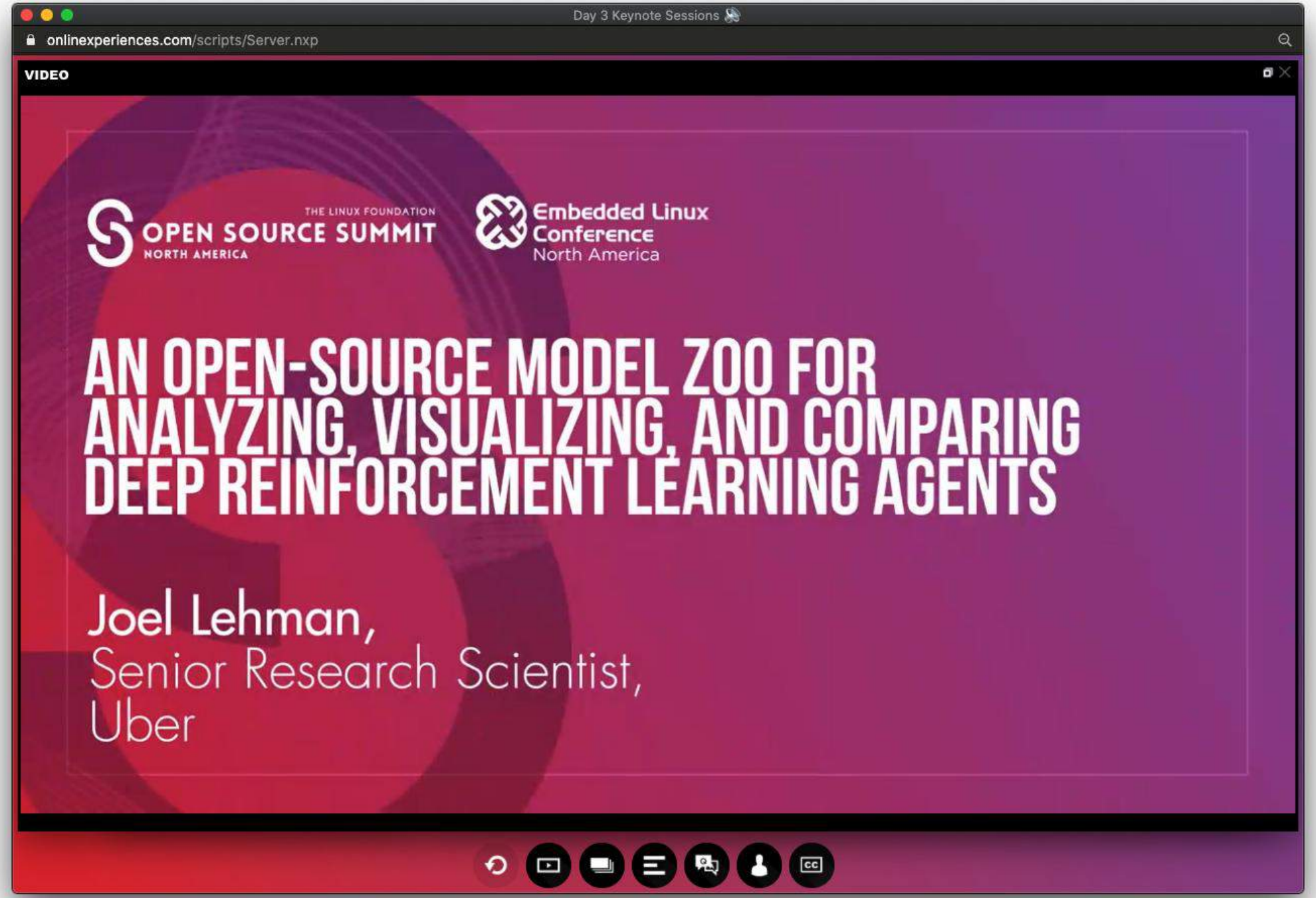
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THE LINUX FOUNDATION
OPEN SOURCE SUMMIT
NORTH AMERICA
Embedded Linux
Conference
North America
AN OPEN-SOURCE MODEL ZOO FOR ANALYZING, VISUALIZING, AND COMPARING DEEP REINFORCEMENT LEARNING AGENTS
Joel Lehman,
Senior Research Scientist,
Uber
CC

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Make it easier to research the *behavior* of reinforcement learning agents produced by different algorithms

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An Open-Source Model Zoo for Analyzing, Visualizing, and Comparing **Deep Reinforcement Learning** Agents

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An Open-Source (Atari) Model Zoo for Analyzing, Visualizing, and Comparing Deep Reinforcement Learning Agents

