

Ant Colony Optimization with Multiple Objectives

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1 Purpose and Scope

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

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. Ants also consider different factors such as the distance it needs to cover. 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

3 Procedure

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. Then I'll need to implement an additional variable that is factored into the decision making of each ant. If that can work, I can begin looking for the best combination of how pheromon and 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.