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Cluster Technique based Channel Sensing in Cognitive Radio Networks

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ABSTRACT

Clusters based Channel Sensing such as MIN, MAX and Group Average graph based clusters. MIN is the shortest edge between two nodes in different clusters and MAX is the longest edge between two nodes in different subsets of nodes. Group Average defines cluster proximity to be the average pairwise length of edges from different clusters. All the Secondary Users(SUs)in the clusters send the source information to their Cluster Head(CH) through the available common channel at this location. Each cluster in the CHs transmit own decision to the common receiver. the proposed method provide Hierarchical based clustering on the interior and exterior cluster channel conditions with reduce overload and delay of sensing. Clusters based Channel Sensing provides preferable stability and scalability because of its under dynamically moving Primary Users(PUs) activity.

Keywords: Cluster Head (CH), Primary User(PU), Secondary User(SU), Clusters based Channel Sensing.

1. INTRODUCTION

Cluster analysis based only on information of group is similar and or different from the groups. Within group is greater similarity and difference between groups is better or high distinct the clustering schemes[12]. clustering techniques is used to divide the number of different nodes in the groups. Aparitional clustering is the division of different set of groups into non overlapping clusters such that each groups of nodes is in extremely one subset we obtain the tree form of hierarchical clustering. Each node in the tree combination except leaf edge nodes is the children sub clusters. and root the tree is containing cluster in the nodes. In the most general cases overlapping or non overlapping clustering is used to belong the simultaneously to more than one group. Rather than make an specified nodes to a single cluster at placed equally good clusters. Dynamic Management Spectrum[1] solves the issue of spectrum under utilization in wireless communication in a better way. It provides a highly reliable communication. In this the unlicensed users are allowed to use the unused spectrum of the Primary Users (PU).Cognitive radio (CR) will change its transmission parameters like waveform, protocol, operating frequency, networking etc., based on the interaction with environment in which it operates[2]. Figure 1 shows the Dynamic Spectrum Accessin Cognitive Radio, there exist tem porallyun used spectrum holes in the licensed spectrumband. Hence, Next Generation (xG) networks can be deployed to exploitthese spectrumholes through cognitive communication techniques.

Although the main purpose of the xG network is to determine the best available spectrum, xG functions[13] in the licensed band are mainly aimed at the detection of the presence of primary users (PUs). where the xG network coexists with the primary network at the same location and on the same spectrumb and. Thus, the interference avoid ance with primary users is the most important is sue, in this architecture. Further more, if primary users appear[6] in the spectrumb and occupied by xG users, xG users should vacate the current spectrumb and and move to the new available spectrum immediately, called spectrum

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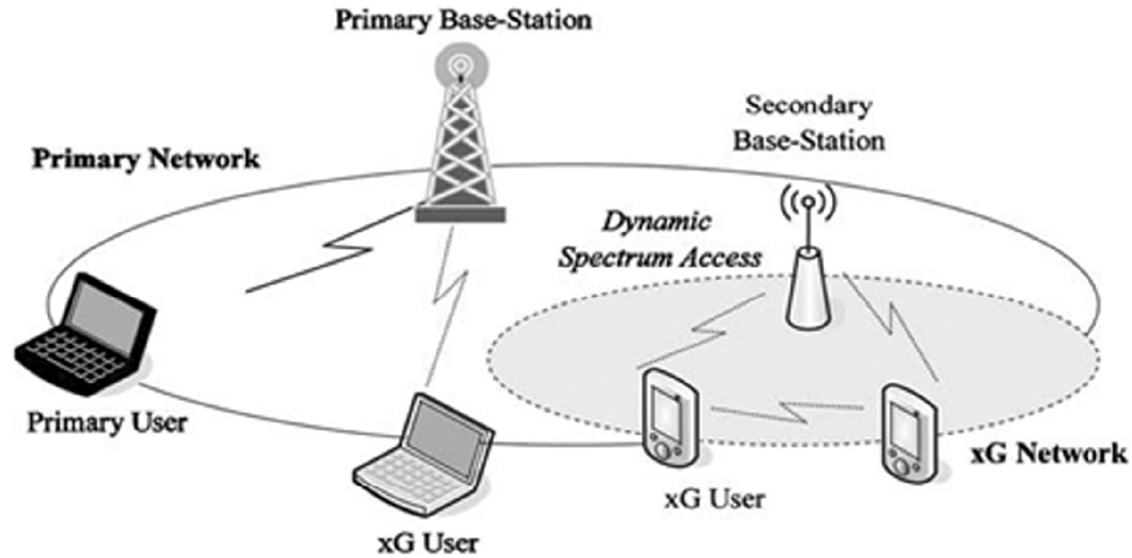

