

# Achieving Cooperative Foraging Task by Local Communication for Robotic Swarm

ローカルコミュニケーションを適用した  
ロボティック スワームの群れ採餌行動達成

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## 【Introduction】

Swarm Robotics is the study of a large group of autonomous robots that emerges collective behavior without any global information. Since robots in a swarm robotic system have limited local sensory information, sharing crucial information with other robots to enlarge the range of exploration is more efficient than exploring individually. However, information sharing among robots in a robotic swarm is also a huge challenge. To solve this problem, we applied a communication model to a robotic swarm. By the help of deep reinforcement learning, the policy is trained to develop an appropriate adaptive behavior.

## 【Experiments Settings】

The goal of this thesis is to achieve the cooperative foraging task when the sensory range of robots in a swarm is limited. In our experiment, we achieve a local communication for robotic swarm by an additional detectable intermedium state and local group reward. Soft Actor-Critic(SAC) is the baseline algorithm applied in our experiment. We evaluate our method by evaluating the performance between the baseline and communication model in the different sensory ranges.

## 【Results】

The box plot in Fig.2 shows the performance in different sensing range of normal sensors of 400 episodes in terms of mean reward, averaged over all agents and timesteps. We evaluate SAC baseline and SAC with communication by running 20 times for each detection range. As shown in Fig.2, SAC with communication largely outperforms the baseline, especially in the situation when the detection range becomes smaller. With the help of the SAC algorithm and communication model, the robotic swarm generates cooperative behavior and finishes the task even though in a small sensory range.

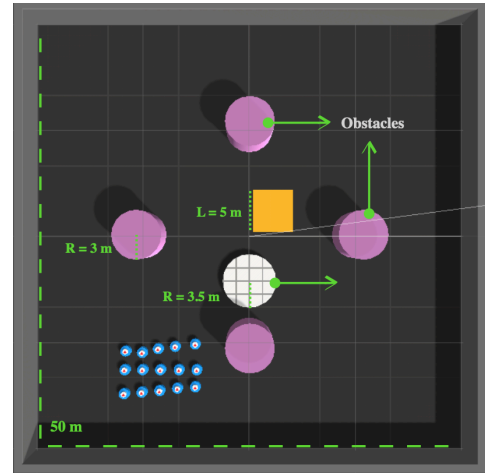


Fig. 1. The design of the environment.

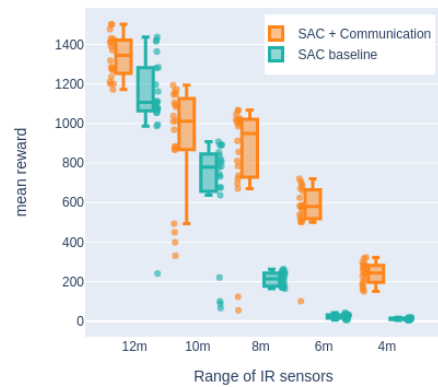


Fig. 2. Result