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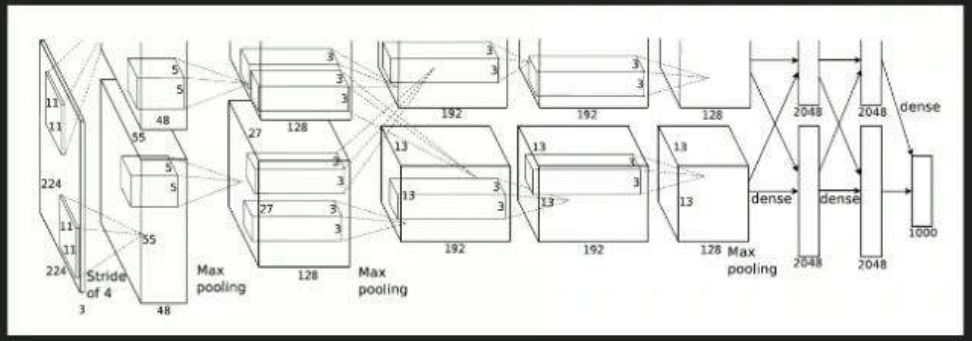
An Open-Source **Model Zoo** for Analyzing, Visualizing, and Comparing Deep Reinforcement Learning Agents



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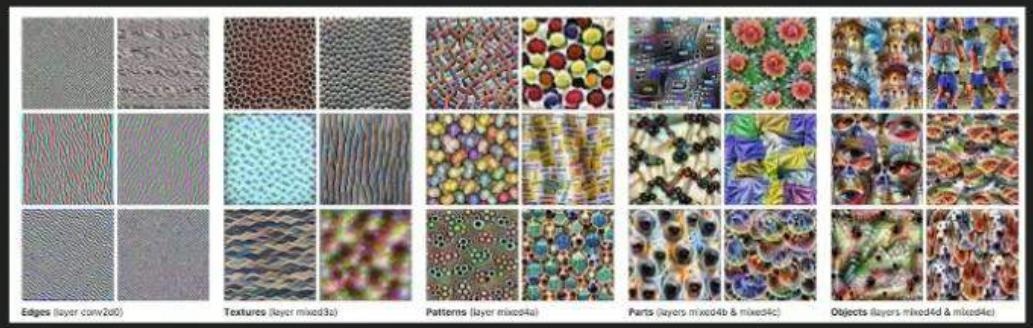
An Open-Source Model Zoo for **Analyzing, Visualizing, and Comparing** Deep Reinforcement Learning Agents



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Reinforcement Learning

Learning from Rewards

1

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Reinforcement Learning

Learning from Rewards

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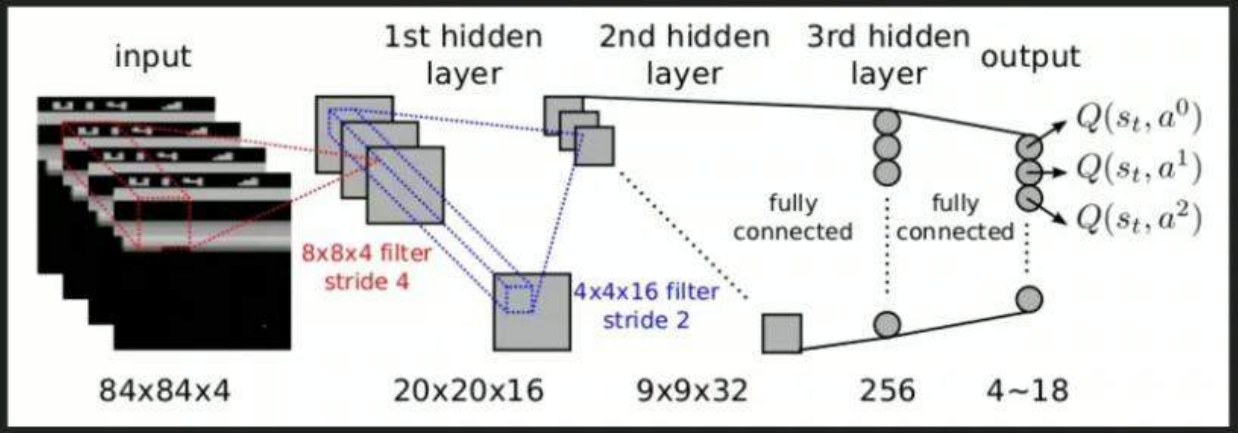
Deep Reinforcement Learning



