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***Research Paper***

# Analysis of channel allocation and management using tlbo, ga & de algorithms in cellular networks

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## Abstract:

Accuracy of spectrum sensing in cellular mobile networks can be increased by reducing the sensing error probability, call blocking probability & by increasing network throughput. In our Project work, an advanced algorithms like Teaching Learning Based Optimization (TLBO), Genetic (GA) and Differential Evaluation (DE) Algorithms are used to analyze the sensing error probability, call blocking probability and network throughput. We will propose a channel allocation and management scheme with the above mentioned algorithms for supporting mobile users. With the help of these algorithms, sensing error and call blocking probabilities are analyzed to find out an optimal value for reducing the errors to some extent and improving network throughput. Channel Allocation in cellular networks is a key aspect with channel impairments and non-ideal antenna patterns. Finally, performance analysis is done through comparison of simulation results.

***Keywords:*** *Call Blocking Probability; Cellular Networks; Differential Evolution Algorithm; Genetic Algorithm; sensing error Probability; Teaching Learning Based Optimization Algorithm; Throughput.*

## 1. Introduction

### 1.1 Cell Networks:

A cell system or portable system is correspondences organize where the last connection is remote. The system is circulated over land territories called cells, each served by no less than one settled area handset, yet more ordinarily three cell locales or base handset stations. These base stations give the cell the system scope which can be utilized for transmission of voice, information and others. A phone ordinarily utilizes an alternate arrangement of frequencies from neighboring cells, to maintain a strategic distance from impedance and give ensured benefit quality inside every phone [1].
At the point when consolidated these cells give radio scope over a wide geographic zone. This, empowers an expansive number of convenient handsets (e.g. cell phones, tablets and PCs furnished with portable broadband modems, pagers, and so on.) to speak with each other and with settled handsets and phones anyplace in the system, by means of base stations, regardless of whether a portion of the handsets are traveling through in excess of one cell amid transmission. The essential cell organize is as appeared in [Fig 1].

#### 1.1.1 Frequency Reuse:

The key normal for a cell organize is the capacity to re-utilize frequencies to increment both scope and limit. As depicted above, contiguous cells must utilize diverse frequencies; however there is no issue with two cells adequately far separated working on a similar recurrence, gave the poles and cell organize clients' gear don't transmit with an excessive amount of energy [1].

The components that decide recurrence reuse are the reuse separate and the reuse factor. The reuse separate, D is computed as

$$D=R\sqrt{3N} \quad (1)$$

Where R is the cell span and N is the quantity of cells per group. Cells may shift in span from 1 to 30 kilometers (0.62 to 18.64 mi). The limits of the cells can likewise cover between contiguous cells and expansive cells can be separated into littler cells.

The frequency (or recurrence) reuse factor is the rate at which a similar recurrence can be utilized as a part of the system. It is 1/K (or K as indicated by a few books) where K is the quantity of cells which can't utilize similar frequencies for transmission. Normal esteems for the recurrence reuse factor are 1/3, 1/4, 1/7, 1/9 and 1/12 (or 3, 4, 7, 9 and 12 relying upon documentation).

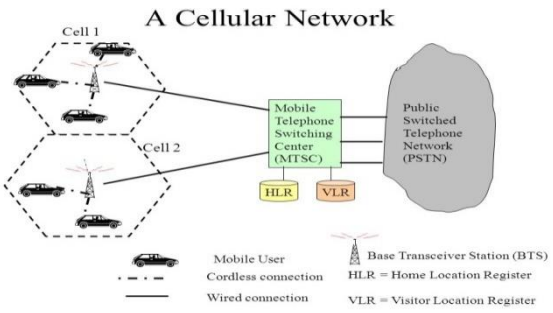



**Fig: 1** A Cellular Network

In the event of N segment reception apparatuses on a similar base station site, each with various heading, the base station site can serve N distinctive areas. N is commonly 3. A reuse example of N/K indicates a further division in recurrence among N part

reception apparatuses per site. Some present and verifiable reuse designs are 3/7 (North American AMPS), 6/4 (Motorola NAMPS), and 3/4 (GSM).
On the off chance that the aggregate accessible data transfer capacity is B, every cell can just utilize various recurrence channels comparing to a transmission capacity of B/K and every part can utilize a data transmission of B/NK.
This thought of recurrence reuse is given in the underneath [Fig 2(a) and Fig 2(b)].

