

# Matlab 2017 – Ants Behavior

- **Group Name:** Mantlab
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- **Project Title:** Optimizing the efficiency in a network of multiple ant colonies

## General Introduction

Ant colonies have a very interesting practise to build food supply chains. Although a single ant itself has quite limited abilities, the colony as a whole can arrange itself in a very sophisticated network depending on the initial state of their environment. The interactions of the individuals lead to a more efficient solution for the colony by optimizing path lengths and choosing between a variety of food sources.

In our project, we would like to reproduce the behaviour of a single ant colony. Furthermore, we want to investigate how multiple ant colonies interact with each other. We are especially interested in the equilibrium state, towards which this system tends. And how the parameters shown in the section “the model” influence the efficiency of the network.

## The model

Our model is based on the paper “Trail Formation in Ants”. This Paper created models of the behaviour of a single ant. It defines the movement of every ant based on three ground rules:

1. On the way back from a food source the ant lays a trail of pheromones based on the quality of the visited food source.
2. On an intersection, the ant decides a path with the probability  $p_l$  or  $p_r$ . These probabilities depend on the amount of pheromones on each path.
3. The ant may make a U-turn and walk back to an intersection, if the path has little pheromones on it, or the ant is going in an unfavourable direction.

## Fundamental questions

- How can the productivity in a network be maximised?”, the productivity is defined as “total food brought back to all nests over time”.

We plan to find the solution to the first question by implementing a model, with the specifications outlined in the paper “Trail Formation in Ants” from the suggested project page and investigate the following parameters:

1. The quality of the food sources stays the same and the population sizes don't change
2. The ants are free to change colonies. But the quality of the sources stays the same
3. The quality of the sources changes so that the sources which are more popular become more desirable (if there are many ants going to a source the quality of that source will increase)
4. A combination of 2 and 3

## Expected results

Ants make the decision to follow a route based on the amount of pheromone on the trails. This causes trails with lots of traffic to continue growing. Therefore, we expect that large trails, which already have lots of traffic to grow even further.

## References

- Base project (Camazin2001, chapter13, Trail Formation in Ants)
- Michelin roadmap

- Biologically Inspired Model of the Swiss Railroad Network Depending on Population Growth Paper