel selection (BUACS) and Complexity Analysis is assignment algorithms to solve the formulated optimization problem in which the non-identical SUs are adaptively assigned to groups based on their probabilities of detection.

2.The throughput efficiency maximization problem for non-identical SUs as a non-linear binary programming problem which is generally NP hard.

3.Using extensive simulations, we show that our proposed algorithms can achieve comparable performance to the optimal solution with much lower computational complexity and can outperform the existing non-adaptive grouping and sequential sensing schemes.

4.We examine the effect of different parameters such as the number of groups, the number of SUs, the sensing duration and imperfect reporting channel conditions on the performance of the algorithms as well as the the existing non-adaptive grouping and sequential sensing schemes.

5. Helpful Hints

Equations:

We have to analyze that proposed three assignment algorithm Channel selection Best User Assignment (CSBUA) ,Best User Assignment for Channel Selection-1(BUACS1) & Best User Assignment for Channel Selection2 (BUACS2) performing with non-adaptive grouping and sequential CSS scheme.

The BUACS2 algorithm has higher computational complexity to compared other CSBUA & BUACS1 Algorithm, it causes by imperfect reporting channel between heterogeneous user and fusion center in our group based CSS. In SU scheme the error reduce was taken The probability of false alarm for each group as $P_F(gi)$, Similarly, the probability detection for each group $P_D(gi)$.

Now ,investigate different counting rule propose adaptive assignment algorithm for compare average probability detection and false alarm in group 'i' (over 1000 simulation run) the different number is assign to group satisfies OR and majority voting (MV) fusion rule. in order to achieve the desired sensing accuracy, Pd for the group using MV rule, we need to considerably increase the number of cooperating users in this group (provided sufficient number of users K are available for cooperation) compared to the OR rule. which will in turn result in more number of sensing rounds and higher average sensing overhead. The CSBUA, BUACS1 and BUACS2 algorithms assign users to a group in descending order of their probability of detection on this group, using the OR fusion rule, we can achieve higher probability of detection compared to the MV rule for the same number of users in a group on the expense of higher probability of false alarm. We can achieve the desired sensing accuracy, Pd for the group using MV rule, we need to considerably increase the number of cooperating users in this group the fusion center uses the OR fusion rule to combine the decisions from the set of cooperating SUs in each group.

6. CONCLUSIONS

In this group-based CSS scheme, channels sharing the same Co-operating users are scheduled to sense in different sensing rounds. The cooperating secondary users to different groups to maximize the throughput efficiency while maintaining a predefined sensing accuracy.The Group users optimal performance with low computational complexity and can also improve the throughput efficiency significantly compared to the existing non-adaptive assignment and sequential CSS scheme. The proposed assignment algorithms have low computational complexity.

ACKNOWLEDGEMENT

We thank our colleagues from SVPMs COE, Malegaon(Bk). who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations /conclusions of this paper.We would also like to show our gratitude to the Prof.N.B. Dhaigude for sharing their pearls of wisdom with us during the course of this research, and we thank 3 "anonymous" reviewers for their so-called insights. We are also immensely grateful to HOD Dr. A.A. Patil for their comments on an earlier version of the manuscript, although any errors are our own and should not tarnish the reputations of these esteemed persons.

REFERENCES

[1] M. Nekovee, "Cognitive radio access to TV white spaces: Spectrum opportunities, commercial applications and remaining technology challenges," in *Proc. IEEE Int. Symp. New Front. Dyn. Spectr. Access Net.*, Apr. 2010, pp. 1–10.

[2] A. Ghasemi and E. S. Sousa, "Spectrum sensing in cognitive radio networks: Requirements, challenges and design trade-offs," *IEEE Commun. Mag.*, vol. 46, no. 4, pp. 32–39, Apr. 2008.

[3] I. F. Akyildiz, B. F. Lo, and R. Balakrishnan, "Cooperative spectrum Sensing in cognitive radio networks: A survey," *Phys. Commun. (Elsevier) J.*, vol. 4, pp. 40–62, Mar. 2011.

[4] R. Deng, J. Chen, C. Yuen, P. Cheng, and Y. Sun, "Energy-efficient Cooperative spectrum sensing by optimal scheduling in sensor-aided cognitive radio networks," *IEEE Trans. Veh. Technol.*, vol. 61, no. 2, pp. 716–725, Feb. 2012.