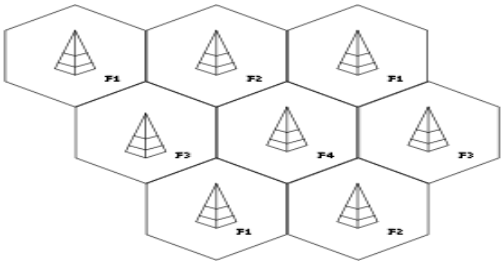



**Fig: 2**(a) Example of freq reuse factor 1/4

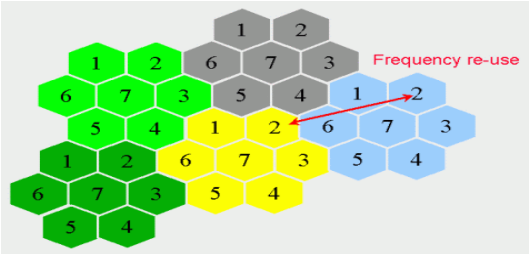



**Fig: 2(b)** Example of freq reuse factor 1/7

The aggregate sum of frequencies is for this situation isolated in 7 sets of frequencies. Each set is utilized as a part of another cell. The group of 7 cells is rehashed to cover the total geographic territory.
At the point when the client moves starting with one cell then onto the next, the call must be exchanged starting with one base station then onto the next. This is known as a "handover" (handoff).

### 1.1.2 Cellular Handover (or handoff) in Mobile Phone Networks [1]:

With CDMA, various CDMA handsets share a particular radio channel. The signs are isolated by utilizing a pseudo clamor code (PN code) particular to each telephone. As the client moves starting with one cell then onto the next, the handset sets up radio connections with numerous cell locales (or parts of a similar site) at the same time. This is known as "delicate handoff" in light of the fact that, dissimilar to with conventional cell innovation, there is nobody characterized point where the telephone changes to the new cell.

In IS-95 between recurrence handovers and more seasoned simple frameworks, for example, NMT it will normally be difficult to test the objective channel straightforwardly while imparting. For this situation different procedures must be utilized, for example, pilot reference points in IS-95. This implies there is quite often a concise break in the correspondence while hunting down the new channel took after by the danger of a startling come back to the old channel. On the off chance that there is no progressing correspondence or the correspondence can be interfered with, it is workable for the portable unit to precipitously move starting with one cell then onto the next and afterward inform the base station with the most grounded flag. The cell handoff in versatile cell systems is as show in [Fig 3].

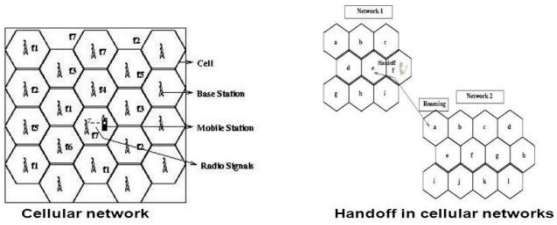



**Fig: 3** Handoff in Mobile Networks

## 1.2 Channel Allocation and Management:

### 1.2.1 Channel Allocation:

Channel portion manages the assignment of diverts to cells in a cell organize. Once the channels are designated, cells may then enable clients inside the cell to convey by means of the accessible channels. Directs in a remote correspondence framework normally comprise of recurrence groups as well as CDMA pseudo commotion groupings, however in a conceptual sense, they can speak to any non specific transmission asset. There are three noteworthy classifications for allocating these channels to cells (or base-stations) [1]. They are
1. Settled or Fixed Channel Allocation
2. Dynamic Channel Allocation and
3. Half and half or Dynamic Channel Allocation which is a mix of the initial two techniques.

