

TJHSST Senior Research Project Proposal: Ant Colony Optimization 2006-2007

Ryan Ward

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1 Problem Statement and Purpose

Ant Colony Optimization (ACO) is an algorithm that is used to find near-optimal solutions to computationally intensive problems. The algorithm mimics the system that ants use to find the closest food source (optimal solution). ACO simulates the moving of these ants as they choose which direction to go based on where other ants have been. As ants travel they leave behind pheromones that other ants will follow, so that a trail that leads to a food source will be followed and reinforced. The goal of this project is to successfully model this behavior as well as study its applications in computer science. An environment similar to the Traveling Salesman Problem will be used to evaluate the effectiveness of ACO.

2 Background

The ACO algorithm was initially proposed in 1992 and accepted as a well defined metaheuristic algorithm in 1999. Since then ACO has been used to find near-optimal solutions to multiple problems involving vast amounts of combinations and is shown to run more efficiently than other known algorithms on a variety of levels. A recently published book, Ant Colony Optimization by Marco Dorigo and Thomas Sttzele, covers the inner-workings of the algorithm and its applications.

3 Procedure and Methodology

I will primarily be writing the code in Java since that is the language I am more confident in writing in and I am familiar with OOP techniques. The program can be tested for accuracy by solving the simulation iteratively for smaller data sets and then comparing that solution with the ACO algorithm solution. I anticipate not needing any outside resources, although Ant Colony Optimization might help to give me a good basis for the project. The project can be divided into 3 parts: the first part would be to create the environment to test the ACO algorithm, the second would be to create the ACO algorithm, and the third would be to adjust the algorithm to make it more efficient or make the algorithm in such a way so that it can update itself to the addition or removal of data points.

4 Expected Results

The result from this project would be an ACO algorithm that finds a near-optimal solution to the Traveling Salesman Problem in a short amount of time. The effectiveness can be rated by time efficiency of the algorithm. Analyses can be done comparing different versions of the ACO algorithm to other algorithms or determining which versions of the ACO algorithm create the best results.