Swarming behaviour in predator-prey model

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Collective behaviour course research seminar report

This is a sample abstract.

Simulation | swarming behaviour | predator | prey

The sudden emergence of swarming behaviours in animals is one of the most striking examples of collective animal behaviour. These behaviours have been extensively studied for their implications for the evolution of cooperation, social cognition and predator–prey dynamics[1]. Swarming, which appears in many different species like starlings, herrings, and locusts, has been linked to several benefits including enhanced foraging efficiency, improved mating success, and distributed problem-solving abilities. Furthermore they are hypothesized to help with improving group vigilance, reducing the chance of being encountered by predators, diluting an individual's risk of being attacked, enabling an active defence against predators and reducing predator attack efficiency by confusing the predator. [2].

In this project we will be taking inspiration from the work of Li et al. (2023) and Olson et al. (2013) to explore how survival pressures can drive the emergence of swarming behaviour. The first goal will be to create a realistic simulation where both prey and predators learn to adapt through reinforcement learning based on their drive to survive. Modeling these interactions, we will observe how simple survival pressures can lead to evolution of more complex behaviours like flocking, swirling and edge predation.

Then, we will extend our research by evolving out existing model by introducing new environmental obstacles and new species to observe how interspecies interactions lead to new survival strategies.

Related work

Methods

Results

Even though we currently don't have any results, we can outline what we anticipate to achieve. One of the results will be a simple model that is a recreation of Li et al. (2023) model in python. It is expected to model the development of swarming behaviours. We have already extracted their code and have successful ran it. We intend to compare our results with the article.

After that, we will build upon our existing model by adding new obstacles and interspecies interactions.

Discussion

CONTRIBUTIONS. AK did introduction and expected results, TB will do that, VL will do this and that.

1. Olson RS, Hintze A, Dyer FC, Knoester DB, Adami C (2013) Predator confusion is sufficient to evolve swarming behaviour. *Journal of The Royal Society Interface* 10(85):20130305.

2. Li J, Li L, Zhao S (2023) Predator–prey survival pressure is sufficient to evolve swarming behaviors. *New Journal of Physics* 25(9):092001.