Kumari Arunima et al. 2019, 7:6
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology

An Open Access Journal

An Efficient Genetic Approach for Cognitive Network Dynamic Link Development

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Abstract

Cognitive radio network increase spectrum as non-licensed users get chance to transfer there data. Hence IOT devices get dynamic access to the spectrum by sensing channel data. This paper resolve the end to end path for data transfer where spectrum utilization, interference and lesser intermediate node were consider as main objective. To achieve that objective genetic algorithm Teacher Learning Based Optimization was used. Genetic algorithm generate dynamic path as per node positions and spectrum channel. This work apply only Teacher phase for finding end to end path. Experiment was done on different number of secondary nodes for various possible links. Results were compared with existing algorithm and it was obtained that proposed work improve spectrum utilization.

Keywords: Cognitive radio, genetic algorithms, power allocation, subcarrier pairing.

I. INTRODUCTION

In long distance correspondence, researcher have many variables that are influencing the signal from numerous points of view. Fading is the wonder that happens because of the impacts of the signal in the way of goal .not just this; researcher additionally have noise and interference designs that are influencing the general framework impressively. Researcher have to make their impact to a moment level, to such an extent that there will be no transmission blunders happening in transmission and after gathering as well. So as to decrease the noise impact, researcher goes for presenting the idea of relays. Relays are the canny handsets, that are in the middle of the way of source and goal, where the signal is been sent to the goal through the assistance of transfers. So another approach identified as Decode-and-forward criteria. This idea is utilized as a part of transfers and to decrease the interference design.

Here, signals are frequency regulated first and these signs are again made to resemble orthogonal to each other having monitor interim. These decreases in interchanges. So by actualizing these, researcher goes for effective use of framework assets by considering a portion of the components. A calculation to choose the best transmits path between the system nodes. The calculation can choose immediate, double or differing qualities transmission in view of the accessible range and in Addition the most extreme reasonable transmission powers.

The frameworks are thinking about single bearer channels. Proposed a calculation to choose the best transmit path between the system nodes. The calculation can choose immediate, double or assorted qualities transmission in view of the accessible range and the greatest suitable transmission powers. The frameworks are thinking about single bearer channels proposed a calculation to choose the best transmit path between the system nodes. The calculation can choose immediate, double or differing qualities transmission in light of the accessible range and in addition the most extreme admissible transmission powers. The frameworks are thinking about single bearer channels. A Cognitive radio (CR) has been proposed to tackle the range under-usage issue by permitting a gathering of auxiliary clients (SU) to get to the

unused radio range initially allotted to the essential client (PU). The CR execution and the range use can be additionally enhanced by utilizing the agreeable interchanges in which a few transfers are utilized to help the source to goal transmission.

Psychological radio, with the capacity to adaptable adjust its transmission parameters, has been considered as a progressive innovation to powerfully get to the under-used wireless spectrum [1]. So as to completely use the range assets, productive dynamic range portion and sharing plans are imperative. Novel range get to control conventions and control channel administration ought to be intended to suit the dynamic range condition while stay away from crash with an essential client. At the point when an essential client re-shows up in an authorized band, a great range handoff system is required to give auxiliary clients smooth frequency move with low idleness. In multi-bounce subjective remote systems, middle of the road intellectual nodes ought to cleverly bolster transferring data and steering through utilizing an arrangement of powerfully evolving channels. Keeping in mind the end goal to deal with the interference to the essential clients and the common impedance among themselves, optional clients' transmission power ought to be painstakingly controlled, and their opposition for the range assets ought to likewise be tended to.

II. RELATED WORK

In [6] talked about subcarrier and power portion issue for orthogonal frequency division multiple access in view of relay. The joint streamlined issue is characterized as far as power portion, subcarrier task and relay choice. The above issue is sorted by two strategies, for example, sub gradient strategy and double decomposition. The target of method is to enhance the throughput. Two low- complexity -sided quality imperfect plans are presented for diminishing the computational cost. The above plans are tried by PC reenactments which depend on LTE-A system. The proposed conspires additionally support heterogeneous administrations which meets the Qos. Relay choice and asset assignment underpins GBR and AMBR activity in a multi-client agreeable OFDMA-based uplink framework. Three plans are proposed, for example, QoS mindful ideal joint relay choice, subcarrier task and power portion which are under an aggregate power requirement. A joint improvement issue has been researched with a specific end goal to accomplish the greatest throughput by fulfilling QoS prerequisites of individual client for relay choice and asset distribution. The computational multifaceted nature was diminished with the assistance of problematic plans. Favorable circumstances of paper [6] are it expands the framework throughput. In any case, doesn't meet the Qos necessity.

