SIMATS ENGINEERING

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TECH STAR SUMMIT 2024

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

INTRODUCTION

- This research aims to contribute energy resource allocation to the field of cognitive radio using Particle Swarm Optimization (PSO) compared over Butterfly Optimization (BO) with improved accuracy.
- Butterfly Optimization Algorithm (BOA) is a metaheuristic optimization algorithm inspired by the social behavior of butterflies. Proposed by Tamer N. Haddad and Aboul Ella Hassanien in 2015, BOA is designed to solve optimization problems by simulating the foraging behavior of butterflies.
- This study aims to compare the performance of Particle Swarm Optimization and Butterfly Optimization in efficiently allocating resources in Cognitive Radio networks while optimizing energy efficiency.
- In this study, I compared Particle swarm optimization with Butterfly optimization. Particle swarm optimization produce best accuracy compared with Butterfly Optimization.
- The objective of this study is to investigate and compare the efficacy of Particle Swarm Optimization (PSO) and Butterfly Optimization Algorithm (BO) 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 Both PSO and BOA can be employed for data preprocessing tasks such as data cleaning, normalization, and feature scaling. They can optimize parameters .

→ **Clustering :** PSO and BOA can optimize the parameters of clustering algorithms (e.g., K-means) to identify clusters of similar resources or nodes in cognitive radio networks. This can facilitate resource allocation tasks by grouping together similar resources for efficient utilization.

→ **Feature Extraction :** PSO and BOA can be applied for feature extraction to identify and extract relevant features from the data that are informative for resource allocation in cognitive radio networks. They can optimize the weights or coefficients of feature extraction techniques such as Principal Component Analysis (PCA) or Wavelet Transform to capture the essential characteristics of the data.

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

→ **Output Prediction :** PSO and BOA can be utilized 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.

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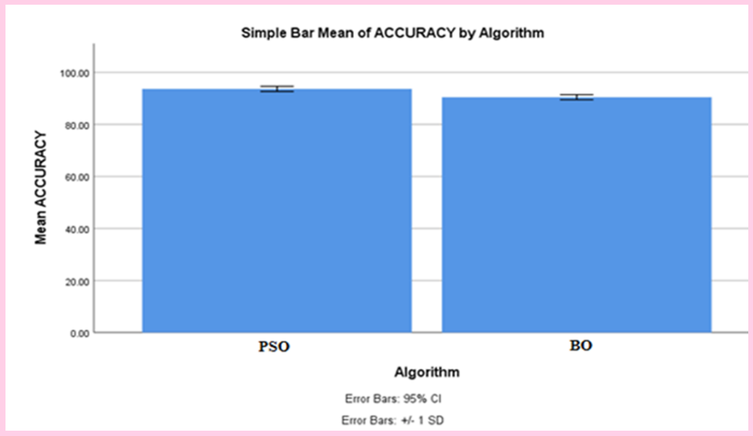
RESULTS



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

Group		N	Mean	Standard Deviation	Standard Error Mean
Accuracy	PSO	20	93.25	2.88360	0.59041
	BO	20	82.25	4.43609	0.76821

Fig :- Comparison the accuracy data values of Particle Swarm Optimization over Butterfly 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 Butterfly Optimization (BO) algorithm in terms of accuracy across given datasets. The mean accuracy for PSO was notably higher at 92.28%, while BO achieved an average accuracy of 82.15%
- 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.
- Therefore, this work provides compelling evidence that the Particle Swarm Optimization (PSO) method surpasses the Butterfly Optimization (BO) algorithm in the creation of an energy-efficient cognitive radio.

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