### 1.2.2 Channel Management:

Direct administration helps in building up a program for offering and overhauling clients inside a particular channel. The point is to streamline correspondence between a business and the client. To do this, you have to fragment your channels as per the attributes of your clients: their requirements, purchasing designs, achievement factors, and so on and afterward redo a program that incorporates objectives, arrangements, items, deals, and showcasing program .The objective of channel administration is to set up coordinate correspondence with clients in each channel. In the event that the organization can adequately accomplish this objective, the administration will have a superior thought which showcasing channel best suits that specific client base. The procedures utilized as a part of each channel could be unique; however the general technique should dependably mark the business reliably all through the correspondence.
A business must figure out what it needs out of each channel and furthermore obviously characterize the structure for every one of those channels to deliver wanted outcomes. Distinguishing the portion of the populace connected to each channel likewise decides the best items to pitch to those channels.

## 1.3 TLBO, GA &DE Algorithms:

We considered the prominent developmental calculations Genetic Algorithm (GA) and Differential Evolution (DE) calculation to think about the improvement consequences of TLBO.

- GA was proposed by John Holland in 1970. The essential tasks of GA are choice, hybrid and change [2].
- DE was proposed by Storn and Price in 1997 [3]. The essential tasks of DE are change, recombination and choice.
- TLBO calculation was presented by Rao et al. in 2011 [4]. The fundamental tasks of TLBO are instructor stage and student stage.

## 2. Analysis of Sensing Error Probability, Call Blocking Probability and Network Throughput utilizing TLBO, GA and DE Algorithms

### 2.1 Analysis of Sensing Error Probability utilizing TLBO, GA and DE:

#### 2.1.1. Utilizing TLBO Algorithm:

Sensing mistake minimization is an imperative part of helpful range detecting that requirements attention. In this the utilization of TLBO under MIN-MAX criterion is proposed to upgrade the weighting coefficients vector of vitality level of range detecting data so the aggregate likelihood of blunder is minimized. The TLBO calculation researches the best weighting coefficients vector which limits add up to likelihood of error. The execution of the
TLBO based strategy is broke down and contrasted and customary delicate decision combination plans like equivalent pick up combine (EGC) [5].
Detecting mistake likelihood can be decreased by finding the ideal estimations of false caution likelihood and misdetection likelihood. Fundamental speculation demonstrate for PU discovery can be characterized as takes after

$$H0\ x(t) = n(t) \quad (2)$$
$$H1:\ x(t) = h*s(t) + n(t) \quad (3)$$

Where Ho is the theory that channel is free i.e. PU isn't transmitting, H1 is the theory that channel is at present possessed by PU, s(t) is transmitted flag of PU, x(t) is SU gotten flag and n(t) is clamor.

The detecting mistake likelihood ($P_e^j$) of j[th] SU is given by

$$P_e^j = P_f^j * P(H_0) + P_m^j * P(H_1) \quad (4)$$

Where $Ho$ is the hypothesis that channel is free i.e. PU is not transmitting, $H1$ is the hypothesis that channel is currently occupied by PU, $s(t)$ is transmitted signal of PU,$x(t)$ is SU received signal and $n(t)$ is noise.

$$P(H\_0) + P(H\_1) = 1 \quad (5)$$

We considered TLBO algorithm to minimize the sensing error probability i.e. equation number (4) to find optimized values of $P_f^j$ and $P_m^j$ of J[th] SU.

$$P_e^j = P_f^j * P(H_0) + P_m^j * P \quad (6)$$

Subject to $0 \le P_f^j \le 0.5;\ 0 \le P_m^j \le 0.9$ (7)

#### 2.1.2. Utilizing Genetic Algorithm:

GA was proposed by John Holland in 1970. The basic operations of GA are selection, crossover and mutation [2].Genetic Algorithms is particularly reasonable in tackling mind boggling and nonlinear issues, which are troublesome for customary seeking calculations. By and by clever sensor, nonlinear mistake of wise sensor is the wellspring of generally framework. For the inadequacy of the nonlinear critical thinking way existed by and by, we display another way joined hereditary calculations and cubic spline to adjust nonlinear mistake.

