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 Whale Optimization

INTRODUCTION

- This research aims to contribute energy resource allocation to the field of cognitive radio using Particle Swarm Optimization (PSO) compared over Whale Optimization (WO) with improved accuracy.
- Whale Optimization Algorithm (WOA) is a metaheuristic optimization algorithm inspired by the social behavior of humpback whales during bubble-net feeding. It was proposed by Seyedali Mirjalili and Andrew Lewis in 2016. WOA is designed to solve optimization problems by mimicking the hunting behavior of whales.
- This study aims to compare the performance of Particle Swarm Optimization and Whale Optimization in efficiently allocating resources in Cognitive Radio networks while optimizing energy efficiency.
- In this study, I compared Particle swarm optimization with Whale optimization. Particle swarm optimization produce best accuracy compared with Whale Optimization.
- The objective of this study is to investigate and compare the efficacy of Particle Swarm Optimization (PSO) and Whale Optimization Algorithm (WO) 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 WOA can be used for data preprocessing tasks such as data cleaning, normalization, and feature scaling.

→ **Clustering :** PSO and WOA can optimize the parameters of clustering algorithms (e.g., K-means) to find optimal cluster centers. This can aid in grouping similar resources or nodes in cognitive radio networks, which can help in resource allocation tasks.

→ **Feature Extraction :** PSO and WOA can be applied for feature extraction, aiming to identify and extract relevant features from the data that are most informative for resource allocation in cognitive radio networks. This could involve optimizing the weights or coefficients of feature extraction techniques such as Principal Component Analysis (PCA) or Wavelet Transform.

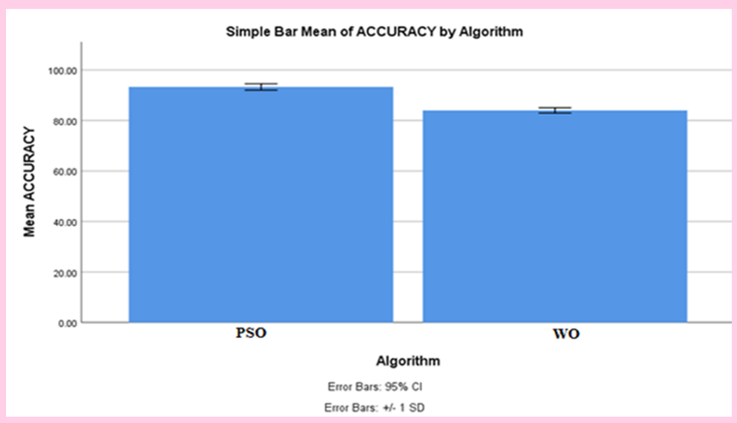
→ **Feature Selection :** Both PSO and WOA can optimize the selection of features that are most relevant to resource allocation in cognitive radio networks. They can iteratively select subsets of features that contribute most to the efficiency and effectiveness of resource allocation.

→ **Classification :** PSO and WOA can optimize the parameters of classification models such as support vector machines (SVM), decision trees, or neural networks. This can help in classifying resources or nodes in cognitive radio networks based on their characteristics and usage patterns.

→ **Output Prediction :** PSO and WOA can be used for predicting outputs related to resource allocation decisions. By optimizing the parameters of prediction models, they can improve the accuracy of predictions regarding resource usage, interference levels, or network performance.

Efficient Energy-Efficient Resource Allocation in Cognitive Radio Networks Using Particle Swarm Optimization Compared Whale Optimization

RESULTS



Group		N	Mean	Standard Deviation	Standard Error Mean
Accuracy	PSO	20	94.12	1.66410	0.52333
	WO	20	84.15	3.56553	0.72490

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

Fig :- Comparing the accuracy data values of Particle Swarm Optimization over Whale 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 Whale Optimization (WO) algorithm in terms of accuracy across given datasets. The mean accuracy for PSO was notably higher at 94.12%, while WO achieved an average accuracy of 84.15%
- 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.
- Finally, this research shows that the Particle Swarm Optimization (PSO) algorithm outperforms the Whale Optimization (WO) algorithm when it comes to creating an energy-efficient cognitive radio. With an accuracy of 94.12% compared to WO accuracy of 84.15%, the PSO-based energy efficient cognitive radio outperforms WO.

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.