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Deep Reinforcement Learning

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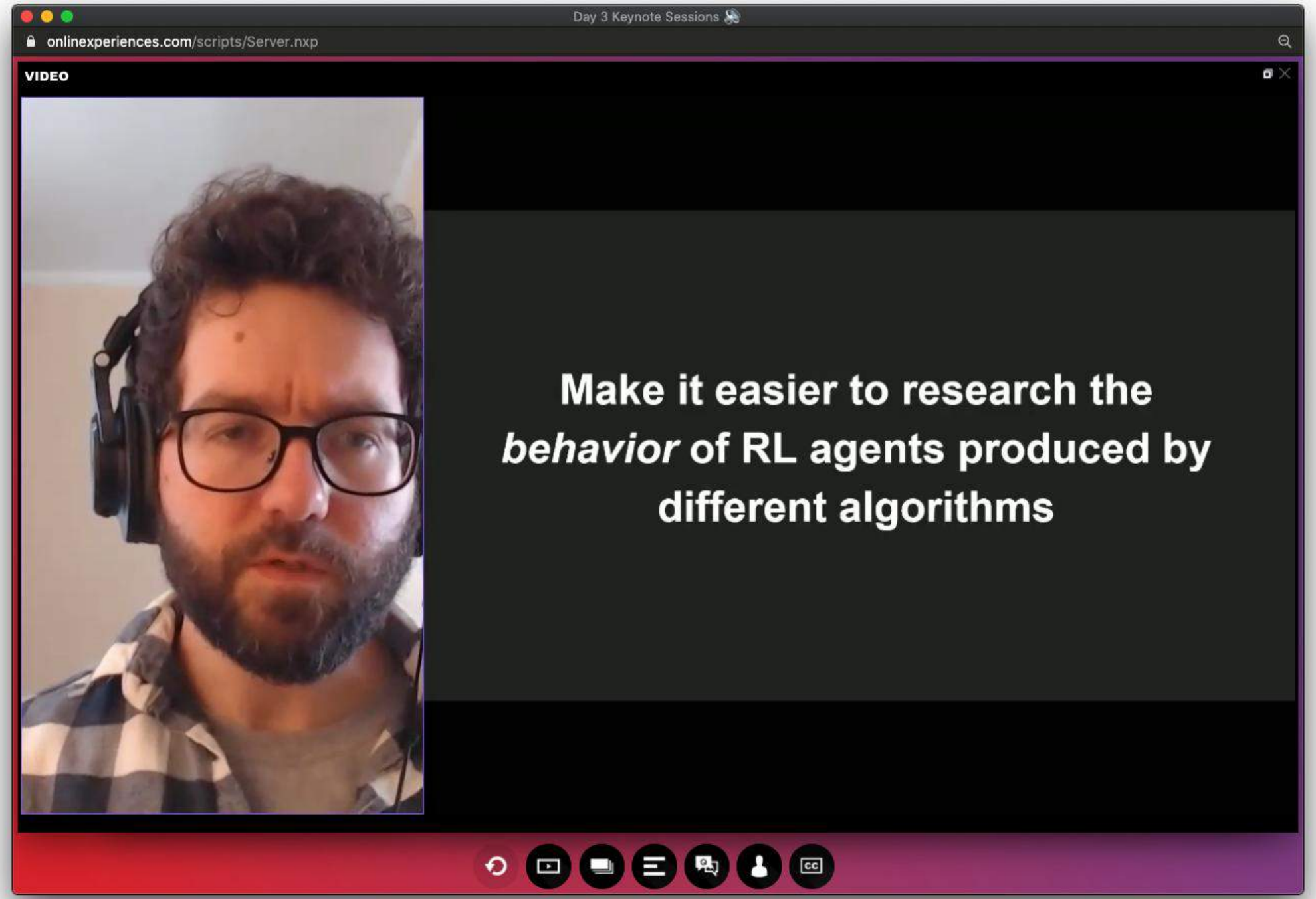
Deep Reinforcement Learning

- **Lots of potential**
- But…
  - Important in some tasks to *understand* what an agent is doing
- Just as *explainable AI* is important for supervised learning, it is also important for reinforcement learning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Make it easier to research the
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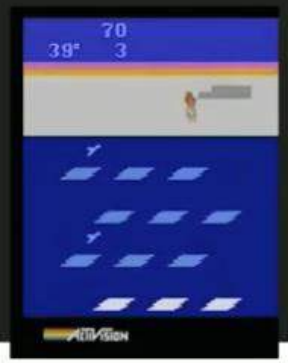

Deep Neuroevolution: Genetic Algorithms are a Competitive Alternative for Training Deep Neural Networks for Reinforcement Learning

Felipe Petroski Such Vashisht Madhavan Edoardo Conti Joel Lehman Kenneth O. Stanley Jeff Clune
Uber AI Labs
{felipe.such, jeffclune}@uber.com