Spline addition work is in like manner utilized and essential among those joined and unfaltering interjection work. The cubic spline work with 2-arrange proceed with subsidiary is utilized under the state of fulfilling venture configuration requests more often than not. It can be demonstrated that the determination of introduction issues S(x) exists remarkably under the state of over three limit conditions. It can be proved that the resolution of interpolation problems S(x) exists uniquely under the condition of above three boundary conditions [6].

#### 2.1.3. Utilizing DE Algorithm:

Sensor Node Localization is thought to be a standout amongst the most basic issues in a Wireless Sensor Network (WSN). The goal of limitation is assurance of physical co-ordinates of a gathering of sensor hubs. The area data assumes a key part for scope, sending of sensor hubs and save tasks. Numerous applications, for example, steering and target following are all area subordinate. This work goes for deciding the area of the sensor hubs with high accuracy. The underlying piece of this work is done by limiting the hubs utilizing Mobile Anchor Positioning (MAP), a without range restriction strategy.

The thought is to analyze the execution of DE-MAP calculation to Genetic Algorithm with Mobile Anchor Positioning (GA - MAP). Root Mean Square Error (RMSE) has been utilized as an execution measure to think about between the two methodologies to be specific, DE-MAP and GA-MAP. Recreation comes about exhibit the way that our proposed Differential Evolution with Mobile Anchor Positioning (DE-MAP) calculation is successful in cutting down the confinement mistake when contrasted with GA-MAP [7] calculation.

### 2.2 Analysis of Call Blocking Probability utilizing TLBO, GA and DE:

It is proposed to reduce the overall call drop or call blocking in a particular cell and thereby making room to accommodate more number of new originating calls. The average duration of calls generated by different subscribers within a cellular network is not same.
Here proposed the new approach by considering recent algorithms to reduce call blocking probability. The average call durations of all subscribers are computed from the recent call history. This approach is particularly useful in a cell having heavy traffic with mostly business calls.

### 2.3 Analysis of Throughput utilizing TLBO, GA and DE:

#### 2.3.1. Utilizing TLBO Algorithm:

In managing truss shape and size enhancement issues, the truss topology is endorsed and it is thought to be unaltered amid the advancement system. In any case, the cross-sectional regions of components and nodal arranges are considered as plan factors which ought to be upgraded. The normal frequencies are considered as outline limitations to maintain a strategic distance from reverberation with the outer excitations [16]. The heaviness of the structure ought to be limited subject to some recommended requirements.

The seeking procedure comprises of two stages, i.e. Educator Phase and Learner Phase. In educator stage, students initially get information from an instructor and after that from schoolmates in student stage. In the whole populace, the best arrangement is considered as the educator (X teacher). Then again, students gain from the instructor in the educator stage. In this stage, the instructor tries to improve the aftereffects of different people (Xi)

by expanding the mean consequence of the classroom (X mean) towards his/her position (X teacher).

### 2.3.2. Utilizing Genetic Algorithm:

Since numerous strings need to compose vertices to the finish of the line, nuclear activities are utilized to counteract information races. The level-synchronous execution of the calculation requires a worldwide hindrance between emphases [17]. Since the CUDA programming model doesn't give an express hindrance between strings having a place with various Cooperative Thread Arrays (CTAs), the general strategy utilized to guarantee worldwide synchronization is to just dispatch numerous portions.

Having this kind of synchronization at each level of the diagram traversal winds up unfeasible in light of the fact that high-width charts can require a large number of them, bringing about a costly overhead. For wildernesses that are sufficiently extensive to be prepared by different CTAs yet sufficiently little to be handled by one CTA per Streaming Multiprocessor (SM) of the GPU (for this situation, a GTX 280 with 30 SMs), a between piece synchronization

### 2.3.3. Utilizing DE Algorithm:

Writing superior GPU executions of chart calculations can be testing. In this paper, we contend that three improvements called throughput enhancements are critical to superior for this application class [20]. These improvements portray a substantial usage space making it improbable for software engineers to actualize them by hand.

