AWS re:Invent

AIM428

Under the hood of AWS DeepRacer

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AWS AI

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Agenda

- AWS DeepRacer recap
- Augment simulation environment
- Manipulate neural-net inputs
- Modify neural network
- Run distributed rollouts
- Debug your model
- Prepare for the 2020 League!

AWS DeepRacer recap

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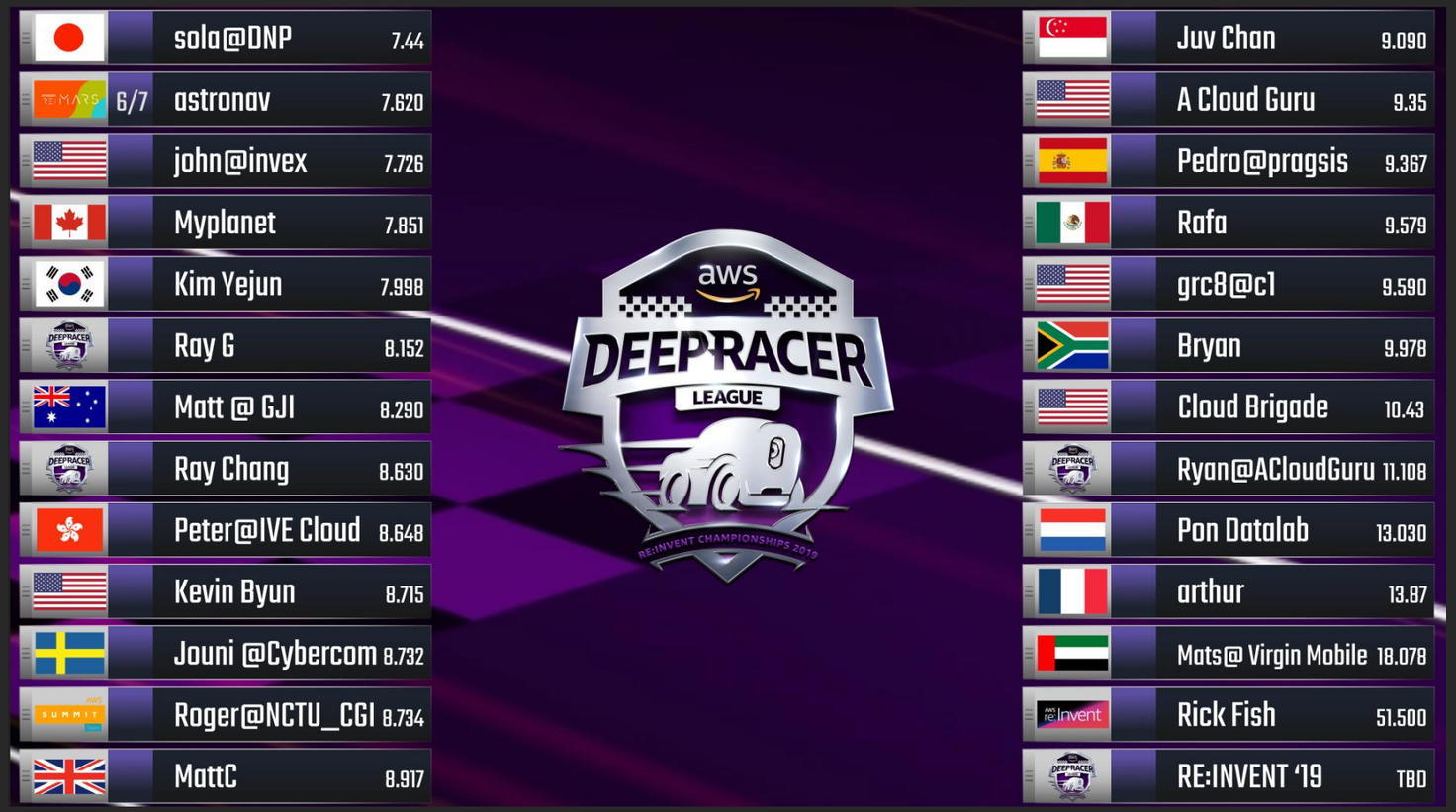
AWS DeepRacer: An exciting way for developers to get hands-on experience with reinforcement learning (RL)

1/18 scale autonomous race car

Virtual simulator, to train and evaluate

Global Racing League

AWS DeepRacer League 2019 - Summit Circuit



21 races, 17 countries, thousands of developers of all skill levels, and a world record of 7.44 seconds

www.deepracerleague.com

AWS DeepRacer League 2019 - Virtual Circuit

6 virtual race winners and 18 top point-getters

https://deepracer-community.slack.com/

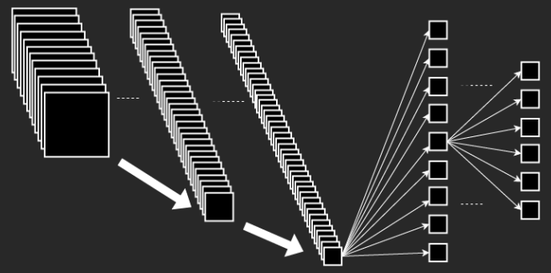
Lab – create your Amazon SageMaker Notebook

GitHub: http://bit.ly/reInvent2019-400

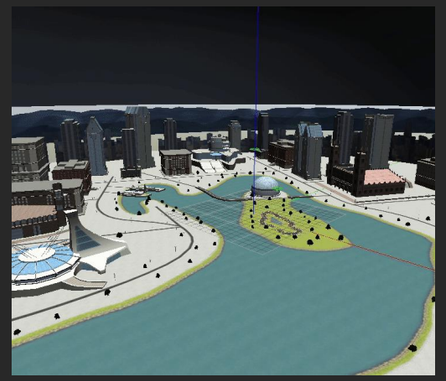
Objective: Follow the instructions to set up your Amazon SageMaker notebook