2018

Abstract

1. Introduction

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Workflow to Analyze Agents (without Model Zoo)

Download/configure training environment	Download/configure training code	Get training code to run
Integrate training code with distributed compute system	Run at scale (much computation)	Gather trained network files
Figure out how to load in trained network	Code/integrate standard post-hoc analysis method	Execute analysis

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With model zoo

In [15]:

```
#load model
m = MakeAtariModel("a2c","SeaquestNoFrameskip-v4",1,"final")()

#grab frames and high-level neural representations
frames = m.get_frames()
rep = m.get_representation()

imshow(frames[10])
figure()
plot(rep[10])
```

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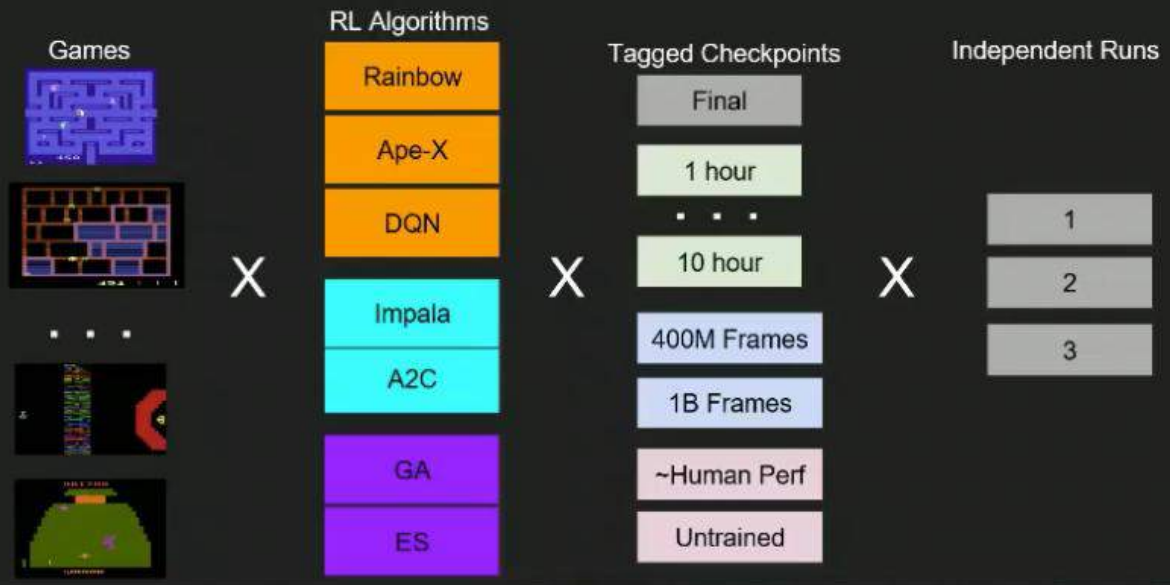
An Atari Model Zoo: Lots of Trained Models



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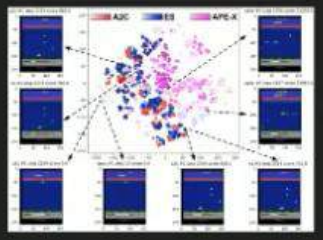
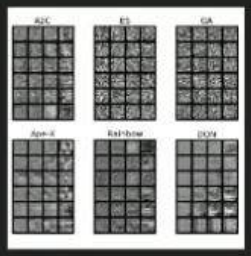
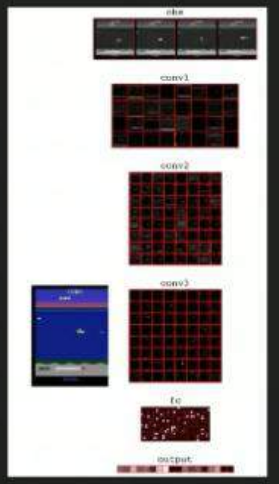
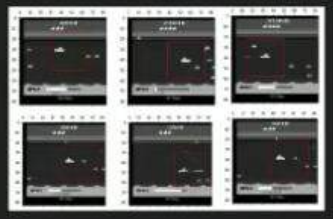
Accompanying Software

