

Introduction to Reinforcement Learning and RLlib

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Anyscale

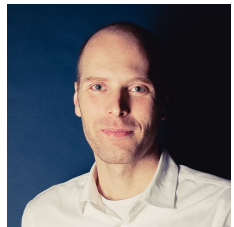
Who we are: Original creators of Ray, a unified framework for scalable, distributed computing. Part of that framework are our libraries for ML and data processing.

What we do: Scalable compute for AI and Python

Why we do it: Scaling is a necessity, scaling is hard; make distributed computing easy and simple for all developers.



RL Team @ Anyscale



Sven



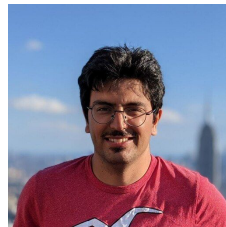
Jun



Avnish



Artur



Kourosh



Christy



Steven



Rohan



Charles





Some of RLib's Industry Users

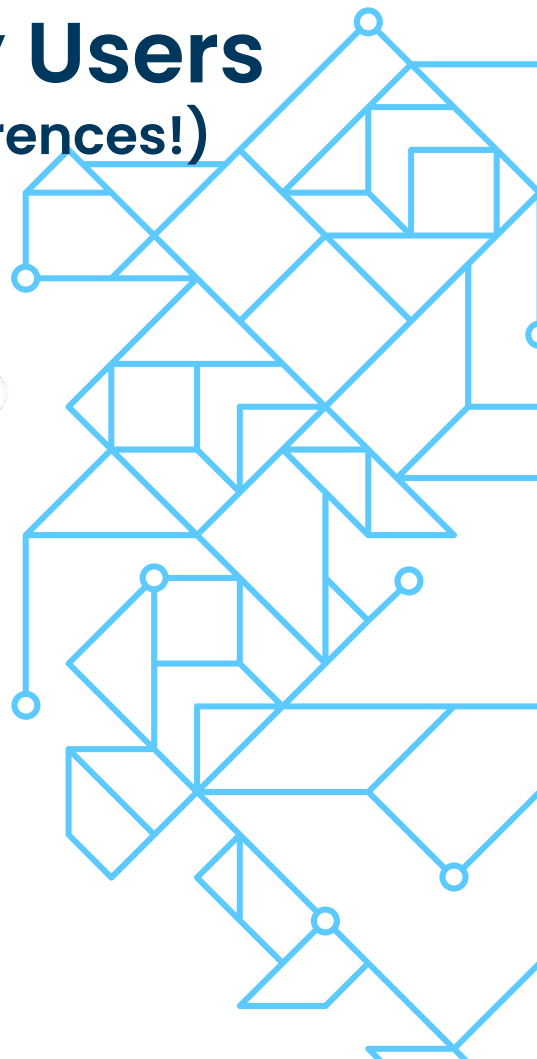
(thanks for presenting at our conferences!)



J.P.Morgan

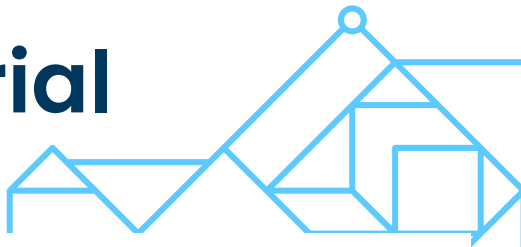



TWO SIGMA





Overview of the Tutorial



Lesson	Description
Module 1	
01 Intro to RL, RLlib and Gym Environment APIs	Introduction to Reinforcement Learning, RLlib, and the OpenAI Gym Env APIs
Module 2	
02 Multiagent RLlib Environment	Creata a custom multi-agent RLlib game anvironment
BREAK 	
03 Train a RLlib Multi-Agent model using Ray Tune	Train RLlib to play your multiplayer game using Ray Tune API
Module 3	
04 Introduction to Offline RL	Introduction to Offline RL
05 Ray Serve and RL	Using RLlib in combination with Ray Serve to deploy a policy into production
4:30pm - HAPPY HOUR + Meetup	
Module 4 (take home)	
06 Introduction to RLlib and Recommender Systems	Introduction to RecSys in combination with RLlib
07 End-to-end Demo (multi-agent with in-game recommender system using Serve)	Demo of what you will build in this tutorial





Happy Hour @ 4:30pm & Ray Meetup @ 6pm – Seacliff foyer

Meetup

Ray Summit Meetup Community Talks

Monday, August 22
6:00 PM – 8:00 PM

We are delighted to host an exclusive Ray Summit Meetup, hosted by Anyscale with Ray community talks, on the eve of the summit. Invited Ray community speakers will share how they use Ray to scale and solve challenging ML problems.

