

IERG6130

Course Project Overview

Bolei Zhou

The Chinese University of Hong Kong

Overview

- 2 students work in a group, on a RL-relevant project
- Deliverables:
 - Project proposal (by the end of week 3)
 - Mid-term presentation (week 8)
 - Github repo containing your work (commits, readme, polished code)
 - Course report (in NIPS LaTex Template)
 - Final presentation (week 14)

Guideline

- Be creative
- Start with something small
- Take into consideration of your resources:
In-house GPUs, CPUs, AWS?

Goal

Gain a deep knowledge about
reinforcement learning



More Challenging Goal

Able to submit the work to a
top conference

Project Proposal

- Project proposal due: by the end of **Jan. 22, 2019**
- Proposal update due: by the end of **Feb. 9, 2019**

Key elements:

- Identify the problem and why it is interesting
- Which environment you will use, which RL agent you think might work
- Key reference or most relevant work
- 2-page proposal in Latex Template:
[https://github.com/cuhkrlcourse/RLexample/tree/master/project template](https://github.com/cuhkrlcourse/RLexample/tree/master/project_template)
- Email to: cuhkrlcourse@googlegroups.com, with title: 2020spring-proposal-withyourname

Project Proposal Structure

- Problem Definition
- Related Work
- Environment and Data
- Proposed Approach
- Possible Experiments
- *Some Initial Results

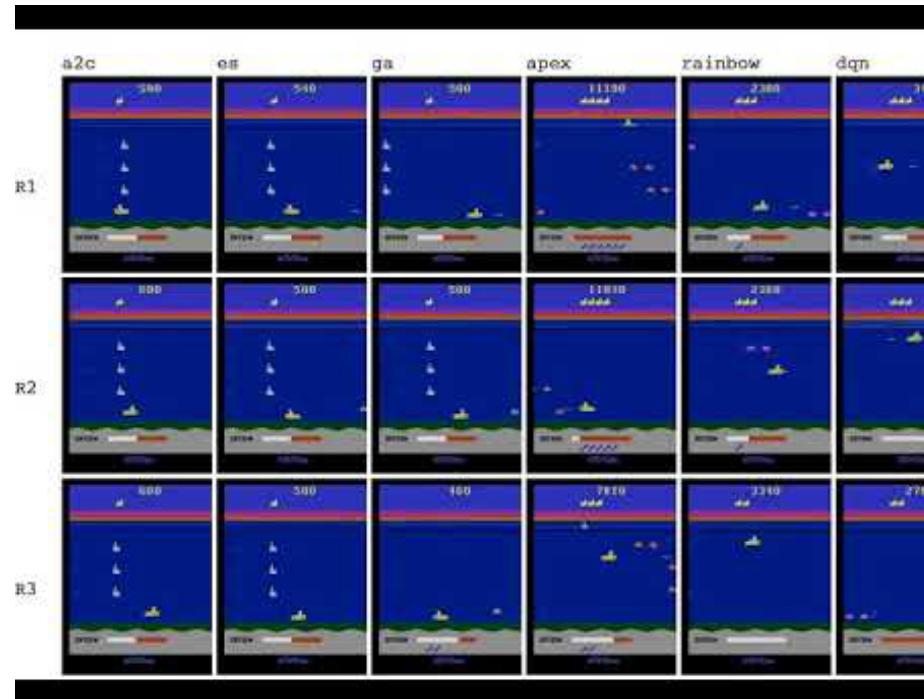
Transfer learning in RL: To build a generalist agent

- Many different games are there
- Learning from scratch for every game is time-consuming.
- How to reuse the weights or knowledge for different games