Figure 1: Dynamic Spetrum Access

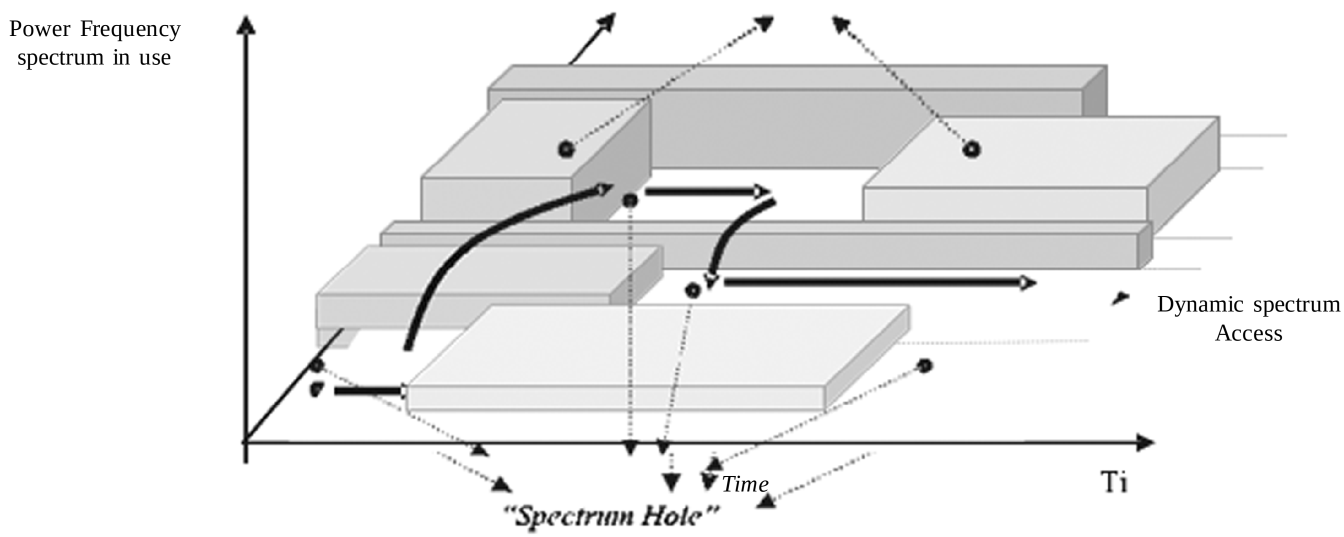

Figure 2: Spectrumhole concept. (Illustration of White Spaces in Licensed Bands)

hand off. Cognitive Radio performs the following functions: It has spectrum channel sensing, spectrum management, spectrum sharing, spectrum mobility. spectrum channel sensing is used to identify the available location on the PUs and unused spectrum band. spectrum management[5] is used to identify how long the SUs can using spectrum band.spectrum sharing is to share the spectrum band information among the SUs. spectrum mobility is to maintain dynamic communication[20] until the transition to better spectrum. Since most of the spectrum is already as signed, the most important challenge is to share the licensed spectrum with out in terfering with the transmission of other license dusers as illustrated in Fig. 2.

The cognitive radio enables the usage of temporally unused spectrum, which is referred to as spectrum hole or white space[23]. If this band is further used by alicense duser, these condary users(SU) moves to another spectrum hole or stays in the same band, altering its transmission power level or modulation scheme to avoid interference as shown in Fig. 2.

