

Description of the project (phase2)

Introduction

We saw during the first phase of the project how a simple mechanism of marking the edges of a graph with pheromones can lead the ants of a colony, after a number of iterations, to find a good path to a place where food can be found. This solution inspired a series of methods for solving optimization problems, named Ant Colony Optimization (ACO), [1]. We used a modified version of the algorithm called Ant System to model a scenario of a colony of ants searching for food outside their ant hill.

The study from the first phase ended up with an analysis of the implemented ACO method for finding food. However, better approaches can be used and an explicit coordination strategy may improve the performance of the system. Thus, the second phase of the project is to propose and use a strategy of coordination between the ants so that we expect some better results in terms of the number of iterations needed, the number of ants used, etc. Thus, the new ants created, named *smart ants*, are expected to behave better.

Another analysis, of the method chosen in the second phase, this time, should be linked to the one made before and this way the two approaches will be compared.

The Use of Coordination Strategy & The New Scenario

The coordination strategy used during this second phase is left at the choice of the students. Any strategy that uses coordination between ants, by means of communication, is appropriate. However, the strategy should model a realistic scenario, so the ants have only a partial view of the environment, so do the other agents.

The new scenario, illustrated by Fig. 1, is a little bit different concerning another aspect too, the one of the food locations. So food can be found at more locations and, at each location, only a limited amount is available. The goal of the ants is to transport as much food as possible to the ant hill (only one, as in the first phase of the scenario too) or to transport all the food available in the environment as fast as possible.

After the scenario will be implemented a new analysis should be made, having in mind the analysis made during the first phase, so that the results offer the possibility to compare the two methods.

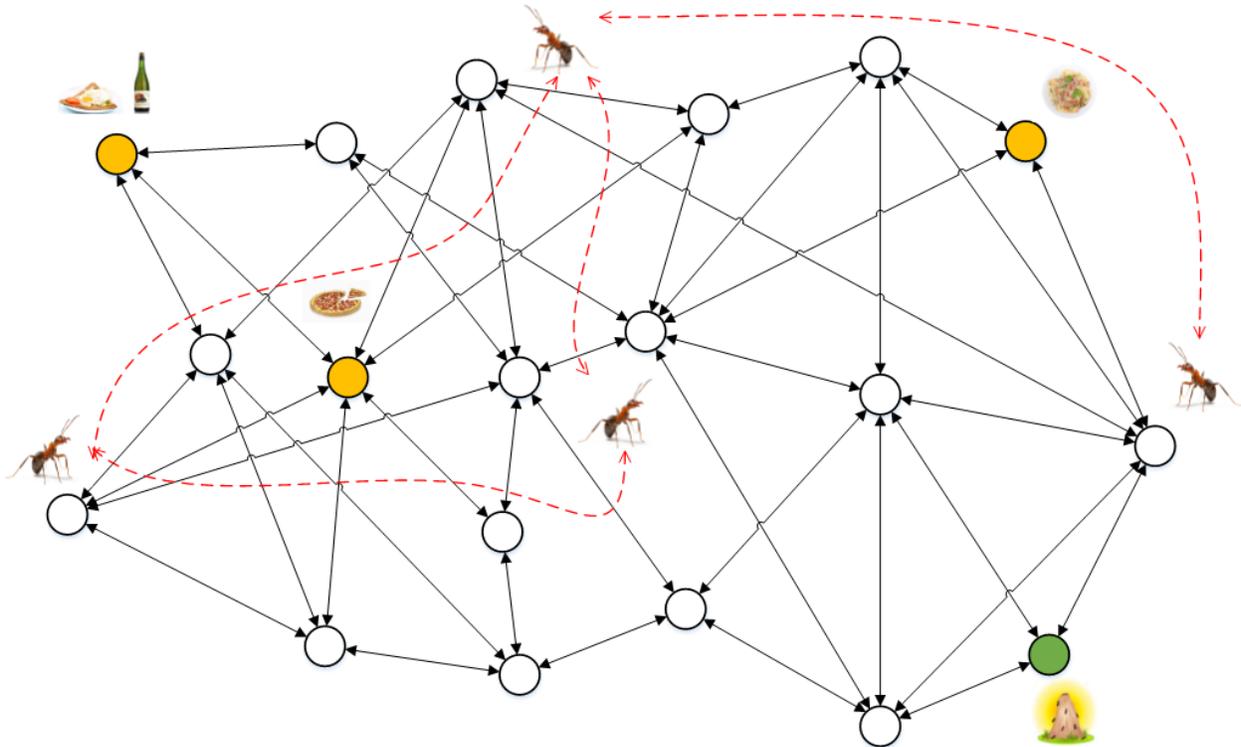


Fig. 1 Illustration of the new scenario, comprising coordination strategies and multiple food locations; The location containing the ant hill is green, the ones containing food are colored in yellow and the communication between the ants is illustrated using red dashed lines.

Homework (Phase 2 – a total of 10p)

- modify the implementation from Phase 1 in order to include more food locations and to use coordination strategies; (6p)
- analyze the behavior of the system with respect to the same aspects as the ones considered during the first phase (advice: while making the analysis have in mind the following requirement!); (2p)
- compare the two approaches, the one used in the first phase and the one that uses coordination strategies. (2p)

References

[1] Dorigo, M., Birattari, M., & Stutzle, T. (2006). Ant colony optimization. *Computational Intelligence Magazine, IEEE*, 1(4), 28-39.