You don't have to be registered for the Ray Summit to attend. The meetup is free for the community. Join us for the Ray Summit Happy Hour from 5:00 – 6:00 p.m., followed immediately by the meetup.

Agenda (The times are not strict; they may vary slightly.)

- 5:00 – 6:00 p.m. Ray Summit Community Happy Hour (in Seacliff Foyer)
- 6:00 p.m. Welcome remarks, announcements, and agenda – Jules Damji, Anyscale
- 6:05 p.m. Talk 1: Ray + Arize: Close the ML infrastructure loop – Aparna Dhinakaran, Arize AI
- 6:35 p.m. Q & A
- 6:40 p.m. Talk 2: Maintaining long-running distributed Ray clusters – Jaehyun Sim, Ikigai Labs
- 7:20 p.m. Q & A
- 7:25 p.m. Talk 3: Large-scale distributed approximate nearest neighbor search with Ray – Daniel Acuna, Syracuse University
- 7:50 p.m. Q & A

Talk 1: Ray + Arize: Close the ML infrastructure loop Detecting, diagnosing, and resolving ML model performance can be difficult for even the most sophisticated ML engineers. As more machine learning models are deployed into production, it is imperative we have tools to monitor, troubleshoot, and explain model decisions. Join Aparna Dhinakaran, chief product officer at Arize AI, in a discussion on the state of commonly seen ML production monitoring challenges. Learn how to use ML Observability from training through production environments to find upstream model issues faster, monitor your models in real time at scale, and improve model interpretability and explainability.



Daniel Acuna
Associate Professor, Computer
Science Department, University of
Colorado



Jaehyun Sim
Director of Engineering, Ikigai Labs,
Inc.



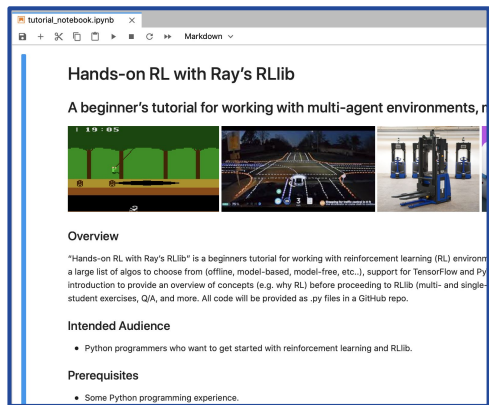
Aparna Dhinakaran
Chief Product Officer, Arize AI



Jules Damji
Lead Developer Advocate, Anyscale



And now ... Moving to our Jupyter Notebook





Anyscale User/Password



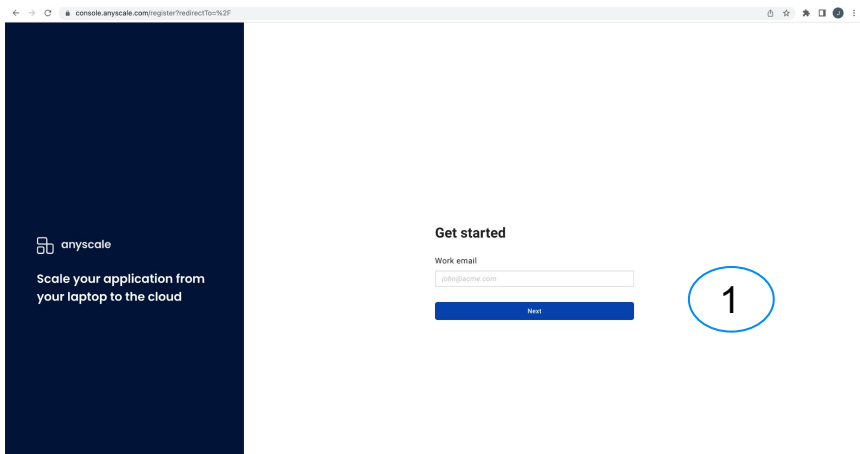
<https://bit.ly/rsummit2022-class-logins>

