Robotics and Embedded Systems

Human Brain Project

Master/Bachelor Thesis

Meta Reinforcement Learning in Dynamic Environment

Background

Unlike humans that are able to learn new skills quickly from very few examples, artificial agents are usually trained with great amount of experience and still not able to adapt to different tasks easily. The concept of meta reinforcement learning (meta-RL) has been recently proposed to enable agents to learn similar but new skills from small amounts of experience by leveraging a set of tasks with a shared structure. The most recent work, PEARL [1], utilized a variational auto-encoder (VAE) for task representation learning in combination with soft actor-critic (SAC) for policy learning, which achieves higher sample efficiency and asymptotic performance than previous work, such as recurrence-based and gradient-based methods. However, due to the task representation learning strategy with few-shot adaptation, it is limited to narrow task distributions and stationary environments, where tasks do not change within episodes.

Your Tasks

In this thesis, you will develop meta-RL algorithms that try to solve tasks in dynamic environment, where the standard Markov Decision Process does not apply, such as a change of the reward function, the parameters of the dynamic model of the environment, or even the task itself. To be specific:

1. You will learn knowledge about RL and meta-RL.
2. You will work on the basis of our current algorithm and further improve the algorithm or develop a novel algorithm.

Requirement

- High self-motivation and passion on research.
- Six month working time.
- Existing knowledge about RL or meta-RL will be a bonu

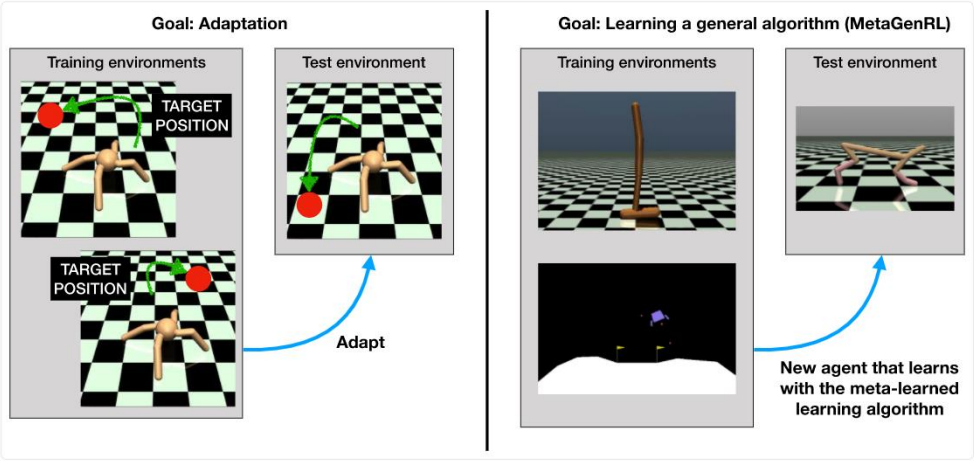

Figure 1 Example of the task setting in meta-RL [2].

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[1] *Efficient Off-Policy Meta-Reinforcement Learning via Probabilistic Context Variables.* https://arxiv.org/abs/1903.08254
[2] *Improving Generalization in Meta Reinforcement Learning using Learned Objectives.* https://arxiv.org/abs/1910.04098