To address this issue, we have executed these enhancements in a compiler that produces CUDA code from a transitional level program portrayal called IrGL. Contrasted with best in class written by hand CUDA usage of eight diagram applications, code created by the IrGL compiler is up to 5.95x times quicker (middle 1.4 xs) for five applications and never over 30% slower for the others. Throughput advancements contribute a change up to 4.16x (middle 1.4x) to the execution of unoptimized IrGL code.

## 3. Results & Discussions

### TLBO:

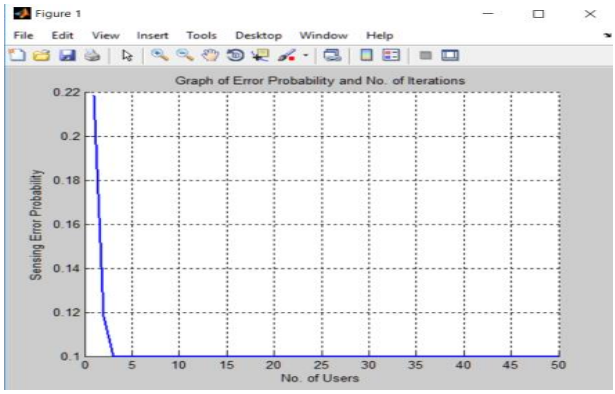



**Fig4.** Sensing Error Probability

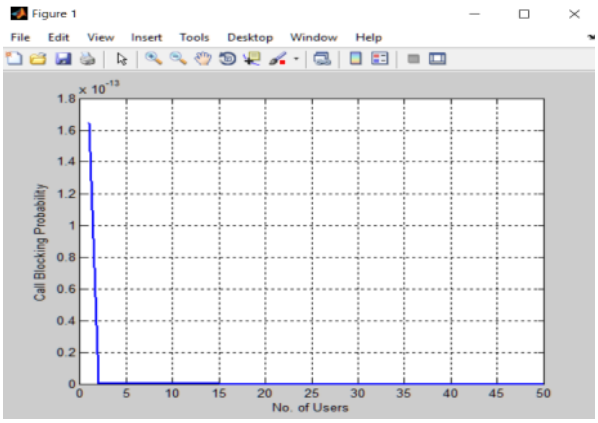



**Fig5.** Call Blocking Probability

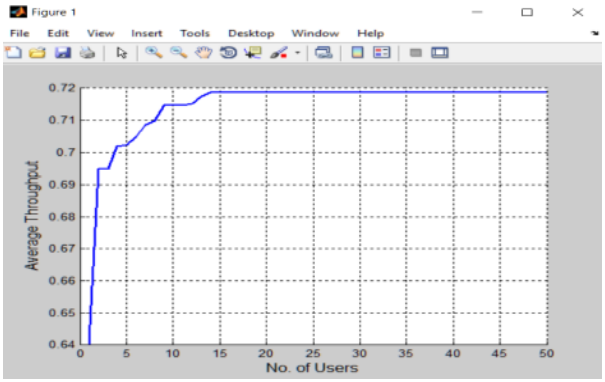



**Fig6.** Throughput

By considering TLBO algorithm, above figures Fig.4, 5, 6 showing the results of our analyzed parameters as sensing error probability, call blocking Probability and Throughput. Here in TLBO, sensing error probability, call blocking probability as shown in fig.4, 5 is lesser than GA and DE analysis as shown in figures fig.7,8 of GA and fig.10,11 of DE

### GA:

By considering GA, above figures Fig.7, 8, 9 showing the results of our analyzed parameters as sensing error probability, Call blocking Probability and Throughput.