- Choose any line from spreadsheet under your class name: "Introduction to Ray RLLib"
- In column "Account" switch "Not Available"
- For example, Username/password: `yinhaonan55+520@gmail.com/tutorialpassword520`

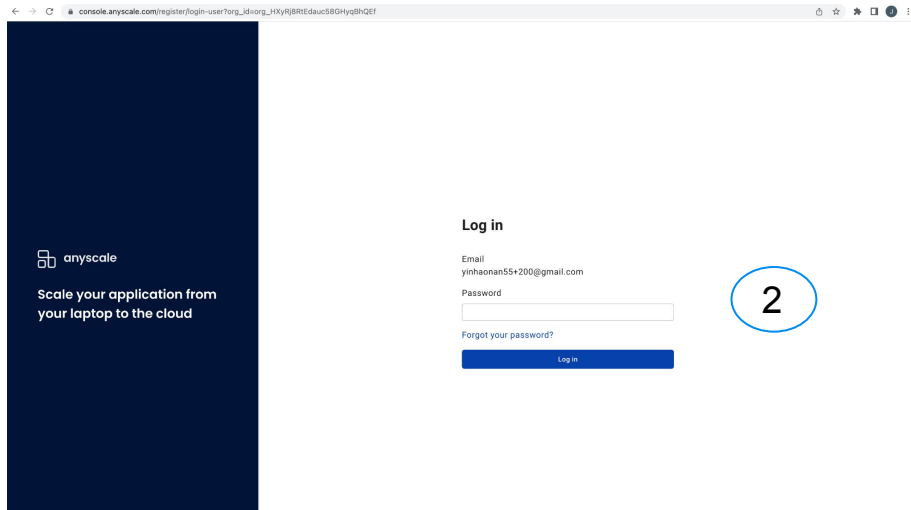


Your Anyscale Cluster

- Console: <http://console.anyscale.com/>
- User name: <username@gmail.com>
- Password : password



The screenshot shows the registration page of the Anyscale console. The browser address bar displays 'console.anyscale.com/register?redirectedTo=2'. The page has a dark blue header with the Anyscale logo and the text 'Scale your application from your laptop to the cloud'. Below the header, the 'Get started' section contains a 'Work email' label and a text input field with the placeholder 'john@acme.com'. A blue 'Next' button is positioned below the input field. A blue circle with the number '1' is placed to the right of the 'Next' button.



The screenshot shows the login page of the Anyscale console. The browser address bar displays 'console.anyscale.com/register/login-user?org_id=org_11xyfj@tEdauc580HygthQET'. The page has a dark blue header with the Anyscale logo and the text 'Scale your application from your laptop to the cloud'. Below the header, the 'Log in' section contains an 'Email' label and a text input field with the placeholder 'yinhaonan55+200@gmail.com'. Below the email field is a 'Password' label and a text input field. A blue 'Log in' button is positioned below the password field. A blue circle with the number '2' is placed to the right of the 'Log in' button.



Your Anyscale Cluster

← → ↻ console.anyscale.com/o/ray-summit-tutorial-2022-test/clusters

anyscale

- Home
- Projects
- Interactive sessions
- Jobs
- Services
- Clusters**
- Configurations

Tutorial Account

Help

Feedback

< Collapse

Clusters

+ Create ▶ Start ⏸ Terminate 🔄 Resume

🔍 Search names

Cluster status Created by Include archived

<input type="checkbox"/>	Name	Status ↓	Active resources	Cost ⓘ ↕	Cluster environment	Project	Cloud	Created by	Created
<input type="checkbox"/>	cluster-0	Terminated	None	\$0.80	ray_tutorial_app_config_allentest200:1	Ray-Tutorial	ray-summit-test-cloud (GCP)	Me	7/18

1 - 1 of 1 < >

3

4



Your Anyscale Cluster

console.anyscale.com/o/ray-summit-tutorial-2022-test/projects/prj_U1G82gWidjDMen5JRWsNejaN/clusters/ses_QSpdJDjX3pu4Xz93iD9Sb7p

5

Ray-Tutorial > cluster-0

Jupyter Dashboard Grafana Terminate <> Connect

About this cluster

Status	ID	Created by
Active (auto-suspend in 2880 minutes)	ses_QSpdJDjX3pu4Xz93iD9Sb7p	yinhaonan55+200@gmail.com
Created at	Access	Project
Jul 18, 2022, 2:13:41 PM	Only admins and you can view and edit	Ray-Tutorial