[5] S. Huang, X. Liu, and Z. Ding, "Optimal sensing-transmission structure for dynamic spectrum access," in *Proc. IEEE Conf. Comput. Commun.*, Apr. 2009, pp. 2295–2303.

[6] P. Cheng, R. Deng, and J. Chen, "Energy-efficient cooperative spectrum sensing in sensor-aided cognitive radio networks," *IEEE Wireless Commun.*, vol. 19, no. 6, pp. 100–105, Dec. 2012.

[7] S. Chaudhari, J. Lundn, and H. V. Poor, "Cooperative sensing with imperfect reporting channels: Hard decisions or soft decisions?," *IEEE Trans. Signal Process.*, vol. 60, no. 1, pp. 18–28, Jan. 2012.

[8] K. Umebayashi, J. J. Lehtomaki, T. Yazawa, and Y. Suzuki, "Efficient decision fusion for cooperative spectrum sensing based on OR-rule," *IEEE Trans. Wireless Commun.*, vol. 11, no. 7, pp. 2585–2595, Jul. 2012.

[9] P. Salvo Rossi, D. Ciuonzo, and G. Romano, "Orthogonality and cooperation in collaborative spectrum sensing through MIMO decision fusion,"*IEEE Trans. Wireless Commun.*, vol. 12, no. 11, pp. 5826–5836, Sep.2013.

[10] C.-H. Liu, J. Tran, P. Pawelczak, and D. Cabric, "Traffic-aware channel sensing order in dynamic spectrum access networks," *IEEE J. Sel. Areas Commun.*, vol. 31, no. 11, pp. 2312–2323, Nov. 2013.

[11] H. Kim and K. G. Shin, "Efficient discovery of spectrum opportunities with MAC-layer sensing in cognitive radio networks," *IEEE Trans. Mobile Comput.*, vol. 7, no. 5, pp. 533–545, May 2008.

[12] X. Cao, P. Cheng, J. Chen, S. S. Ge, Y. Cheng, and Y. Sun, "Cognitive radio based state estimation in cyber-physical systems," *IEEE J. Sel. Areas Commun.*, vol. 32, no. 3, pp. 489–502, Mar. 2014.

[13] Y. Chen, "Optimum number of secondary users in collaborative spectrum sensing considering resources usage efficiency," *IEEE Commun. Lett.*, vol. 12, no. 12, pp. 877–879, Dec. 2008.

[14] H. Su and X. Zhang, "Cross-layer based opportunistic MAC protocols for QoS provisionings over cognitive radio wireless networks," *IEEE J. Sel. Areas Commun.*, vol. 26, no. 1, pp. 118–129, Jan. 2008.

[15] S. Xie, Y. Liu, Y. Zhang, and R. Yu, "A parallel cooperative spectrum sensing in cognitive radio networks," *IEEE Trans. Veh. Technol.*, vol. 59 no. 8, pp. 4079–4092, Oct. 2010.

[16] Y. Liu, R. Yu, Y. Zhang, and C. Yuen, "An efficient MAC protocol with selective grouping and cooperative sensing in cognitive radio networks,"*IEEE Trans. Veh. Technol.*, vol. 62, no. 8, pp. 3928–3941, Oct. 2013.

[17] E. Peh, Y. Liang, Y. L. Guan, and Y. Zeng, "Optimization of cooperative

sensing in cognitive radio networks: A sensing-throughput tradeoff view," *IEEE Trans. Veh. Technol.*, vol. 58, no. 9, pp. 5294–5299, Nov. 2009.

[18] L. Khalid and A. Anpalagan, "Adaptive grouping scheme for cooperative spectrum sensing in cognitive radio networks," in *Proc. IEEE Veh.Technol. Conf.*, May 2014, pp. 1–5.

BIOGRAPHIES

Prof.Nitin Dhaigude is working as Lecturer in department of Electronics & Telecommunication at SVPMs COE ,Malegaon(Bk) Baramati.He obtain B.E. (Elect. & Tele.)in SVPMs COE ,Malegaon(Bk) and Also in M.Tech in COE ,Pune.He attend several workshop and conference across India. And Paper publish in international Journals.

Mr.Aniket Nale is student of M.E. in SVPMS COE ,Malegaon(Bk).He obtain B.E. (Elect. & Telec.) in SVPMS COE ,Malegaon(Bk).He has attend several workshop and conference and paper was published in National Conference.