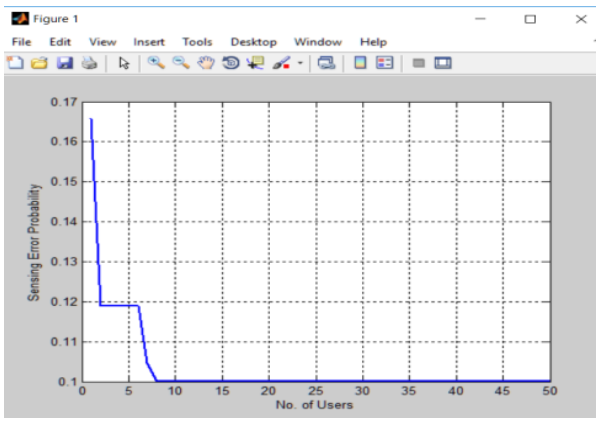



**Fig7.** Sensing Error Probability

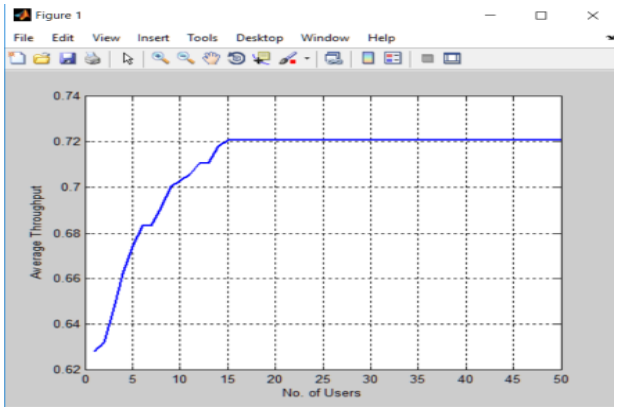



**Fig9.** Throughput

**DE:**

By considering DE algorithm, above figures Fig.10, 11, 12 showing the results of our analyzed parameters as sensing error probability, call blocking Probability and Throughput. Here in DE analysis, throughput as shown in fig.12 is more than TLBO and GA analysis as shown in figures fig.6 of TLBO and fig.9 of GA.

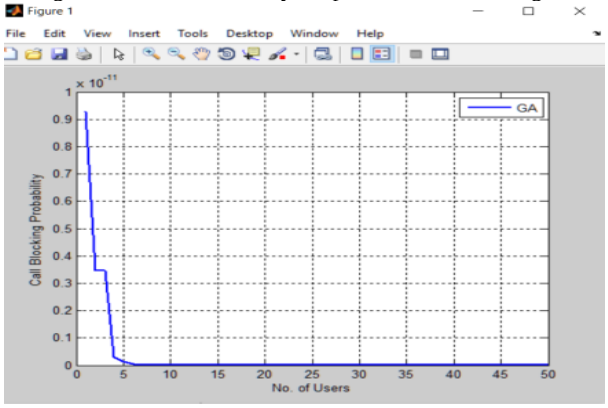



**Fig8.** Call Blocking Probability

**Fig10.**Sensing Error Probability

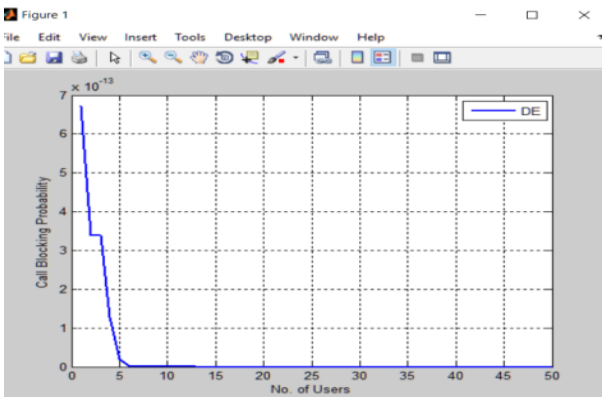
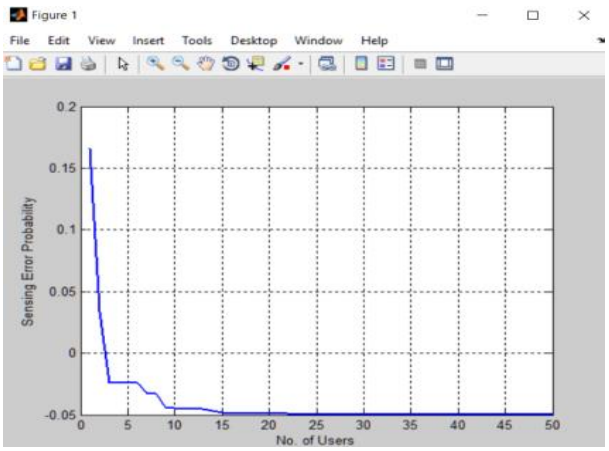