Resource usage

CPU	Object store memory	GPU
0 utilized / 8 running	0 B utilized / 6.87 GiB running	-
Cost since last start	Cost since creation	
\$0.80	\$0.80	

Configuration

Cluster environment	Compute config	Cloud
ray_tutorial_app_config_allintest200:1	autogenerated-config-2022-07-18T14:13:41.023925	ray-summit-test-cloud (gcp, us-central1)
Network access		
Public with auth token		

Terminal

Tab 1

```
exec env ZDOTDIR=/tmp zsh
(base) ray:~%
```



Your Anyscale Cluster

The screenshot shows the Anyscale JupyterLab interface in a web browser. The address bar displays the URL: `dashboard-ses-qspddjdjx3pu4xz93id9sb7p.anyscale-hxyrj8r-g28hqi-0000.anyscale-test-production.com/jupyter/lab`. The interface includes a top menu bar with options: File, Edit, View, Run, Kernel, Tabs, Settings, and Help. Below the menu is a toolbar with icons for creating new files, opening recent files, and saving. On the left, a file browser sidebar shows a search bar labeled 'Filter files by name' and a table of files:

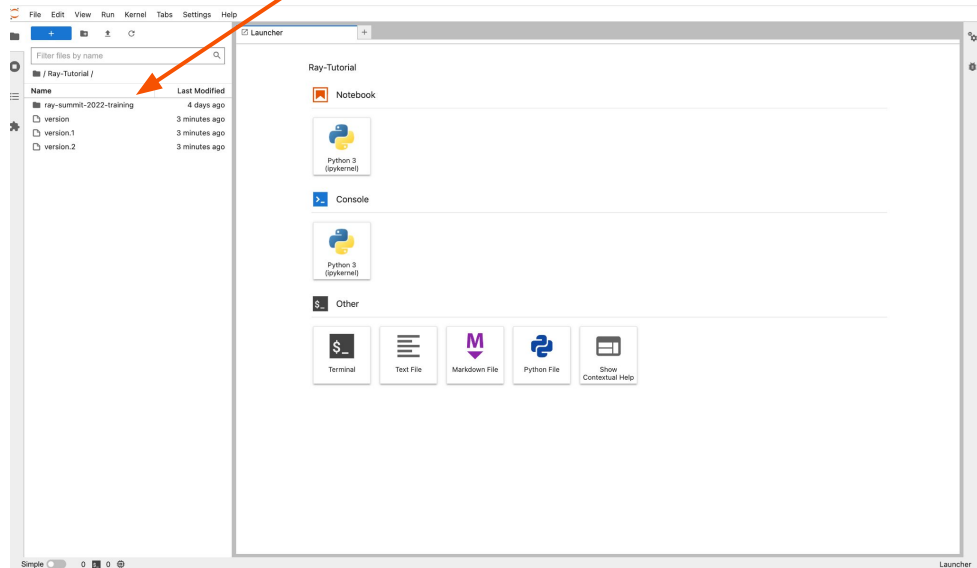
Name	Last Modified
anaconda3	2 months ago
Ray-Tutorial	2 minutes ago
requireme...	2 months ago

An orange arrow points to the 'Ray-Tutorial' file. In the center of the interface, a large blue circle with the number '6' is overlaid. The main workspace area is titled 'Launcher' and contains several interactive elements: a 'Notebook' section with a Python 3 (ipykernel) icon, a 'Console' section with a terminal icon, another 'Python 3 (ipykernel)' icon, and an 'Other' section with icons for Terminal, Text File, Markdown File, Python File, and a 'Show Contextual Help' button. The bottom status bar shows 'Simple' mode and a 'Launcher' label.