2. SPECTRUM SENSING

Spectrum Sensing Clustering Structure: Each secondary nodes[19] can ability to sensing the available channel[14] at this location. SUs nodes have atleast one common available channel in the location.

Every clusters form any one of Cluster Head(CH).chosen the CHs among any possible nodes in the groups. All CHs receives the source channel information from the remaining among nodes in the cluster groups and then aggregated[7] all the source information from inter and intra cluster group communication and then transmits information to common receiver.All the PUs occupying corresponding colors among the different channels on the current location. These channels unavailable to SUs occupying transmission distance for communication. Neighboring nodes share the common available channel information from a cluster and any one of node chosen as CH on each cluster. we assign there are N number of SU nodes and optimum number of clusters. The proposed spectrumsensing grouping is shown in Fig. 3.

The kth cluster is denoted as c_k and has N_k is SU nodes. The ith node of c_k is n_i^k, whose coordinate distance is (x_i, y_i). The spectrumsensing grouping can be organized into two classes: inter cluster grouping and intra cluster grouping communication. During the intra communication, all the SU nodes send their source information to each CH through the common available channel.

When the jth node is chosed as CH, all other grouping nodes share the source information to CH, as shown in Fig. 4. where Pr is the sum of minimum receiving power and $d\left(n_i^k, n_j^k\right)$ is the Euclidean distance between the ith and jth node through available channel location.

