Genetic Algorithms

It is a process of natural selection which begins with a population of potential solutions which are each evaluated based on their effectiveness.

Why is Genetic Algorithm used?

Genetic Algorithms are used because they excel at solving complex optimization problems where traditional methods may struggle, particularly in large or nonlinear search spaces.

Optimization:

1) Parameter Tuning: Adjust key parameters like population size and mutation rates

2) Adaptive methods: Dynamically modify parameters based on performance.

3) Elitism: Preserve the best solutions across generations.

Applications:

1) Machine learning: Feature selection.

2) Robotics: Control systems, path finding.

Particle Swarm

What is PSO?

Particle Swarm is an algorithm inspired by the movement of ~~bird~~ birds or fish swarms. Each particle represents a potential solution and moves through the search space, adjusting its position based on its own best experience and the best position found by swarm.

Why is PSO used?

PSO is widely used because it is a simple yet powerful technique for solving complex optimization problems. It requires minimal parameter tuning and does not depend on gradient information.

Optimization Techniques:

1) Parameter Techniques: Adjust swarm size and coefficient.
2) Adaptive Parameters: Dynamically modify parameters
3) Velocity damping: Limit speeds to avoid overshooting

Date
Page

Applications

1) Engineering Design: Optimizing Structure
2) Finance: Portfolio optimization
3) Machine Learning: Hyperparameter tuning

Ant Colony Optimization

What is ACO?

ACO is a swarm intelligence-based algorithm inspired by the foraging behaviour of ants. In nature, ants deposit pheromones on their paths to communicate with one another, guiding other ants towards food sources.

Why use ACO?

ACO is used because it effectively solves complex combinational optimization problems by mimicking the natural behaviour of ants

Optimization

1) Adaptive Parameters : Modify pheromone influence during execution

2) Dynamic Pheromone Update : Adjust evaporation rates based on quality.

3) Hybrid Algorithm : Combine with other techniques.

Date
Page

Applications

1) Routing : Vehicle routing, Travelling Salesman Problem

2) Scheduling: Job-Shop scheduling

Cuckoo Search

What is Cuckoo Search?

A nature-inspired optimization algorithm that mimics cuckoo brood parasitism to find optimal solutions through "cuckoo" solutions.

Why use cuckoo search?

Cuckoo search is used because it effectively addresses complex optimization problems with its unique blend of exploration and exploitation strategies inspired by nature.

Optimization

1) Parameter Tuning
2) Adaptive Techniques
3) Hybrid Approaches

Applications

1) Engineering Design
2) Machine Learning
3) Finance

Grey WOF Optimization

What is GWO?

A nature-inspired algorithm mimicking the hunting behaviour of grey wolves. It uses their social hierarchy to explore and exploit solutions through encircling and attacking strategies.

Why is GWO used?

We use the GWO because it effectively solves complex optimization problems through its unique simulation of the social and hunting behaviours of grey wolves.

Optimization

1) Parameter Turning
2) Hybrid Approaches
3) Load Balancing

Applications

1) Data Mining
2) Game Development
3) Network Design.