In [7] Cooperative range sharing plan increment the spectrum use adequately by allowing auxiliary users(SUs) to impart the authorized groups to essential users(Pus) in powerful and sharp way. This paper talked about how one PU and one SU understand an effective spectrum sharing plan by means of dynamic non-agreeable haggling. The PU does not have the entire data about SU's vitality taken a toll which is one of the key difficulties in this paper. Favorable position of this paper [7] is, it has higher information rate yet builds haggling power utilization. Detecting based spectrum sharing procedure consolidates the advantages of both spectrum overlay and spectrum underlay to enhance the throughput of the auxiliary client, without creating destructive interference to the essential client.

In 2014, Ghazzai et al [1] built up a definition for the improvement issue to expand the pick up relating to the Long-Term Evolution cell administrators and decreasing the green house gas (CO_2) outflow. They have proposed the strategies, which chip away at the premise of Genetic calculation and the Particle Swarm advancement, to chop down the vitality use in base stations to a most reduced level by streamlining the adequate vitality that are acquired from the retailers.

Monteiro et al [3] has proposed a power administration calculation for the amplifying the base MOS of the remote clients in the meantime centered around the Quality of administration for the asset assignment. Investigation is done on the test system for the investigation of the proposed display. It was acquired in the outcomes that proposed framework has intensely diminished the stacked framework.

In [9] The primary inspiration for the HGA structure originates from the possibility that it can diminish the effect of additional suspicions made in past attempts to rearrange the issue. In our HGA, the chromosome is partitioned into a whole number string for subcarrier blending and a genuine number string for control allocation. Two new instatement strategies for these chromosomes, which are inspired by the raised advancement hypothesis, are proposed. New hybrid and transformation plans are additionally

concocted to suit these new chromosomes, and also to deal with the interference to the PUs. Moreover, researcher likewise propose a two-arrange low-multifaceted nature hereditary calculation, which independently decides the best possible subcarrier combines and power designations.

Tang and Xin [16] have applied co-evolution chaotic PSO to maximize energy efficiency, under the constraints of interference power and total transmit power. Anandakumar and Umamaheswari [17] have performed efficient social cognitive handover using socially intelligent secondary users and integration of primary and secondary holes, by applying a SpecPSO technique.

REN HAN et. al. [19] paper addresses the spectrum allocation problem with respect to both spectrum utilization and network throughput in the cognitive-radio-based IoT. On the one side, each link in a transmission path intends to improve the transmission performance on the assigned spectrum channel to maximize the end-to-end throughput. On the other side, these links share the same spectrum channel to concurrently transmit as much as possible to achieve the maximum spectrum utilization. In order to solve the problem, we propose a concurrent transmission model in the network which reveals the constraints of mutual interference and resource competition in links concurrent transmissions. Based on this model, we formulate the spectrum allocation plan for links as the chromosome (solution) in genetic algorithms. Then, we apply the nondominated sorting genetic algorithm-II to solve the multiobjective spectrum allocation problem.

III. PROPOSED METHODOLOGY

This section gives proposed Teacher Based genetic algorithm explanation. Fig. 2 represent whole work block diagram. Each block is detailed in this section for complete understanding of whole work.

Develop Virtual Region and Place Node position

This work start with placement of N number of nodes and in an MxM region. In order to assume the initial stage of the network some energy need to be set for each node in the network. Each link between node have fix spectrum channel to communicate.

Figure 1: Initial setup of proposed model.

1. Generate Population

Here assume some chromosome set that are the combination of different node as per link starting and ending node. So chromosome have p links where each link has some set of nodes Ch={L1, L2,.....Lp}. All Link in chromosome should have unique set of nodes means L1 ∩ L2 ∩ Lm = Null. Each link is a path for the communication as per requirement. Now population is set of probable solution hence P={Ch1, Ch2, Ch3.....Chp}.

