Abstract of Master Thesis 2020

Deep Neuroevolution in Collective Transport with Swarm Robotics System

Deep Neuroevolution を適用した

ロボティック スワームの群れ採餌行動生成

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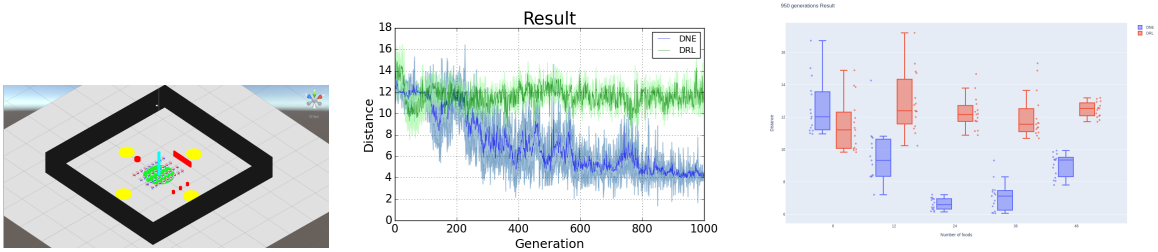
【Background and Motivation】

Swarm Robotics Systems(SRS) are a type of multi-robot systems, consisting of large number of autonomous robots. Deep Neural Networks(DNNs) gain popularity in many applications. It solves many classical problems when combined with reinforcement learning, recognized as Deep Reinforcement Learning(DRL). DRL performs poor on the problem where the object function has much local optimum. To solve this problem, Deep Neuroevolution(DNE) which combines Evolutionary Computation with DNNs is utilized. In this research, DNE is implemented on the SRS, and compared its performance with the results of DRL.

【Experimental Settings】

The goal of this research is to train the SRS to cooperate with each other to push all the foods into the nest area within limited time steps while avoiding obstacles in the scene of Fig. 1(a). In experiment(i), the performance of DNE and DRL are compared under 2 different reward settings. In experiment(ii), the flexibility and scalability are examined in more complicated tasks.



(a) Experimental environment　**(b)** Change of distance during training process　**(c)** Compare of distance under different numbers of agents

Fig. 1. Experimental field and results

【Results】

Computer simulation results show that DNE has the ability of generating collective transport behavior for SRS with high dimensional image inputs in the 2 reward settings. DNE is promised to be robust to the reward setting, and more competent to process the high-dimensional image inputs. Besides, DNE can complete complicated tasks which DRL cannot achieve, and remain stable performance than DRL with various quantities of the agents.