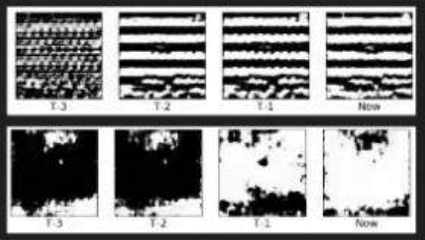
- Code: http://t.uber.com/atarizoo











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Build on / use two previous libraries

https://github.com/tensorflow/lucid

https://github.com/google/dopamine

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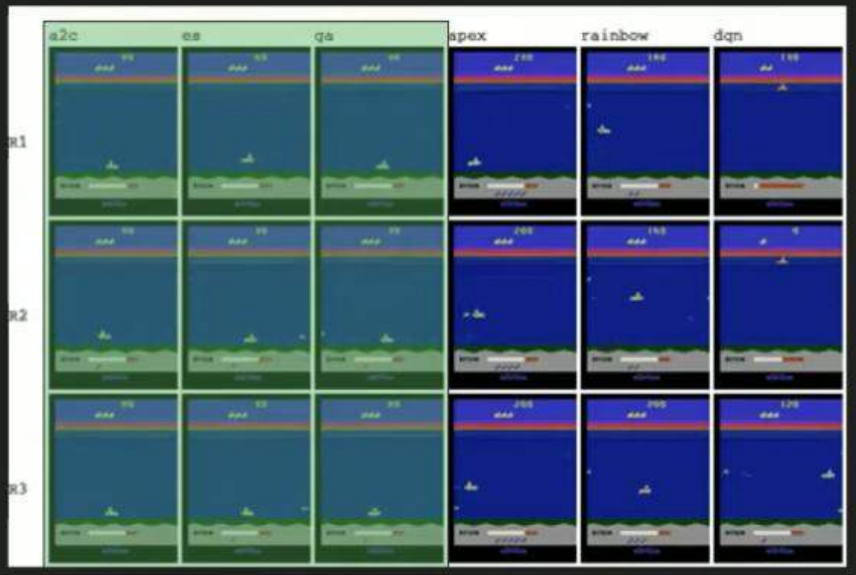
Video grids for quick qualitative comparisons



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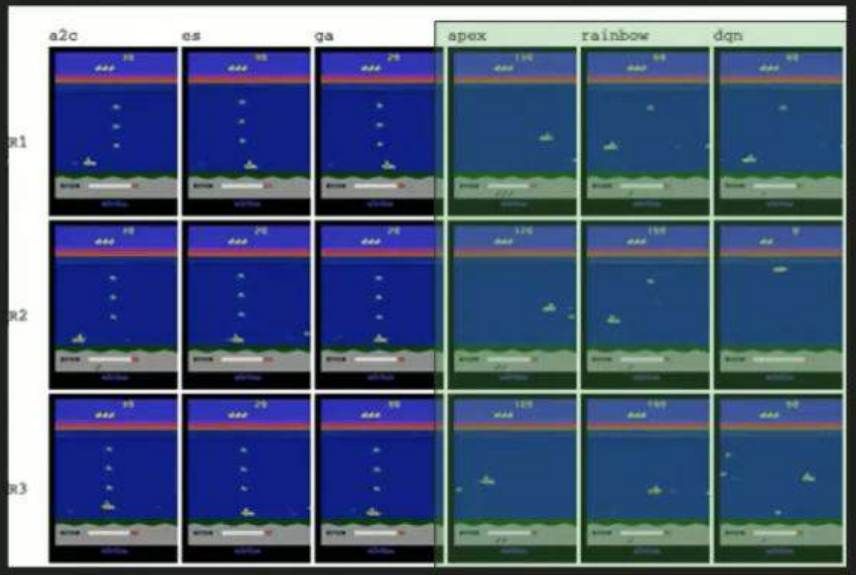
Video grids for quick qualitative comparisons



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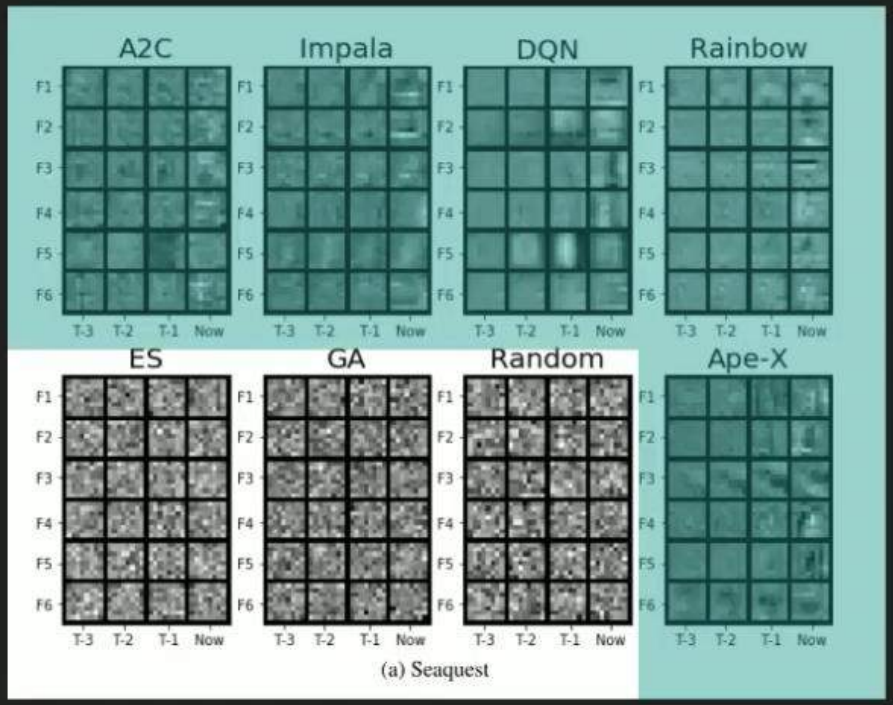