2. Fitness Function

In concurrent transmissions, the performance of a link not only depends on its own setup but also the influence factors from other links sharing the same channel. Signal-to interference plus-noise ratio (SINR) is used to measure the quality of communications [12]. For a link (*i*; *j*) on spectrum channel *m*, its SINR can be calculated as follows:

$$\mathrm{SINR}_{ij}(m) = \frac{h_{ij} P_i}{\sigma^2 + \sum_{(a,b)\in I(m)} h_{aj} P_a}$$

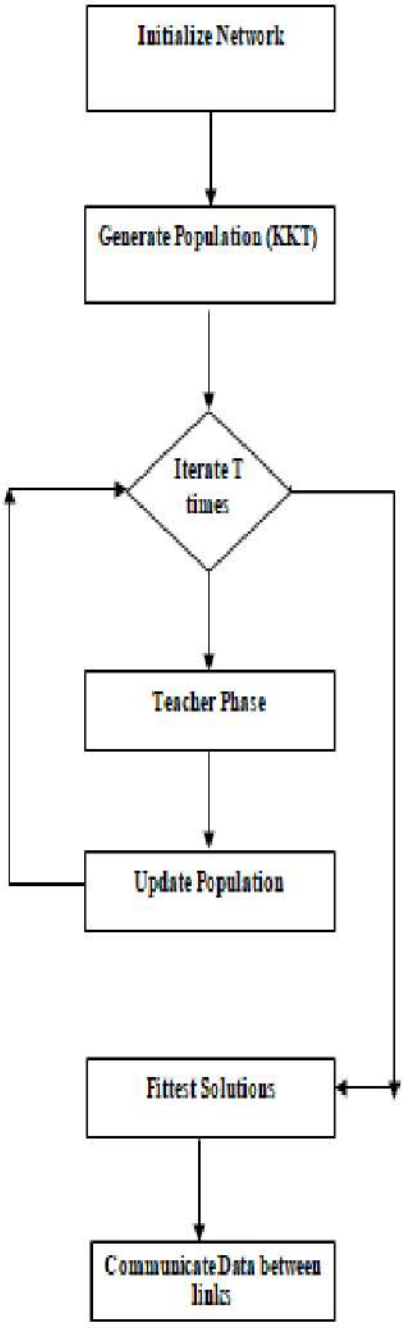

Figure 2: Proposed work Block diagram.

where *pi* denotes transmission power of sender *i*. In this paper, assume that the transmission power of all links is at the fixed level. *hij* represents the channel gain between sender *i* and receiver *j*, which can be denoted by k/d_{ij}^{σ} . Here *k* is the path loss constant. *dij* is the distance between *i* and *j*. σ^2 is the path loss exponent. _2 is the thermal noise that can be considered as a constant, and sigma notation presents the aggregate interference at receiver *j*, which is generated by the links transmitting concurrently on the current spectrum channel. Here, *I* (*m*) presents the set of links sharing spectrum channel *m*. To guarantee the effective link transmission, each intended signal should be successfully decoded at the receiver. For the SINR, there exists a desired value denoted by β, which indicates the threshold of successful decoding. So, if link (*i, j*) intends to access spectrum channel *m* for its transmission, the constraint is satis_ed as follows:

$SINRij(m) > \beta$

For link (*i; j*), the efficient link transmission opportunity *Tij* is de_ned as follows:
$Tij = \min(Ti; Tj)$

Tij evaluates the transmission opportunities on both sides of link (*i; j*). If the link transmits the data of _ow *f* on spectrum channel m, the maximum data rate that the link can maintain is denoted by the following:
$Rij(m) = Tij \times Cij(m)$

Thus, due to the constraint of the resource competition, link (*i; j*) only applies a portion of its link capacity for the flow transmission.

$F_{1\_max} = \max(Rf)$
$F_{1\_min} = \min(Rf)$

$F_{2\_max} = \max(|L|/|M|)$

$F_{2\_min} = \min(|L|/|M|)$

if (F1_max-F1_min)Not Equal 0

$$D = \sum_{k=1}^{2} \frac{R_n + R_{n+1}}{F_{k\_Max} - F_{k\_Min}}$$

EndIf

$$D = D + \sum_{k=1}^{2} \frac{(|L|/|M|)_n + (|L|/|M|)_{n+1}}{F_{k\_Max} - F_{k\_Min}}$$

Fitness ←Sort(D)