Interpretability of the RL models

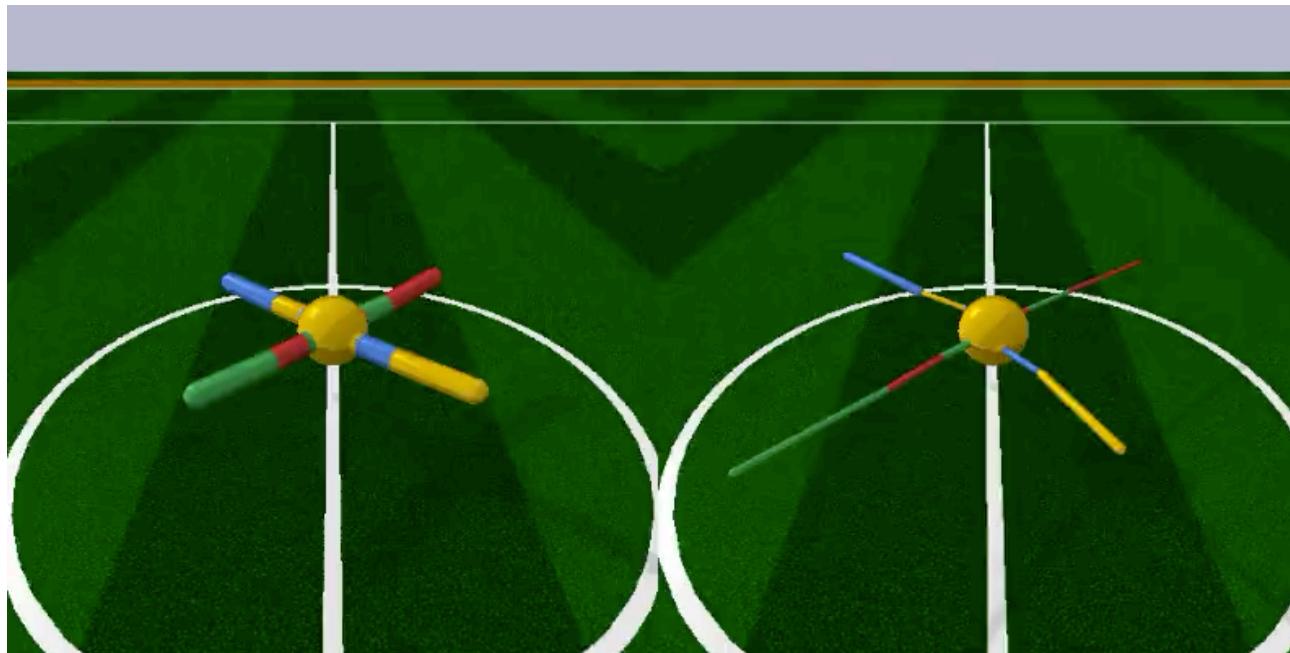
- How to visualize, understand and interpret the learned RL models
- How to analyze and compare the pretrained models?



<https://eng.uber.com/atari-zoo-deep-reinforcement-learning/>

Improving the agent design

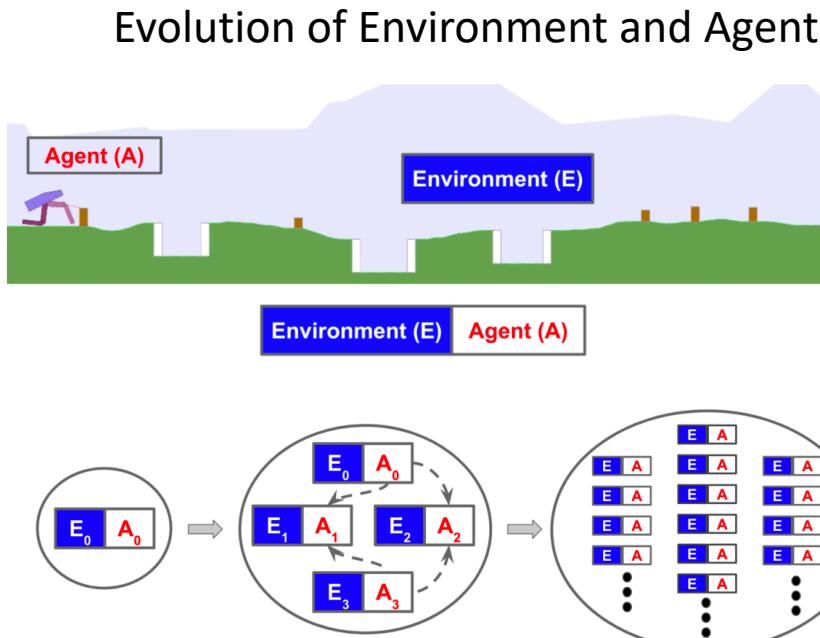
- Usually learnable parameters are the policy and value networks of the agent, but how about the design of the agent?



