Evolving Shepherding Behavior with a Genetic Programming Algorithm

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Abstract

1 Introduction

2 Related Work

While flocking is a popular topic, algorithms for shepherding are less well-studied, and to the best of our knowledge no existing work attempts to evolve such an algorithm with Genetic Programming. Existing approaches to sheparding train a predictive model as in[2], or employ predefined strategies which may be combined to acheive a goal [1].

(Lien et. al, 2005) studies shepherding behavior in an environment with multiple shepherds cooperating to control a flock [**?**]. Shepherds, which exert a repulsive force on the flock, must find *steering points* to influence the direction of the flock as desired. The steering points for the group of shepherds form either a line or an arc on a side of the flock, and each shepard chooses a steering point to approach based on one of several proposed heuristics.

(Sumpter, et. al, 1998) presents a machine vision system that models the position and velocity of a flock of animals [2]. A Point Distribution Mode is used to generate features based on input from a camera mounted on a

"Robotic Sheepdog," and these features are then used to estimate a probability distribution of the movement of the flock over time, conditional on its previous locations and velocities. This probability distribution is estimated using competitive learning in a neural network. Finally, the robot can herd a flock of animals toward a goal by a maximum likelihood estimate of the robot's own path.

(Bennet and Trafankowski, 2012) provides an analysis of flocking and herding algorithms, and also introduces a herding algorithm based on specific strategies inspired by real sheepdogs[1]. [1] also considers using one of several flocking strategies for the animals being herded, and finds that the success of different a herding algorithm is often dependent on the flocking behavior.

(Cowling and Gmeinwieser, 2010) uses a combined top-down and bottom-up approach to provide realistic sheep herding in the context of a game. A finite state machine associated with each sheepdog represents possible herding strategies, such as circling, and the state of the FSM is controlled at the top level by an AI "shepherd" [3].

3 Results

4 Discussion

References

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