Investigating the Impact of Environmental Features on Multi-Agent Communication

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Research Question

In what ways do the features of a multi-agent environment influence the communication protocols learned by reinforcement learning?

Motivation

- Previous research has demonstrated emergent communication protocols between multiple agents using deep reinforcement learning
- Deep neural networks can be hard to analyze, and have been known to use erroneous features in classification tasks
- Hence, there is a need to understand what features are used by the agents to decide communication protocols

Testbed Description
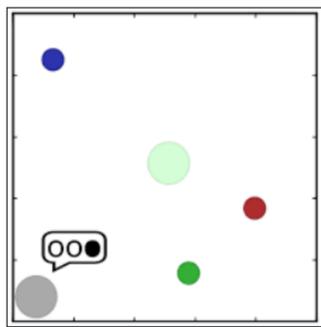
Testbed Diagram

- There are two agents, a talker agent (grey here) and a mover agent (green here)
- The mover agent needs to go to its target landmark, but does not know what it is
- The talker agent can observe only the target landmark color, and must learn to communicate it to the mover agent

Algorithm Description

- A multi-agent actor critic method is used in this project. While training, all agents have access to all other agents' policies and observations. This method did not assume a differentiable model of the environment, unlike other references

Results

- Initially, the talker agent is able to observe the color of the target landmark, and the mover agent is able to observe the landmark positions, but not their colors. Hence, it is unable to understand the messages sent by the talker
- After modifying the environment, the mover agent is also able to observe the colors of the landmarks. This enables the mover agent to interpret the messages sent by the talker agent and reach its intended destination
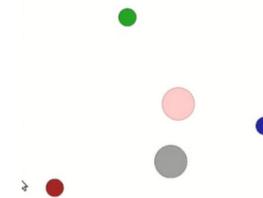
Mover agent (red) in the initial environment
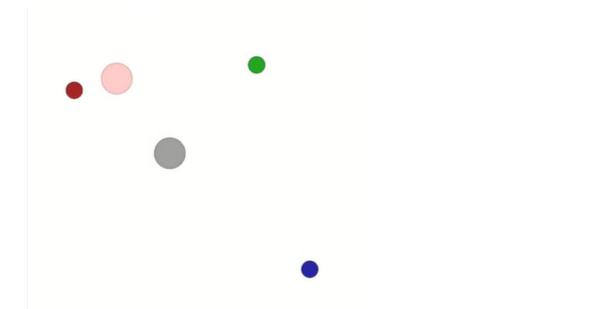
Mover agent (red) in the modified environment

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References

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