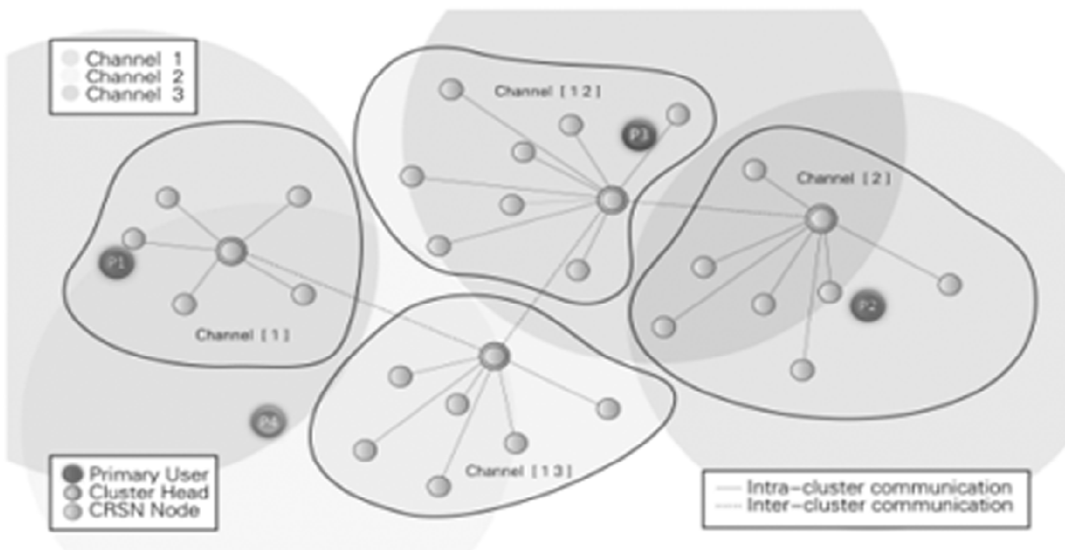

Figure 3: An example of spectrumsensing grouping clusterfor SU

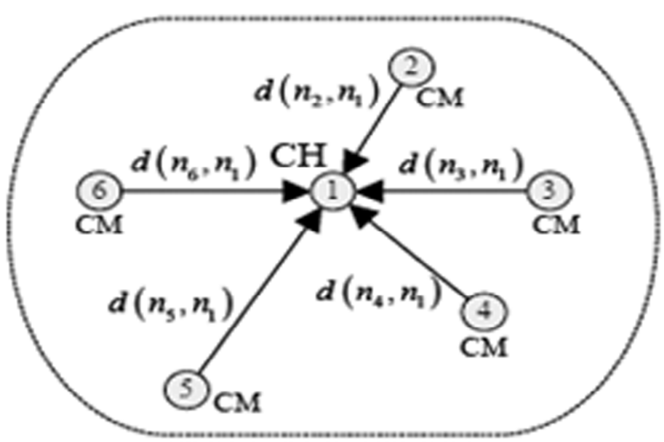

Figure 4: Intra Cluster Communication

When the inter cluster communication[8], the CH compress the different group source information then transmit to nearest CH using average power. The sensed source information is collected through interior and exterior portion of cluster group. We prove that minimizing the energy consumption is equivalent to squared sum of distance between SU nodes and their cluster center module. This objective of constrained clustering [3][4] can be employed to cluster SU nodes under spectrum channel sensing environment. We propose a novel Hierarchical Clustering[9]to form clusters with minimum distance and hence reduces energy consumption. Moreover, Hierarchical Clustering is performed in a fully secured way to improve scalability and stability.

3. DIFFERENT TYPES OF CLUSTERS

Clustering is used to analysis the particular nodes in the groups[21]. It has following types

Well separated: clusters is divides the set of groups[10] in which each group is similar to every other group .Figure 5(a) well separated clusters that has two groups is separated particular space on the points. different group between any two point distance is higher than the within group between any two point distance[15].

Prototype Based: clusters is divides the set of groups in which each group is similar to the prototype based every other group. Figure 5(b) average of all nodes in the cluster is a centroid as mostly middle edge portion point.It is also called center based clusters.

Graph Based: particular nodes are assigned groups and the communication link [11]among groups: i.e., group of clusters connected to one another group. An another example is graph based contiguity cluster. Each contiguity cluster is closer to any point in different cluster on irregular shape which introduce the noise trouble Figure 5(c).other types of graph based approach is graph based set of nodes connected to each other.

Density Based: The two circular clusters are not merged because between them fades noise so that introduce the curve. when noise portion is present, clusters are irregular Figure 5(d)

Shared Property(Conceptual Clusters): number of clusters that share some property. A triangular portion of cluster is adjusted to rectangular shape and there is merged[22] two inter circular clusters

We use the cluster analysis based on the following techniques.

(a) Well-separated clusters. (b) Center-based clusters.

(c) Contiguity-based clusters. (d) Density-based clusters

(e) Conceptual clusters.

Figure 5: Two dimensional points on cluster types

1. K-means: It is used to find users on specified number of clusters(K) and partitional clustering is a prototype based.
2. Hierarchical Clustering: Tree combination[16] is starts with each cluster and the continually merging two closest clusters until a single.
3. Density Based Clustering:automatically determined on the number of clusters. Regions of high density separated from one another by regions of low density.It doesn't produce complete clustering. Low density regions are classified as noise and omitted.Density based clustering locates high density regions that are separated from one another by low density regions. It can handle clusters of arbitrary shapes and sizes.nearest neighbor requires computing all pairwise proximities.

It has

1. Core Points:
   Interior of dense region
2. Border Points:
   Edge of the dense region(within neighborhood of core points).border point close to core points from different clusters.
3. noise points:
   It is not a core (or) border point.

4. PERFORMANCE ANALYSIS

In this section, we analyze and simulate the performancein terms of scalability, energy consumption and stbility. Figure 6 shows an example of Hierarchical Clusteringresult[23], where 50 CRSN nodes and 10 PUs are randomly deployedon a 100 meter × 100 meter field. There are three availablechannels in the system (marked by red, green and blue). Theclustering result is illustrated by dashed enclosures[17] and thecorresponding common channels are labeled in the cluster.Every PU randomly occupies one of the three