<https://designrl.github.io/>

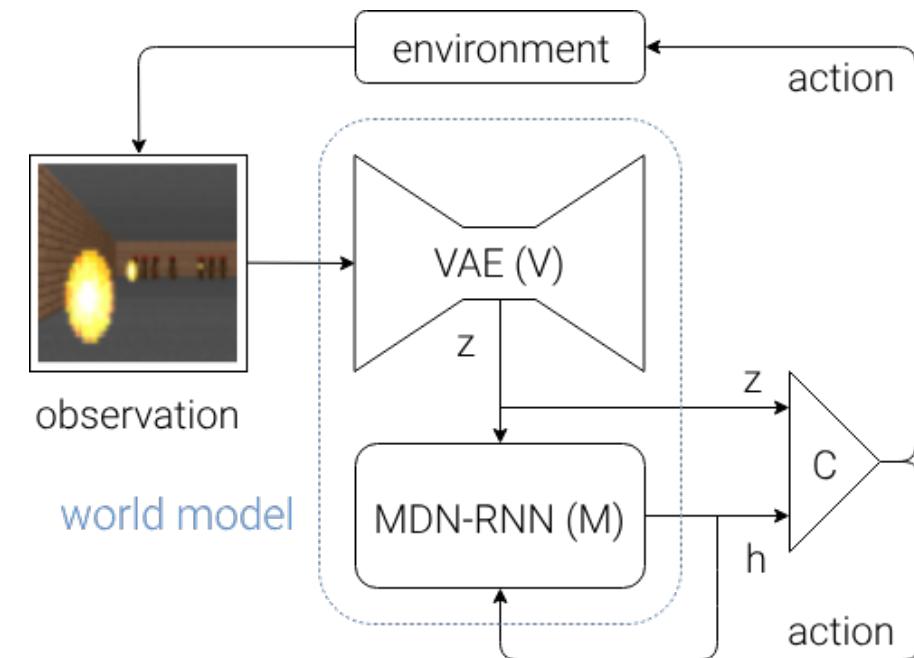
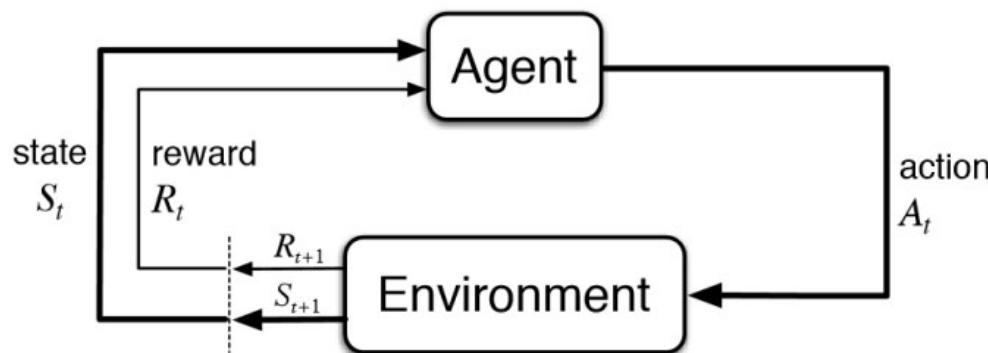
Co-evolution of agent and environment

- Open-Ended Learning: The environment is dynamically changing.



Building a World Model

- Learning a Recursive neural network (RNN) on the environment itself, then the agent will interact with RNN instead of the environment.