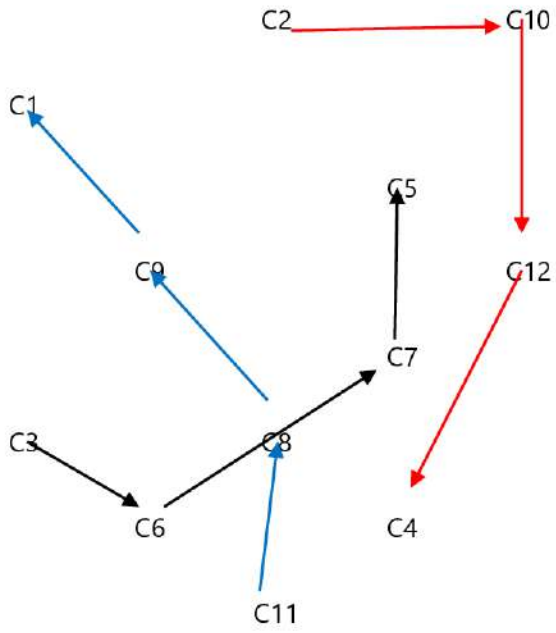

Figure 3: Graphical representation of 3 link in a network.

3. *Teacher Phase*

Top possible solution after sorting will act as the teacher for other possible solutions. Now selected teacher will teach other possible solution by replacing fix number of values as present in teacher solution. By this all possible solution which act as student will learn from best solution which act as teacher.

Main motive of this step is to find best solution from the generated population. Here each possible solution is evaluated for finding the distance from each node so that pair closer to the best solution. Then calculate the fitness value which give overall rank of the possible solution.

A good teacher is one who brings his or her learners up to his or her level in terms of knowledge. But in practice this is not possible and a teacher can only move the mean of a class up to some extent depending on the capability of the class. This follows a random process depending on many factors. Let Mi be the mean at any iteration i. The teacher will try to move mean Mi towards his/her own level so the new mean will be designated as Mnew. The solution is updated according to the difference between the existing and the new mean given:

Difference Meani = ri * (Mnew – Tf *Mi)

Where Tf = teaching factor.

This difference modifies the existing solution according to the following expression

Xnew,i = Xold, i + Difference Meani,i

Where Xnew,i is the updated value of Xold,i. Accept Xnew,i if it gives better function value.

Update Population

Once population get new chromosome than it need to filter with best solution sets. Hence fitness value of each were evaluate and the top p solutions from the new set are filter. Once population get update than as per iteration teacher phase again start. If iteration over than best available solution from the population is consider as final path for required links.

IV. EXPERIMENT AND RESULTS

This section presents the experimental evaluation of the proposed teacher learning based optimization algorithm, with comparison analysis from [12]. All algorithms and utility measures were implemented using the MATLAB tool. The tests were performed on an 2.27 GHz Intel Core i3 machine, equipped with 4 GB of RAM, and running under Windows 7 Professional.

Results

Table -1: Comparison of spectrum utilization.

Spectrum Utilization				
Network Dimension	Nodes	Links	Proposed Work	Previous Work
100x100	40	3	0.9993	0.9927
100x100	60	4	0.999	0.9905
150x150	70	5	0.999	0.9909
150x150	70	6	0.9993	0.9931

From above table 5 it is obtained that proposed work Teacher Learning Based optimization genetic algorithm has high spectrum utilization values as compare to the previous [12] work. This is due to the learning in TLBO which consider the objective function and perform better crossover operation for finding good sequence of nodes in a link.

Table -2: Throughput comparison of Proposed and previous work.

Spectrum Utilization				
Network Dimension	Nodes	Links	Proposed Work	Previous Work
100x100	40	3	59.9684	59.6784
100x100	60	4	59.9584	59.5863
150x150	70	5	59.9578	59.5989
150x150	70	6	59.9681	59.6925

From above table 5 it is obtained that proposed work Teacher Learning Based optimization genetic algorithm has high throughput values as compare to the previous [12] work. This is due to the learning in TLBO which consider the objective function and perform better crossover operation for finding good sequence of nodes in a link.

Table -3: Execution time (Second) comparison of Proposed and previous work.