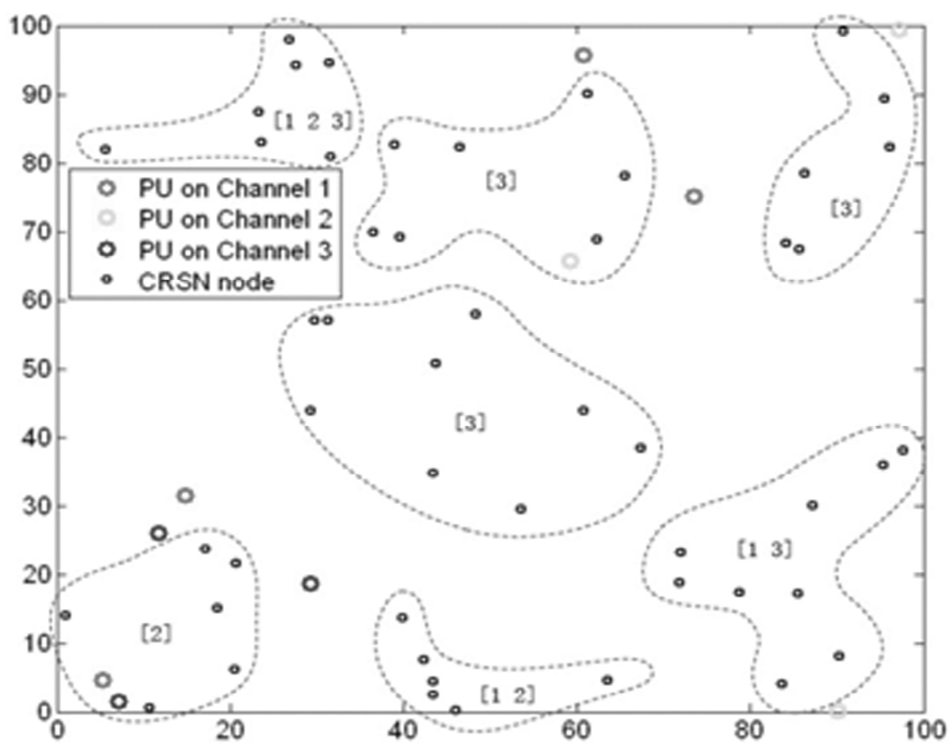

Figure 6: An example of the Hierarchical Clustering.

channels.The protection range for PU is 20 meters, which means the PU's CRSN neighbors within this range cannot access its occupiedchannel.

5. CONCLUSION

In this paper, we proposed a Hierarchical Clustering scheme for cognitive radio sensor networks. We modeled the communication power for SU, whichconsists of intra cluster aggregation and intercluster relaying. After deriving the optimal number of clusters, we minimizethe SUenergy[18] using groupwise constrained clustering, inwhich the spectrum aware requirement. Through extensive simulations, we find that Hierarchical Clusteringmethod exhibits preferable scalability and stability with its low complexity and quick convergence under dynamic spectrum variation, dramaticallyreduce the reportingtimeandenergy consumption.

REFERENCES

[1] Hongjian Sun, Arumugam Nallanathan and Cheng-Xiang Wang, "Wideband Spectrum Sensing For Cognitive Radio Networks: A Survey" IEEE Wireless Commun., Apr. 2013, pp. 74-81.

[2] T. Yucek and H. Arslan, "A Survey of Spectrum Sensing Algorithms for Cognitive Radio Applications," *IEEECommun. Surveys and Tutorials*, vol. 11, no. 1, Jan. 2009, pp. 116-30.

[3] H. Sun *et al..*, "Wideb and Spectrum Sensing with sub-Nyquist Sampling in Cognitive Radios," *IEEE Trans. Sig.Proc.*, vol. 60, no. 11, Nov. 2012, pp. 6068-73.

[4] J. Mo, H.S. So, and J. Walrand, "Comparison of Multichannel MAC Protocols," *IEEE Transactions on Mobile Computing*, vol. 7, no. 1, pp. 50-65, 2008.

[5] P. Bahl, R. Chandra, and J. Dunagan, "SSCH: Slotted Seeded Channel Hopping for Capacity Improvement in IEEE 802.11 Ad-Hoc Wireless Networks," in *Proc. of ACM MobiCom*, Sept. 2004.

[6] I. F. Akyildiz, W.Y. Lee, M. C. Vuran, and S. Mohanty, "Next generation/dynamic spectrum access/cognitive radio wireless networks: a survey," *Elsevier Computer Networks*, vol. 50, no. 13, pp. 2127-2159, 2006.

