



Synopsis
on
Bee Colony Optimization for Travelling Salesman Problem

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INTRODUCTION

Bee Colony Optimization (BCO):

Artificial Bee Colony (ABCO) algorithm is a nature inspired algorithm that was introduced by Karaboga for multi- model and multi-dimensional numeric problems. ABC algorithm gives good results for continuous optimization problems. A set of honey bees, called swarm, can successfully accomplish tasks through social cooperation. In the ABC algorithm, there are three types of bees: employed bees, onlooker bees, and scout bees. The employed bees search food around the food source in their memory; meanwhile they share the information of these food sources to the onlooker bees. The onlooker bees tend to select good food sources from those found by the employed bees. The food source that has higher quality (fitness) will have a large chance to be selected by the onlooker bees than the one of lower quality. The scout bees are translated from a few employed bees, which abandon their food sources and search new ones.

Travelling Salesman Problem (TSP):

The Travelling Salesman Problem describes a salesman who must travel between N cities. The order in which he does so is something he does not care about, as long as he visits each once during his trip, and finishes where he was at first. Each city is connected to other close by cities, or nodes, by airplanes, or by road or railway. Each of those links between the cities has one or more weights (or the cost) attached. The cost describes how "difficult" it is to traverse this edge on the graph, and may be given, for example, by the cost of an airplane ticket or train ticket, or perhaps by the length of the edge, or time required to complete the traversal. The salesman wants to keep both the travel costs, as well as the distance he travels as low as possible. The Traveling Salesman Problem is typical of a large class of "hard" optimization problems that have intrigued mathematicians and computer scientists for years. Most important, it has applications in science and engineering. For example, in the manufacture of a circuit board, it is important to determine the best order in which a laser will drill thousands of holes. An efficient solution to this problem reduces production costs for the manufacturer.

Various techniques have been used to solve TSP. In general, these techniques are classified into two broad categories: exact and approximation algorithms. Exact algorithms are methods which utilize mathematical models whereas approximation algorithms make use of certain heuristics and iterative improvements as the problem-solving process. Some instances in the exact methods category are Branch and Bound, Lagrangian Relaxation, Integer Linear Programming etc. The approximation algorithms can be further classified into two groups: constructive heuristics and improvement heuristics. Instances in constructive heuristics include Nearest Neighbourhood, Greedy Heuristics, Insertion Heuristics, Christofides Heuristics etc. Instances in improvement heuristic include k-opt, Lin-Kernighan Heuristics, Simulated Annealing, Tabu Search, Evolutionary Algorithms, Ant Colony Optimization, Bee System etc.

BCO Model for TSP

Various bee models have been attempted in different domains ranging from dynamic server allocation for internet hosting center, numerical function optimization, hex game playing program, job shop scheduling, to TSP. In Lucic and Teodorovic proposed a Bee System in

tackling TSP. In their model, bees are expected to construct partial tours in every iteration. The position of hive will be reallocated to a new city after every iteration. Interaction among bees in their model is implemented in two ways: memory and waggle dance. Bees are able to memorize how many bees visited certain links in the past and are able to advertise partial tours to other hive mates. Upon initiating a new iteration, the solution is improved by 2-opt, 3-opt and modified 3-opt heuristics

Different Modules in the System

1. User Management – Bug Testing.
Assigned to- Akash Mishra
2. GUI – Implementing the Front end
Assigned to – Vishal Batra
3. Backend Coding – implementing the BCO for TSP
Assigned to- K. Shiva chandra
4. Report Generator - Generate the report.
Assigned to - Ayush Tiwari

Gantt chart