(a) Seaquest

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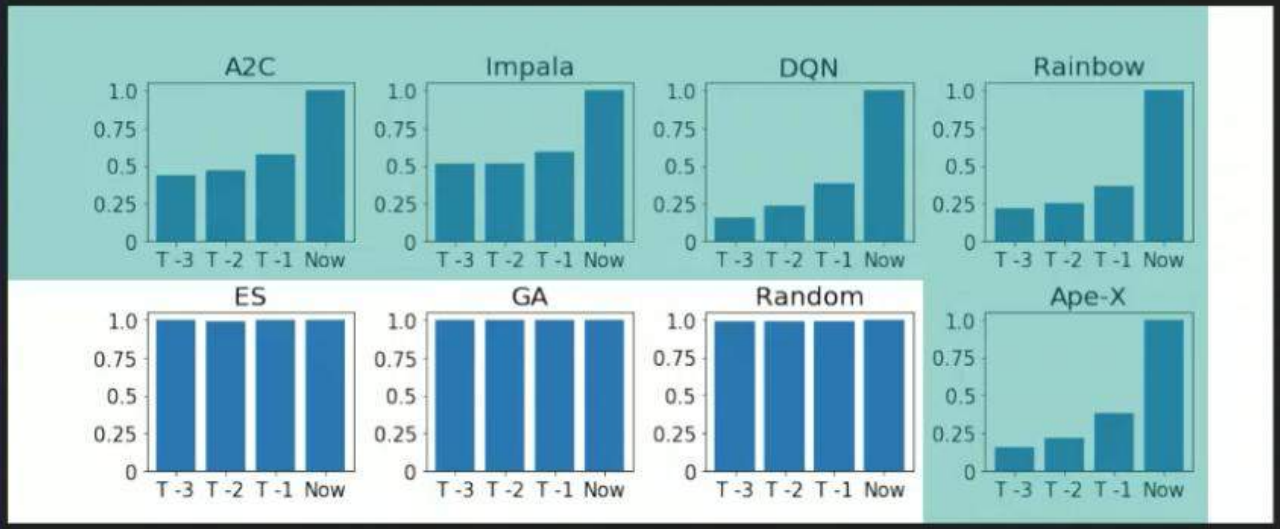
Conv1 Filters: Strength of attention to past frames



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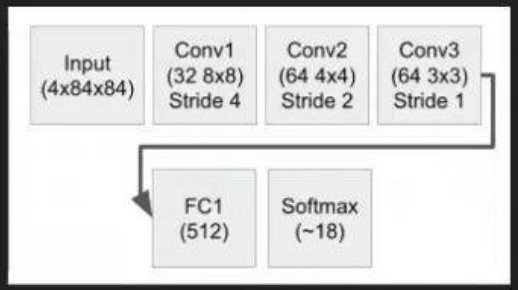
Robustness to Observation Noise

- Re-evaluate trained policy with noisy input, see how performance degrades



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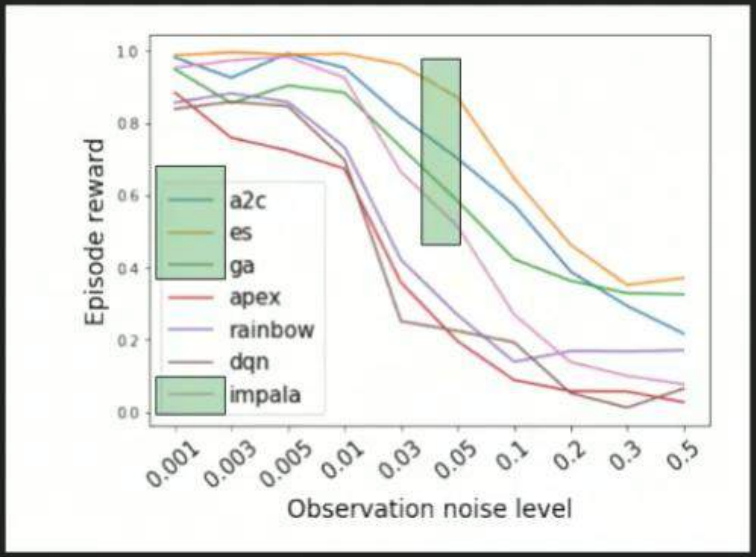
Policy Search more Robust to Observation Noise



