Learning to Play Atari Games

Jule Schatz
Outline

- Motivation
  - Intuition behind the idea
- Previous Research
- Rough New Idea
Learning a New Video Game
Learning a New Video Game
Learning a New Video Game
Learning a New Video Game

Door

You

Key
The Knowledge We Use On a “New” Game

- Physics

VS

[Diagram with a strawberry and a blue circle]
The Knowledge We Use On a “New” Game

- Physics

- Semantics
“Investigating Human Priors For Playing Video Games”
Dubey et al. 2018
Blue - Average time to solve in minutes

Orange - Average number of deaths

Yellow - Average number of states
Reinforcement Learning

“Exploration By Random Network Distillation” Burda, Edwards, Storkey, Klimov (October 2018) Open AI

- 1.97 Billion frames of experience


- 17,949 expert transitions provided for five episodes
- Score of 34,900

<table>
<thead>
<tr>
<th></th>
<th>Montezuma’s Revenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>RND</td>
<td>8,152</td>
</tr>
<tr>
<td>Avg. Human</td>
<td>4,753</td>
</tr>
</tbody>
</table>
Reinforcement Learning

“Exploration By Random Network Distillation” Burda, Edwards, Storkey, Klimov (October 2018) Open AI

- 1.97 Billion frames of experience


- 17,949 expert transitions provided for five episodes
- Score of 34,900
Can we speed up the learning by taking advantage of human priors?
Research Plan - Using knowledge to speed learning

1. Create environment for a Soar agent to explore
2. Create a reinforcement learning Soar agent
3. Create a smarter Soar agent
   a. Uses interactive task learning
   b. Uses semantic memory
   c. Uses reinforcement learning
Research Plan - Using knowledge to speed learning

1. Create environment for a Soar agent to explore
2. Create a reinforcement learning Soar agent
3. Create a smarter Soar agent
   a. Uses interactive task learning
   b. Uses semantic memory
   c. Uses reinforcement learning
Repurposing Tank Soar

Actions
- Move Left
- Move Right
- Move Forward
- Move Backward

State
- Number of Missiles
- X coordinate
- Y coordinate

“door”
“key”

You
A Smarter Agent (rough idea)
A Smarter Agent (rough idea)

- “The goal is to get through the door”
- “How do I get through the door?”

Saves time of figuring out where the reward is.
A Smarter Agent (rough idea)

- “The goal is to get through the door”
- “How do I get through the door?”
- “To get through the door you need to unlock the door”
A Smarter Agent (rough idea)

- “The goal is to get through the door”
- “How do I get through the door?”
- “To get through the door you need to unlock the door”
- Retrieves the concept unlock from semantic memory “Where can I get a key to unlock the door?”
- “To get the key, pick up the missiles”

Saves time of figuring out where the reward is.

Doesn’t need to be taught what unlocking means.
A Smarter Agent (rough idea)

- “The goal is to get through the door”  
  Saves time of figuring out where the reward is
- “How do I get through the door?”
- “To get through the door you need to unlock the door”  
  Doesn’t need to be taught what unlocking means.
- Retrieves the concept unlock from semantic memory “Where can I get a key to unlock the door?”  
- “To get the key, pick up the missles”  
  Has a general idea of how to play the game that isn’t dependent on the current map.
Can we speed up the learning of Atari like games by using semantic knowledge and interactive task learning?

Questions or Comments?