OPTIMIZATION TECHNIQUES

with bio-inspired algorithms

Intro to PySolver

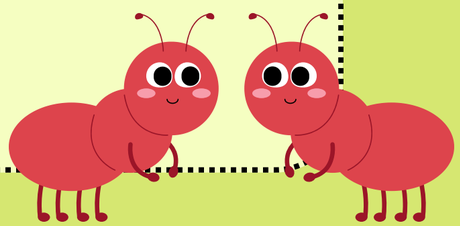
PySolver is a Python-based project that brings together the power of nature-inspired optimization techniques to solve complex problems. It implements three widely-used metaheuristic algorithms that draw inspiration from the collective intelligence observed in natural systems

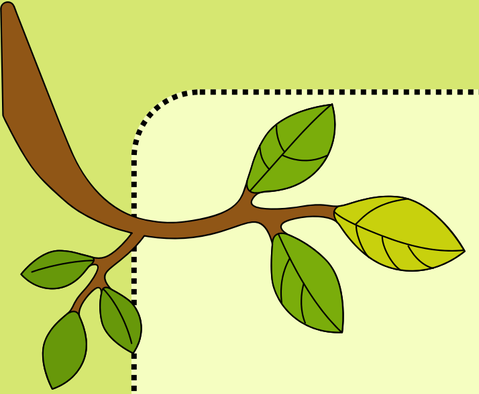
Used Algorithms

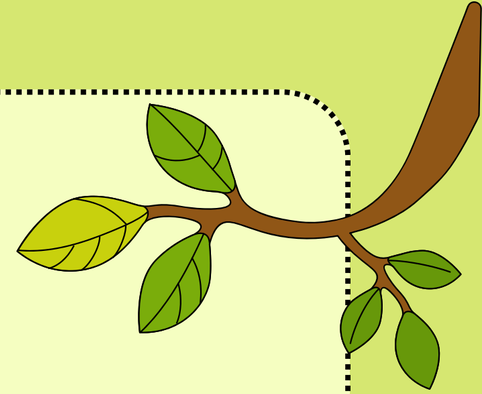
1. **Ant Colony Optimization (ACO)**
2. **Artificial Bee Colony (ABC)**
3. **Particle Swarm Optimization (PSO)**

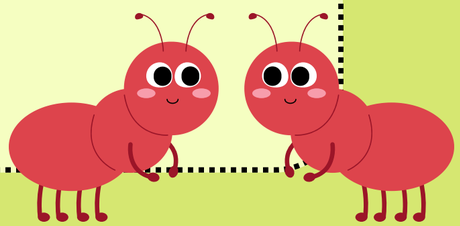
Ant Colony Optimization (ACO)

Ant Colony Optimization (ACO) is a probabilistic technique inspired by the foraging behavior of real ants. When ants search for food, they leave behind pheromone trails that help other ants follow the most promising paths. ACO simulates this behavior with artificial agents (ants) that explore a solution space and communicate indirectly via virtual pheromones. Over time, shorter or better paths accumulate more pheromones, guiding the colony toward optimal or near-optimal solutions. ACO is particularly effective for discrete and combinatorial optimization problems, such as routing, scheduling, and network design.



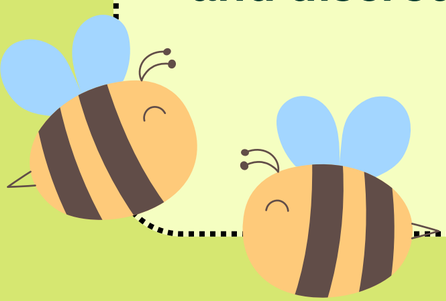


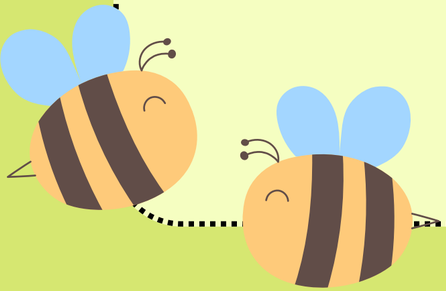




Artificial Bee Colony (ABC)

Artificial Bee Colony (ABC) is a swarm intelligence algorithm based on the foraging behavior of honey bees. In nature, bees divide their roles into employed bees, onlooker bees, and scout bees. Employed bees explore known food sources, onlooker bees select food sources based on shared information, and scout bees search for new possibilities. The ABC algorithm mimics this process to explore and exploit the solution space efficiently. It is suitable for both continuous and discrete optimization problems and is valued for its simplicity, flexibility, and strong global search capabilities.





Particle Swarm Optimization (PSO)

Particle Swarm Optimization (PSO) is inspired by the social behavior of animals, such as bird flocking or fish schooling. In PSO, a swarm of particles (potential solutions) moves through the search space, adjusting their positions based on their own experience and the experience of their neighbors. Each particle keeps track of its best-known position and is also influenced by the best-known positions of others. This leads to a dynamic balance between exploration and exploitation, allowing the swarm to converge toward high-quality solutions. PSO is widely used for solving continuous optimization problems due to its simplicity and fast convergence.


THANK YOU