Interpreting Intentions in Coordinated Tasks

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Problem Overview

Coordinating teams of agents is a common problem in multiagent domains. It is hard to learn how to complete tasks that require the collaborative efforts of multiple robots doing the right thing at the right time. The goal of this research is to incorporate predictions of agent’s future intentions into the decision making process. Intuitively, knowing what others are planning on doing will help agents chose more optimal actions.

Methods

We used a simulated domain in which agents pick up Points of Interest in pairs and return them to a home base.

Populations of agent policies are evolved using the cooperative coevolutionary algorithm (CCEA).

How to incorporate intent?

- Predict other agent locations in X time steps
- Alter agent state representations: If others are closer to a POI, it is less important
- Use altered state to select an action in the present

Results

The number of worlds completed in a given generation indicate how each of the learning algorithms perform over time. As shown in previous research [1], incorporating intent into agent decisions results in more worlds completed (Figure 1) than non-predictive domains. Looking 3 and 5 steps into the future shows a further marginal increase in success compared to single-step lookahead (Figure 2). However, when scaled over the first 10,000 calls to the intent function, 3 and 5 step lookaheads perform worse than single-step. They also perform worse than no-lookahead D rewards (Figure 3).

Conclusion

Projecting intentions further into the future generally improves a system’s ability to learn. A mathematical model of predicted agent intentions can be applied to increase net success in highly coordinated tasks. However, this projection comes at a high computational cost. Future work should examine balancing cost and utility by determining effective methods for intent approximation. It would also be useful to examine prediction when communication and visibility are imperfect.

References


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