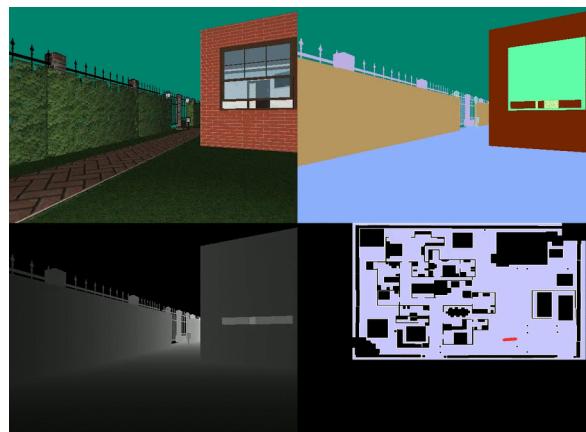


<https://worldmodels.github.io/>

Learning to Navigate

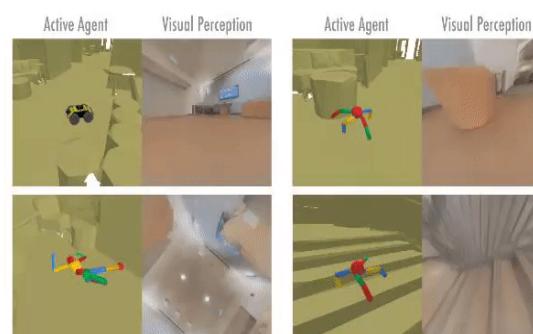
- Many first-view navigation environments

Facebook House3D



<https://github.com/facebookresearch/House3D>

Stanford Gibson



Real-World Perception for Physically Active Agents

<http://gibsonenv.stanford.edu/>

DeepMind Lab



<https://github.com/deepmind/lab>

AI2THOR



<https://ai2thor.allenai.org/>

Learning to Drive

- Carla environment: <http://carla.org/>



Multi-Agent Reinforcement Learning

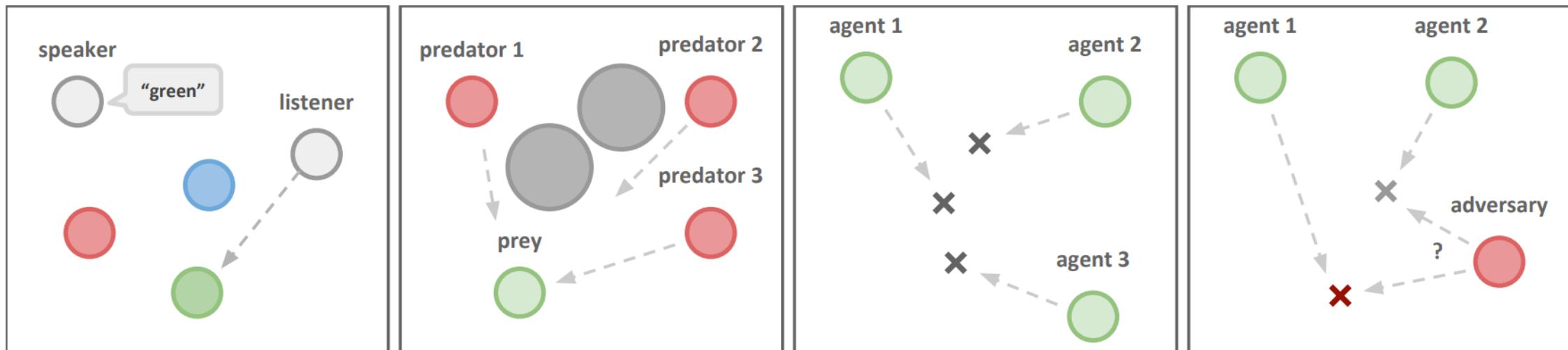


Figure 2: Illustrations of the experimental environment and some tasks we consider, including a) *Cooperative Communication* b) *Predator-Prey* c) *Cooperative Navigation* d) *Physical Deception*. See webpage for videos of all experimental results.