Spectrum Utilization				
Network Dimension	Nodes	Links	Proposed Work	Previous Work
100x100	40	3	132.0917	133.1450
100x100	60	4	96.8044	97.9969
150x150	70	5	118.7815	121.8755
150x150	70	6	125.4815	128.4415

From above table 5 it is obtained that proposed work Teacher Learning Based optimization genetic algorithm has low execution time values as compare to the previous [12] work. This is due to the learning in TLBO which consider the objective function and perform better crossover operation for finding good sequence of nodes in a link.

V. CONCLUSIONS

As CR network has resolved the various issues of the present limited wireless spectrum. Here paper has resolved the issue of dynamic link development for the secondary units. In this work a new genetic approach is utilized named as teacher learning based optimization for the proper pairing. As this approach has teacher phase learning, so obtained pairs are quit efficient on various evaluation parameters. Results are comparing with previous existing approach and it was found that proposed work was better. In the future it is highly desired that algorithm need to be developed which can efficiently utilize the available resources with minimum loss.

REFERENCES

[1]. H. Ghazzai, E. Yaacoub, M.S. Alouini, And A.A. Dayya, "Optimized Smart Grid Energy Procurement For Lte Networks Using Evolutionary Algorithms," Ieee Transactions On Vehicular Technology, Vol. 63, No. 9, Pp. 4508-4519, November 2014.

[2]. S.S. Hayward And E.G. Palacios, "Channel Time Allocation Pso For Gigabit Multimedia Wireless Networks," Ieee Transactions On Multimedia, Vol. 16, No. 3, Pp. 828- 836, April 2014.

[3]. V.F. Monteiro, D.A. Sousa, T.F. Maciel, F.R.M. Lima, E.B. Rodrigues, And F.R.P. Cavalcanti, "Radio Resource Allocation Framework For Quality Of Experience Optimization In Wireless Networks," Ieee Network, Vol. 29, No. 6, Pp. 33-39, November-December 2015.

[4]. A. Liu, V.K.N. Lau, L. Ruan, J. Chen, And D. Xiao, "Hierarchical Radio Resource Optimization For Heterogeneous Networks With Enhanced Inter-Cell Interference Coordination (Eicic)," Ieee Transactions On Signal Processing, Vol. 62, No. 7, Pp. 1684-1693, April 2014.

[5]. Y. Li, X. Zhu, Chao Liao, Chonggang Wang, And Bin Cao, "Energy Efficiency Maximization By Jointly Optimizing The Positions And Serving Range Of Relay Stations In Cellular Networks, Vol. 64, No. 6, Pp. 2551-2560, June 2015.

[6]. Md Shamsul Alam, Jon W. Mark And Xuemin (Sherman) Shen, "Relay Selection And Resource Allocation For Multi-User Cooperative Ofdma Networks", Ieee Transactions On Wireless Communication, Vol. 12, No.5, May. 2013.

[7]. Yang Yan, Jianwei Huang And Jing Wang, "Dynamic Bargaining For Relay-Based Cooperative Spectrum Sharing", Ieee Journal On Selected Areas In Communications, Vol. 31, No. 8, Aug. 2013.

[8]. Guoqin Ning, Jiaqi Duan, Jian Su1, Duo Qiu, "Spectrum Sharing Based On Spectrum Heterogeneity And Multihop Handoff In Centralized Cognitive Radio Networks", 2011.

[9]. Hung-Sheng Lang, Shih-Chun Lin And Wen-Hsien Fang. "Subcarrier Pairing And Power Allocation With Interference Management In Cognitive Relay Networks Based On Genetic Algorithms". Ieee Transactions On Vehicular

Technology, Vol. 65, No. 9, September 2016 7051

[10]. Tang, M., Xin, Y. "Energy Efficient Power Allocation In Cognitive Radio Network Using Coevolution Chaotic Particle Swarm Optimization", Computer Networks, 100, Pp. 1–11, 2016. Https://Doi.Org/10.1016/J.Comnet.2016.02.010

[11]. Anandakumar, H., Umamaheswari, K. "A Bio-Inspired Swarm Intelligence Technique For Social Aware Cognitive Radio Handovers", Computers And Electrical Engineering, 71, Pp. 925–937, 2018. Https://Doi.Org/10.1016/J.Compeleceng.2017.09.016

[12]. Ren Han, Yang Gao, Chunxue Wu, And Dianjie Lu. "An Effective Multi-Objective Optimization Algorithm For Spectrum Allocations In The Cognitive-Radio-Based Internet Of Things". Ieee Access March 19, 2018.