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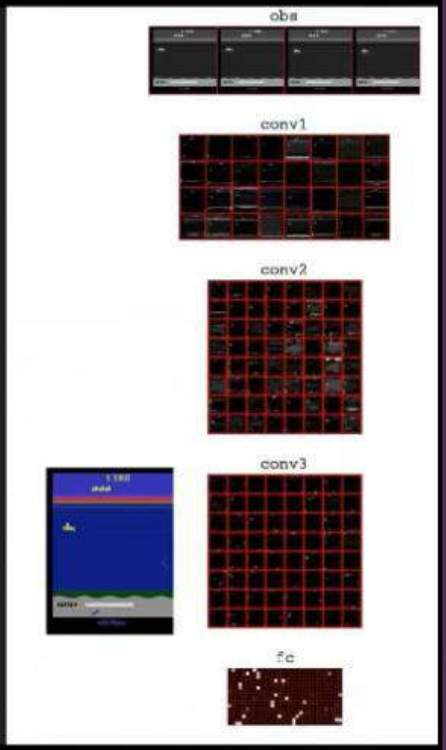
Visualizing activation during evaluation

In the style of DeepVis Toolbox
(Yosinski et al. 2015)



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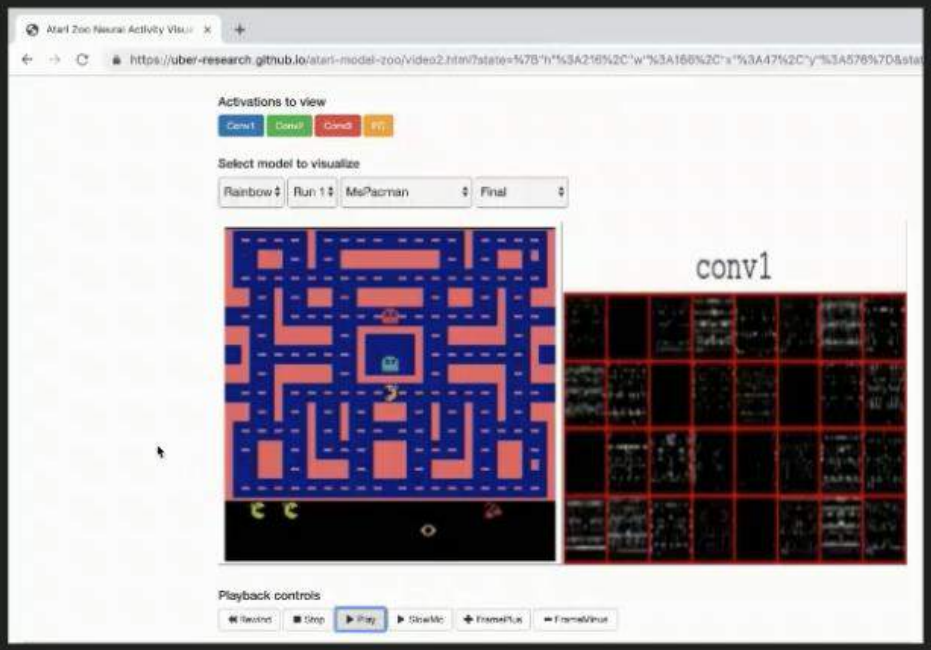
Web tool: https://uber-research.github.io/atari-model-zoo/video2.html



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Future Zoo Directions

- More models (more training algorithms + different environments)
- More analysis tools / metrics
  - Implement methods from supervised learning interpretability for deep RL
- What discoveries are waiting to be found?