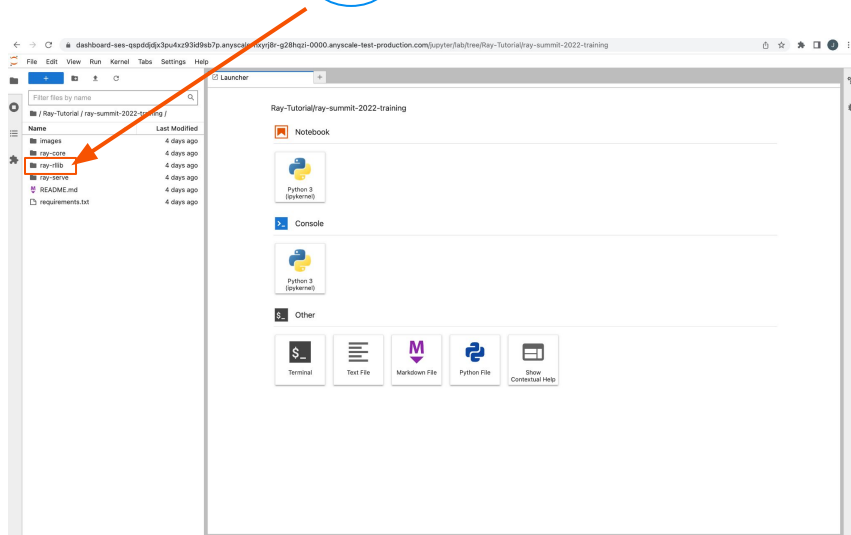


Your Anyscale Cluster



7



8



Tell us what you think + Ask questions

Survey	Q&A Doc
https://bit.ly/ray_summit2022_rllib	https://bit.ly/ray_summit2022_rllib_qa
	

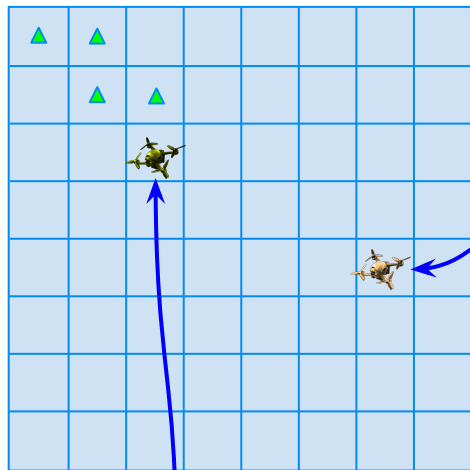
Thank you.

Tell us what you think...

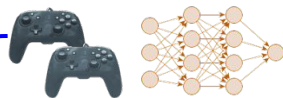
https://bit.ly/ray_summit2022_rllib



Environment 1 (Game)



"Init-Bot"
(playing the game)



\$\$\$?



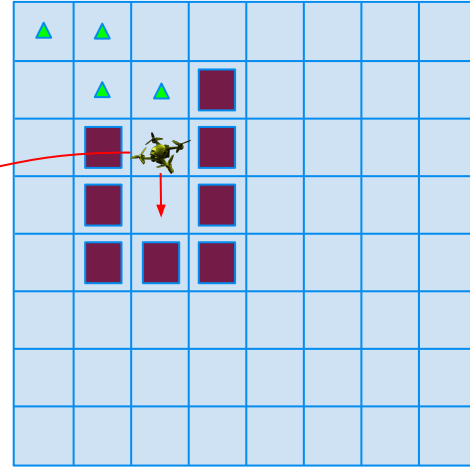
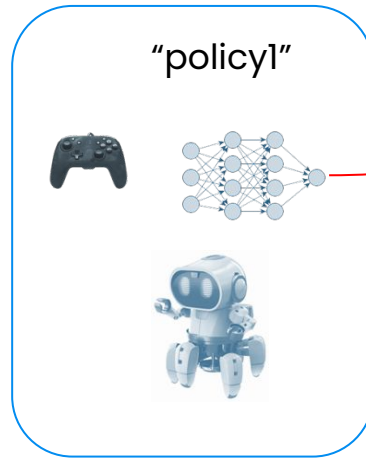
Human players

\$\$\$?

Environment 2 (RecSys)



RecSys-Bot
(learning to recommend
prices)



class **Algorithm**(tune.Trainable)

WorkerSet
(trainer.workers)

“local worker”
class **RolloutWorker**

Policy Map

Pol1

Mo
del

Pol2

Mo
del

```
config.rollouts(  
    num_rollout_workers=0  
)
```

@ray.remote
class **RolloutWorker**

@ray.remote
class **RolloutWorker**

Scalability (e.g.
num_workers=100)

@ray.remote
class **RolloutWorker**

Policy Map

Pol1

Model

Pol2

Model

```
config.rollouts(  
    num_rollout_workers > 0  
)
```

Sampler

Vector Env

Ag1

Ag2

```
config.rollouts(  
    num_envs_per_worker  
)
```