[7] L. Narayanan, "Channel Assignment and Graph Multicoloring," *Handbook of wireless networks and mobile computing*, pp. 71-94, 2002.

[8] N. Choi, M. Patel, and S. Venkatesan, "A Full Duplex Multi-channel MAC Protocol for Multi-hop Cognitive Radio Networks," in *Proc. of Crown Com*, Jun. 2006.

[9] C. Cordeiro and K. Challapali, "C-MAC: A Cognitive MAC Protocol for Multi-channel Wireless Networks," in *Proc. of IEEE DySPAN*, Apr. 2007.

[10] OFCOM, "Digital Dividend: Cognitive Access Consultation on Licence exempting Cognitive Devices using Interleaved Spectrum," Feb. 2009. [Online]. Available: http://www.ofcom.org.uk/consult

[11] O.P. Meena, Ajay Somkumar (2014), "Comparative Analysis of Information Fusion Techniques for Cooperative Spectrum Sensing in Cognitive Radio Networks", Proc. Of Int. Conf. on Recent Trends in Information, Telecommunication and Computing, ITC pp: 137-143.

[12] S. Haykin, "Cognitive radio: brain-empowered wireless communications", *IEEE J. on Selec. Areas in Commun.*, vol. 23, no. 2, pp. 201-220, Feb. 2005.

[13] W. Zhang and K. B. Letaief, "Cooperative spectrum sensing with transmit and relay diversity in cognitive radio networks", *IEEE Trans.on Wireless Commun.*, vol. 7, no. 12, pp. 4761-4766, Dec. 2008.

[14] D. Cabric, S. M. Mishra and R. Broderson, "Implementation issues in spectrum sensing for cognitive radios", *IEEE Proc. 38th Asilomar Conf. Signals, Systems and Computers*, Pacific Grove, CA, vol. 1, pp. 772-776, November 2004.

[15] A. Ghasemi and E. S. Sousa, "Collaborative spectrum sensing for opportunistic access in fading environments", *IEEE Intl. Symp.on New Frontiers in Dynamic Spectrum Access Networks*, pp. 131-136, 2005.

[16] Gong YL, Chen G., Tan L.S., "Abalanced serial k-means based clustering protocol for wireless sensor networks. In: Proceedings of the 4th International Conference on Wireless Communications, Networking and Mobile Computing", 2008 Oct. 12-14, Dalian.Washing-ton DC: IEEE, 2008. 1-6.

[17] Wagstaff K., Cardie C., Rogers S., et al. "Constrained *k*-means clustering with background knowledge," In: Proceedings of the 18th International Conference on Machine Learning, 2001 June 28-30, William-stown. San Francisco: Morgan Kaufmann Publishers, 2001. 577-584.

[18] Klein D., Kamvar S.D., Manning C.D., “From instance level constraints to space-level constraints: Making the most of prior,” In: Proceedings of the 19th International Conference on Machine Learning, 2002 July 8-12, Sydney. San Francisco: Morgan Kaufmann Publishers, 2002. 307-314.

[19] A. K. Jain, R. C. Dubes, “Algorithms for clustering data,” Prentice-Hall, 1988.

[20] P. N. Tan, M. Steinbach, V. Kumar, “Introduction to Data Mining:Chapter 8. Cluster Analysis: Basic Concepts and Algorithms,” Pearson Addison Wesley, 2006.

[21] S. Geirhofer, L. Tong, B.M. Sadler, Dynamic spectrum access in thetime domain: modeling and exploiting white space, IEEE Communications Magazine 45 (5) (2007) 66-72.

[22] N. Nie and C. Comaniciu, “Adaptive Channel Allocation Spectrum Etiquette for Cognitive Radio Networks,” *Proc. of IEEE DySPAN*, Nov. 2005.

[23] Zhang H.Z., Zhang Z.Y., Dai HY, et al. Distributed spectrum-aware clustering in cognitive radio sensor networks. In: Proceedings of IEEE Globe com 2011 Conference, 2011 Dec. 5-9, Houston.Washington DC: IEEE, 2011. 1-6.