SIMATS ENGINEERING
Engineer to Excel
TECH STAR SUMMIT 2024
Name: P. Aswini
Register Number: 192011399
Guided by Dr. Kalimuddin Mondal

Efficient Energy-Efficient Resource Allocation in Cognitive Radio Networks Using Particle Swarm Optimization Compared Over Ant Colony Optimization

INTRODUCTION

- This research aims to contribute energy resource allocation to the field of cognitive radio using Particle Swarm Optimization (PSO) compared over Ant Colony Optimization (ACO) with improved accuracy.
- Ant Colony Optimization (ACO) is a metaheuristic optimization algorithm inspired by the foraging behavior of ants searching for food. Developed by Marco Dorigo in the early 1990s, ACO belongs to the category of nature-inspired optimization techniques and is widely used to solve combinatorial optimization problems.
- This study aims to compare the performance of Particle Swarm Optimization and Ant Colony Optimization in efficiently allocating resources in Cognitive Radio networks while optimizing energy efficiency.
- In this study, I compared Particle swarm optimization with Ant Colony optimization. Particle swarm optimization produce best accuracy compared with Ant Colony Optimization.
- The objective of this study is to investigate and compare the efficiency of Particle Swarm Optimization (PSO) and Ant Colony Optimization Algorithm (ACO) in efficiently allocating resources in Cognitive Radio Networks (CRNs) while optimizing energy efficiency.

MATERIALS AND METHODS

Input Dataset : Dataset is divided into small overlapping or either non-overlapping blocks.

→ **Pre-Processing :** Pre process the data to remove class Imbalance Both PSO and ACO can be used for preprocessing tasks such as data cleaning, normalization, and outlier detection to prepare the data for further processing.

→ **Clustering :** PSO and GO can be utilized for clustering the data to group similar data points together. This step can help identify patterns in the data and facilitate further analysis.

→ **Feature Extraction :** PSO and ACO can be applied for feature extraction, aiming to identify and extract relevant features from the data that are most informative for subsequent analysis.

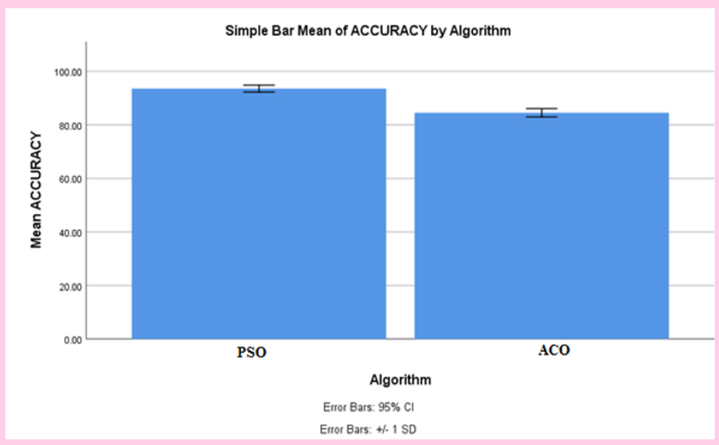
→ **Feature Selection :** Both PSO and ACO can be employed for feature selection to determine the subset of features that contribute most to the performance of the system while minimizing redundancy and noise.

→ **Classification :** PSO and ACO can optimize the parameters of classification models (e.g., support vector machines, decision trees) to enhance classification accuracy and efficiency.

→ **Output Prediction :** Both PSO and ACO can be used for predicting outputs based on the trained classification models. They can optimize parameters to improve the accuracy and reliability of the predictions.

Efficient Energy-Efficient Resource Allocation in Cognitive Radio Networks Using Particle Swarm Optimization Compared Over Ant Colony Optimization

RESULTS



Particle Swarm Optimization is compared over the Ant Colony Optimization, In this comparison Particle Swarm Optimization gives more accuracy when compared with Ant Colony Optimization.

Group		N	Mean	Standard Deviation	Standard Error Mean
Accuracy	PSO	20	92.28	2.65860	0.36541
	ACO	20	84.16	4.66109	0.54321

Fig :- Comparing the accuracy data values of Particle Swarm Optimization over Ant Colony Optimization

DISCUSSION AND CONCLUSION

- The Particle swarm optimization technique is statistically significant since its significance value is $p=0.055$ ($p<0.05$) from the independent sample T-test analysis.
- The results of the energy efficient study for Cognitive Radio revealed a clear and consistent trend. The Particle Swarm Optimization (PSO) algorithm consistently outperformed the Ant Colony Optimization (ACO) algorithm in terms of accuracy across given datasets. The mean accuracy for PSO was notably higher at 92.28%, while ACO achieved an average accuracy of 84.16%
- Based on the analysis, Particle swarm optimization outperformed the existing models in terms of Accuracy and F1 score.
- These findings emphasize the potential of Computer Networks, specifically Particle Swarm Optimization helped in more resource allocation with improved accuracy.
- As a result, this study offers strong evidence that, when it comes to creating an energy-efficient cognitive radio, the Particle Swarm Optimization (PSO) method outperforms the Ant Colony Optimization (ACO) algorithm.

BIBLIOGRAPHY

- Asoke Nath & Triparna Mukherjee - 2020, "Cognitive Radio-Trends, Scope, and Challenges in Radio Network Technology", International Journal of Advance Research in Computer Science and Management, vol. 3, No. 6.
- D. Seema Dev Aksatha - 2021, “Improving the Energy Efficiency of Cognitive Radio Wireless Network Using Coverset Prediction “, Turkish Journal of Computer and Mathematics Education TURCOMAT Vol. 12 No. 13.
- Gyanendra Prasad Joshi, Seung Yeob Nam & Sung Won Kim - 2022, “Cognitive Radio Wireless Sensor Networks: Applications, Challenges and Research Trends“, Sensors Basel., Vol. 13, No. 9.
- Muhammad Naeem, Kandasamy Illanko, Ashok Karmokar, Alagan Anpalagan & Muhammad Jaseemuddin - 2020, “Energy-Efficient Cognitive Radio Sensor Networks: Parametric and Convex Transformations “, Sensors Basel. Vol. 13, No. 8.
- Xueqing Huang, Tao Han, & Nirwan Ansari - 2021, “On Green Energy Powered Cognitive Radio Networks”, *EEE Communications Surveys & Tutorials*, vol. 17, no. 2.