**Fig11.** Call Blocking Probability



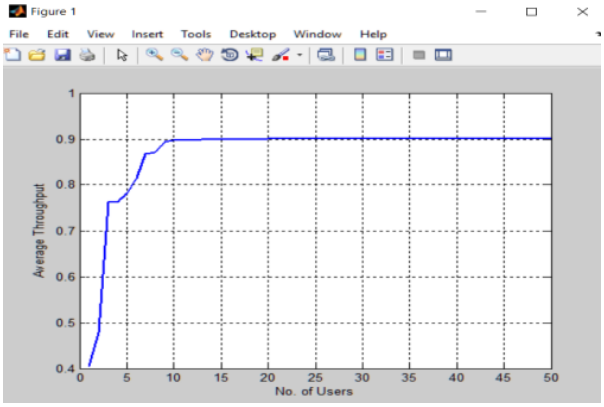




**Fig12.** Throughput

**Table 1:** Correlation of Simulation Result

| Calculations using Algorithms/Parameters | No. Of Users | Sensing Error Probability | Call Blocking Probability | Throughput |
|---|---|---|---|---|
| TLBO | 50 | 0.1 | 1.3444e-12 | 0.71863 |
| GA | 50 | 0.10024 | 2.3104e-14 | 0.72076 |
| DE | 50 | - 0.049884 | 5.2395e-116 | 0.9 |

## 4. Conclusion

### Sensing Error Probability:

- When contrasted with the reenactment comes about, the sensing error probability is low in TLBO and GA.
- In DE calculation, the sensing error probability is negative, yet the negative probability isn't legitimate in Networks.
- In this way, the TLBO and Genetic calculations are significant.

### Call Blocking Probability:

- When contrasted with the reproduction comes about, the call blocking probability is low in TLBO.

- Be that as it may, in GA and DE the call blocking probability is high contrasted with TLBO. Thus, TLBO calculation is considered.

**Throughput:**

- When contrasted with reenactment comes about, the throughput is most extreme in DE where as TLBO and GA is relatively equivalent.

Based on the applications, the numbers of users are accommodated using any one of the algorithm. So, finally we can conclude that using the above mentioned algorithms; we can decrease the sensing error probability & call blocking probability and increases the network throughput.

## References


[1] Guowang Miao; Jens Zander; Ki Won Sung; Ben Slimane (2016). Basics of Mobile Data Networks. Cambridge University Press. ISBN 1107143217.

[2] R. L. Haupt, S.E. Haupt, Practical Genetic Algorithms, John Wiley and children, INC., Publication. ISBN 0-471-45565-2. 2004.

[3] R. Storn, K.Price, "Differential development a straightforward and productive heuristic for optimization over spaces", Journal of worldwide Optimization 11(4). pp 341-359, 1997.

[4] V. Rao, V.J. Savsani and D.P. Vakharia,"TLBO advancement technique for nonstop nonlinear expansive scale issues", Information Sciences183 (1) (2012) 1-15.

[5] A. Ghasemi and E. S. Sousa, Spectrum sensing in cognitive radio networks: Requirements, challenges and design trade-offs, IEEE Communication Magazine, vol.46, no.4, pp.32-39, 2008.

[6] Wang Xiao-Ping, Cao Li-Ming, genetic algorithms —theory^ application and software realization, Xi'an: Xi'an Jiaotong university Publishing House, 2002.

[7] I.F.Akyildiz, W.Su, Y.Sankarasubramanium, and E.Cayirci, "Wireless Sensor Networks:A Survey", IEEE Communications Magazine, Vol. 40, No. 8, Aug. 2002 pp. 102-114.