<https://github.com/openai/multiagent-particle-envs>

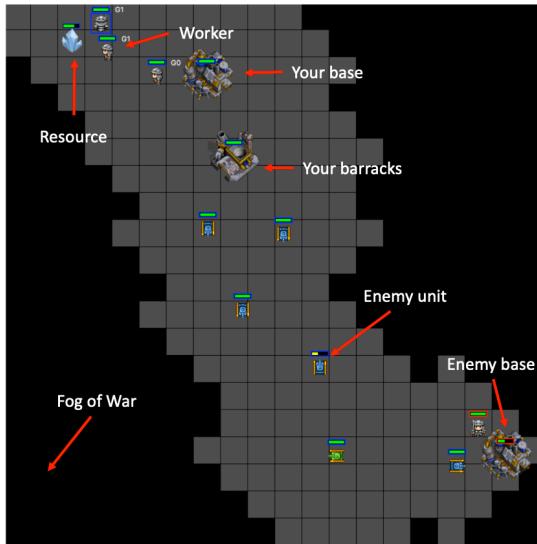
<https://github.com/LantaoYu/MARL-Papers>

<https://arxiv.org/pdf/1706.02275.pdf>

Reinforcement Learning Experimental Platform

- ELF: An Extensive, Lightweight and Flexible Research Platform for Real-time Strategy Games

MiniRTS: A miniature RTS engine



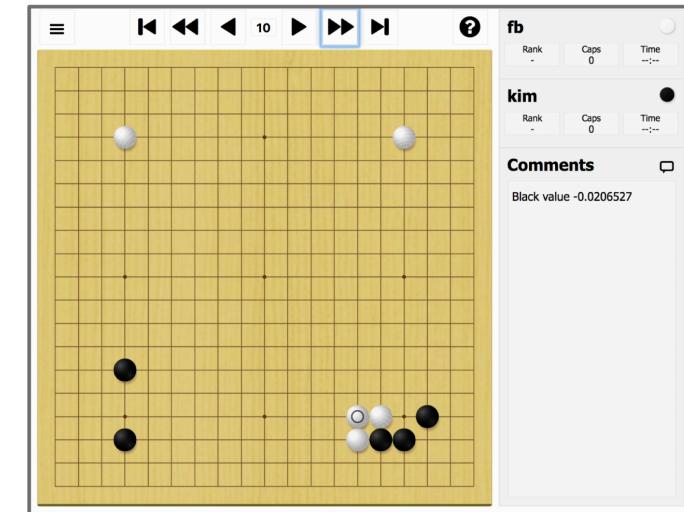
Platform	Frame per second
ALE	6,000
Open AI Universe	60
Malmo	120
DeepMind Lab	287*/866**
VizDoom	7,000
TorchCraft	2,000
MiniRTS	40,000

* Using CPU only

** Using CPUs and GPU



ELF OpenGo: AlphaGo open sourced



<http://yuandong-tian.com/elf-tutorial/tutorial.html>

<https://github.com/facebookresearch/ELF>

Where to get the project ideas

- Your own project!
- OpenAI blog: <https://blog.openai.com/>
- OpenAI fellow project summary: <https://blog.openai.com/openai-summer-fellows-2018/>
- DeepMind blog: <https://deepmind.com/blog/>
- Uber AI blog: <https://eng.uber.com/>
- Facebook AI Research:
- Many great researchers:
 - David Ha: <http://blog.otoro.net/>

Educational Tool of RL

<https://blog.openai.com/spinning-up-in-deep-rl/>



We're releasing Spinning Up in Deep RL, an educational resource designed to let anyone learn to become a skilled practitioner in deep reinforcement learning. Spinning Up consists of crystal-clear examples of RL code, educational exercises, documentation, and tutorials.

Previous year's course projects

<https://course.ie.cuhk.edu.hk/~ierg6130/2019/project.html>