Intrinsically Motivated Deep Reinforcement Learning

Description

Psychologists distinguish between extrinsic motivation, which means being moved to do something because of some specific rewarding outcome, and intrinsic motivation (IM), which refers to being moved to do something because it is inherently enjoyable[2]. Though extrinsic motivation helps in simple use cases where external reward signals are reliable, IM becomes important when RL agents have to learn in the absence of explicit reward. IM helps the agent to engage in exploration, play, and other behavior driven by curiosity.

Figure 1: Schematic of Deep RL with intrinsically motivated auxiliary rewards.

In this project, we will solve reinforcement learning problems under extreme sparse rewards or non-existing rewards (e.g., Vizdoom) by designing an Intrinsic Curiosity Model (ICM). We will use a Kalman filter inspired recurrent latent dynamics model to design the intrinsic curiosity module based on a hybrid forward and inverse dynamics learning architecture.

Figure 2: Examples for sparse reward tasks (Vizdoom, Robot clean up task and Super Mario).

Tasks

The tasks in this project will include:

- Experimental Setup: Choosing, understanding and setting up an extreme sparse / no reward environment where curiosity driven exploration is required.
- Design ICM: Design a Curiosity Driven Module in the latent space.
- Evaluation: Evaluate the performance of these probabilistic ICMs on the sparse reward environments.

References
