Simulating Ant Colonies To Investigate How Worker/Scout Distributions Affect Colony Energy

Harry Howarth, Frazer Bennett-Wilford and Blayze Millward

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Abstract

Ant colonies have the unique ability to dynamically search the terrain surrounding their environments, detect and retrieve sources of food. This is an emergent behaviour that has been well well explored by a variety of past studies [1] often with a focus on examining the way that paths to and from food sources are created and organised. In reality, many species of ants have a number of different castes of ants within their ranks [2]. This study examines what affect different distributions of two castes of ants in particular – the *minor-* and *major-worker* ants – within a colony have on that colony's overall health when faced with differing conditions.

Ant colonies are simulated in Matlab on train that has been descritised into chunks, and food is spawned randomoly throughout the terrain. Ant colonies with differing ratios of simulated minor and major worker ants are created, and their success – as measured by [MEASUREMENT HERE].We found that [FINDINGS HERE] These findings indicate that [INSIGHT INTO ANTS HERE], indicating that a mix of major and minor workers is the most suitable – with the minor workers excelling at [SOMETHING?] while the major workers [DO SOMETHING ELSE], as seen in nature [CITE THIS ACTUALLY HAPPENING - Or, I guess don't if it doesn't really happen and just state that our model was wrong.]

1 Introduction and Background

Ants are *eusocial* creatures, meaning that they possess the highest level of organisation that any social species of animal can possess[?, ?]. Behaviour allows them to perform incredible feats as a whole, even when individually each ant has very little actuation over it's environment. One such example of this is an ant colony's ability to forage for food from its surrounding area, while avoiding obstacles and successfully navigating changes in its environment. This ability in itself has been examined a significant amount in past research[3, ?], and has even lead to algorithmic methods inspired by the behaviour being developed to solve problems faced in areas of computer science, such as those similar to the *travelling salesmant problem*[?, ?].

Another characteristic of eusocial creatures – and the focus of our own investigation – is the separation of groups within the colony into differing *castes* that exhibit specialized behaviour, making them more fit for certain types of jobs over others of their colony[?]. Ants in particular are often divided into up to four differing casts: Queens, Minor Workers (Workers), Major Workers (Soldiers) and Drones[?, ?]. Minor workers typically make up [SOME NUMBER]% of the colony, whereas major works usually make up less, often [THE OTHER NUMBER]% of the colony. Our experiment is interested in the area of finding the ratio of minor to major woker ants that has the most positive impact on an ant colony's ability to thrive within a changing environment.

A number of past studies have examined the way that ant colonies search their surrounding areas to locate and retrieve food [3, ?]. Often the these studies focus on simulating ant colonies to apply the emergent behaviour that they exhibit to solve abstracted technical problems [?, ?], with a smaller number of past works focusing on simulating ant colony behaviour as it is seen in nature [3]

The 2004 work by Vittori et al[3] examined the way that ants navigated their environment, using trails of depositied pheromones which attracted other ants. This work in particular was of interest to us, as it evaluated the results of the model by comparing them to real ants in a number of experiments.

Whereas this [?] introduces the concept of a dual-pheromone system, where one set of pheromone leads away, one toward

[?] discusses the benefits of simulating the ant's return path using pheromones or simply having the ants return directly

TODO: Cite one other thing here, giving it another piece of information

These pieces of information inspired us to do stuff like the other stuff

2 Methodology

3 Results

4 Discussion

5 Conclusions

References

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