[8] Dharma Prakash Agrawal Qing-An Zeng, "Introduction to wireless and mobile systems", Thomason Press, 2003.

[9] Elnoubi, S. M., Singh, R., and Gupta, S.C., "A New Frequency Channel Assignment Algorithm in High Capacity Mobile Communication Systems," IEEE Transactions on Vehicular Technology, vol. 31, no. 3, August 1982.

[10] Chang Wook Ahn and R. S. Ramakrishna, "QoS provisioning dynamic connection-admission control for multimedia wireless networks using a Hopfield neural network", IEEE Transactions on Veh. Technology, Vol.56, No.2, pp.106-107, 2004.

[11] Zhang, M. and Yum, TS. P., "Comparisons of Channel-Assignment Strategies in Cellular Mobile Telephone Systems", IEEE Transactions on Vehicular Technology, vol. 38, no. 4, November 1989.

[12] Yue, W., "Analytical Methods to Calculate the Performance of a Cellular Mobile Radio Communication with Hybrid Channel Assignment," IEEE Transactions on Vehicular Technology, vol. 40, now. 2, May 1991.

[13] Katzela, I., "Channel Assignment Schemes for Cellular Mobile Telecommunication Systems," Unpublished work, Columbia University, December 15, 1992.

[14] Jiang, H. and Rapp port, S. S., "CBWL: A New Channel Assignment and Sharihng Method for Cellular Communication Systems," IEEE Transactions on Vehicular Technology, vol. 43, no. 2, May 1994.

[15] J. Mitola III, G. Maguire Jr., Cognitive radio: making software radios more personal, IEEE Personal Communications 6 (4) (1999) 13–18.

[16] Rao, R.V., Patel, V., 2012. An elitist teaching-learning-based optimization algorithm for solving complex constrained optimization problems. International Journal of Industrial Engineering Computations 3(4), 535–560.

[17] Patrascu, M.; Stancu, A.F.; Pop, F. (2014). "HELGA: a heterogeneous encoding lifelike genetic algorithm for population evolution modeling and simulation".

[18] R.V. Rao, V. Patel, An elitist teaching–learning-based optimization algorithm for solving complex constrained optimization problems Int. J. Ind. Eng. Comput., 3 (4) (2012).

[19] R.V. Rao, V. Patel,Multi-objective optimization of two stage thermo-electric cooler using a modified teaching–learning-based optimization algorithm in. Appl. Artif. Intell, 26 (1) (2013).

[20] S. Das, S. S. Mullick, P. N. Suganthan, "Recent Advances in Differential Evolution - An Updated Survey," Swarm and Evolutionary Computation, 2016.

[21] Tom Simonite (24 January 2013). "Google's Private Cell Phone Network Could Be a Threat to Cellular Carriers | MIT Technology Review". Technologyreview.com. November 2013.

[22] Wu, C.I.; Chen, C.H.; Lin, B.Y.; Lo, C.C. Traffic Information Estimation Methods from Handover Events. J. Test. Eval. 2016, 44, 656–664.

[23] Chang, M.F.; Chen, C.H.; Lin, Y.B.; Chia, C.Y. The Frequency of CFVD Speed Report for Highway Traffic. Wirel. Commun. Mob. Comput. 2015, 15, 879–888.

[24] Lai, W.K.; Kuo, T.H.; Chen, C.H. Vehicle Speed Estimation and Forecasting Methods Based on Cellular Floating Vehicle Data. Appl. Sci. 2016, 6, 47.

[25] Shaik Yasmin Fathima, Md. Zia Ur Rahman, K. Murali Krishna, Shakira Bhanu,Mirza Shafi, "Side Lobe Suppression in NC-OFDM Systems Using Variable Cancellation Basis Function", IEEE Access, vol.5, no.1, pp. 9415-9421, 2017.

[26] Ohatkar, S.N., Bormane and D.S.: Hybrid channel allocation in cellular network based on genetic algorithm and particle swarm optimization methods. IET Commun. 10(13), 1571–1578 (2016).