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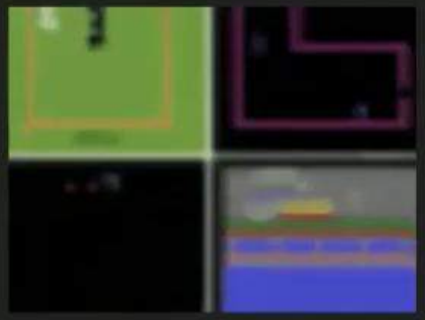
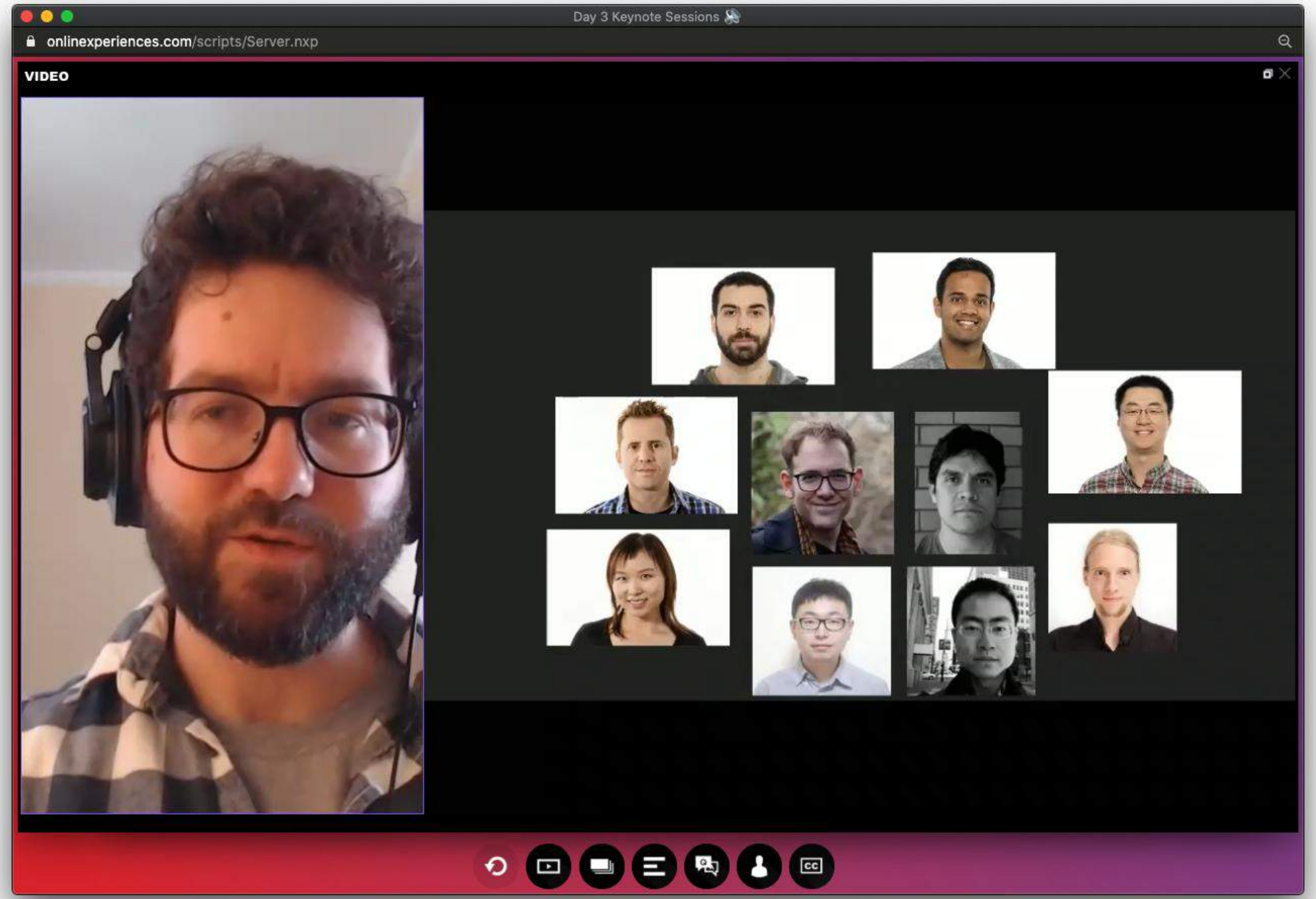
An Atari Model Zoo for Analyzing, Visualizing, and Comparing Deep Reinforcement Learning Agents



Source @ http://t.uber.com/atarizoo

UBER AI

Felipe Petroski Such, Vashisht Madhavan, Rosanne Liu, Rui Wang, Pablo Samuel Castro, Yulun Li, Jiale Zhi, Ludwig Schubert, Marc Bellemare, Jeff Clune, Joel Lehman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Conclusion

- We've released models trained in many Atari games across a range of RL algorithms, and software to easily load and analyze them
- Excited to see how the community uses the zoo and what research it enables
- ***Questions?***
  - ***Lehman.154@gmail.com*** / @joelbot3000
    (or send me a message through the coference chat / message system)

Source (github): ***http://t.uber.com/atarizoo***
Blog post: ***https://eng.uber.com/atari-zoo-deep-reinforcement-learning/***
Web tool: ***https://uber-research.github.io/atari-model-zoo/video2.html***