Ant Colony Optimization with Multiple Objectives
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Abstract

Ant Colony Optimization (ACO) is a useful method to find near optimal paths. The most common algorithms only have ants that choose their individual paths based on pheromones left by other ants. This serves to optimize the distance between the starting location and a certain goal. However, it is often more realistic and useful to factoring other variables.

Keywords: Ant Colony Optimization

1 Introduction

Ant Colony Optimization is a process used to find a near optimal path that satisfies certain restrictions. There is a often need to find the optimal path while satisfying several variables. An example would be to minimizing the time of a certain route while keeping costs low. Often, one or few of the variables are more important or more strict compared to the others. In this case, it would be more important for those select variables to be optimized even if others are not.

2 Background

2.1 Ant Colony Optimization

Ant Colony Optimization (ACO) was inspired by, and mimics, the system used by ants to find a short path from their colony to a food source. As an ant travels back to its colony, it leaves behind a pheromon trail that other ants follow. Other ants then base their decision for which route to use partly based on the amount of pheromon it detects. Over time, pheromon builds up on paths most traversed and evaporates from others. This allows the population to weed out different paths until only a near optimal one remains. The process does not guarantee an optimal solution, but the one it finds should be close. When multiple variables are weighted, the idea is that each ant chooses its route based on each of these variables but

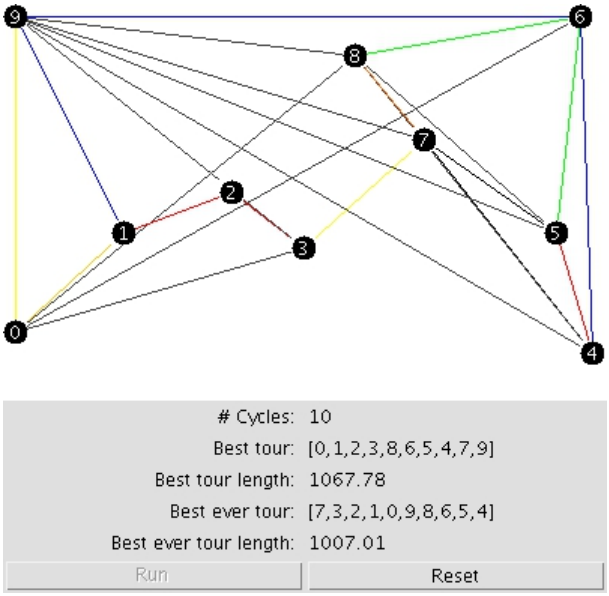

Figure 1: Example of an ACO program, by Dr. Mark Sinclair

considers some more important than others.

3 Procedure

I am planning to work in Java for the project. The first part is to learn and code a working Ant Colony Optimization program. Using my program, I can compare it to other programs running the same graph to compare the results to ensure that mine is working. At least that much needs to be done before the end of second quarter. Then I'll need to implement an additional variable that is factored into the decision making of each ant. Currently, I plan to implement a new pheromone for the second variable. The graph would have two different weights, one for each variable. If that can work, I can begin looking for the best combination of how each variable is weighted.

4 Expected Results

For each run, the data for variables that are used in decision making will be recorded. The results for different weights can be compared to find a near optimal combination. When the all weights for variables set to zero except one, it means only that one variable is taken into account. The results then should match a simple one variable program. Such a run could potentially have unrealistic numbers for the unaccounted variables.

5 Results and Conclusion

There is currently no results, and thus no conclusion.

References

[1] Mora, A.M., et. al, *LaTeX: Balancing Safty and Speed in the Military Path Finding Problem: Analysis of Different ACO Algorithms*. Longdon, England 2007