Timing: 7 min

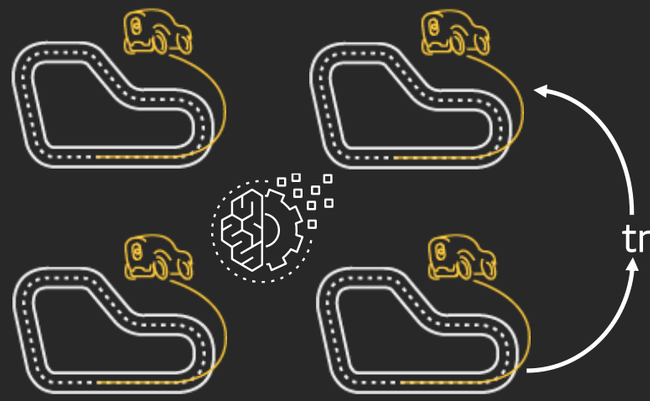
Agenda in context



Neural Network and Algorithm



Environment

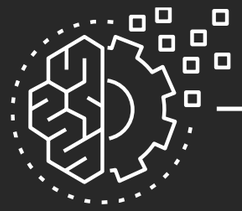


Distributed rollouts

Yes

Still training

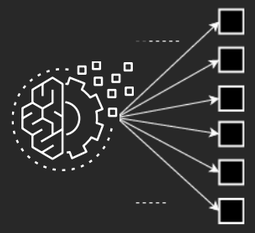
No



Debug Model

Race

State

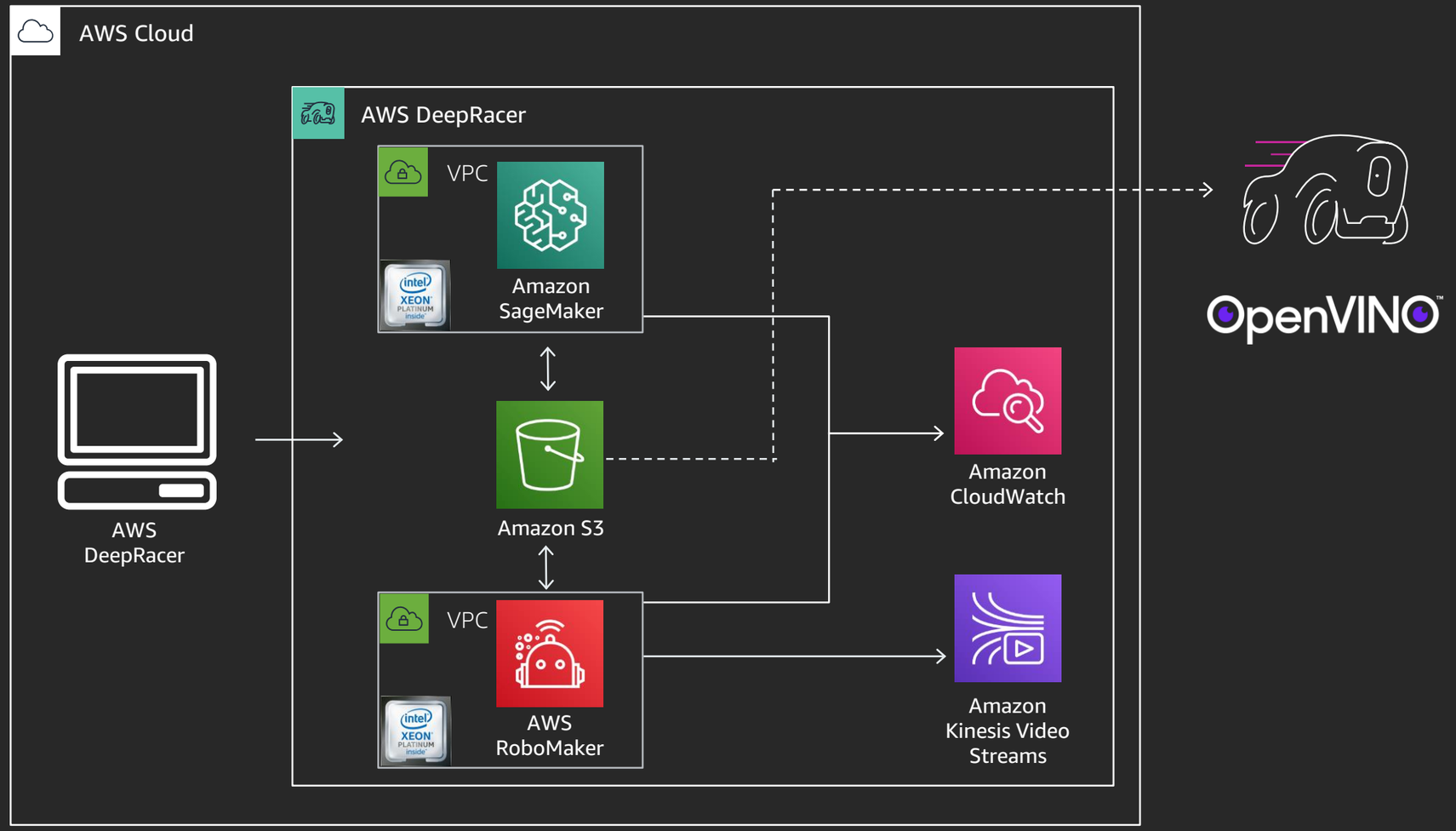


Action

State'

Reward

AWS DeepRacer simulator architecture



Augment simulation environment

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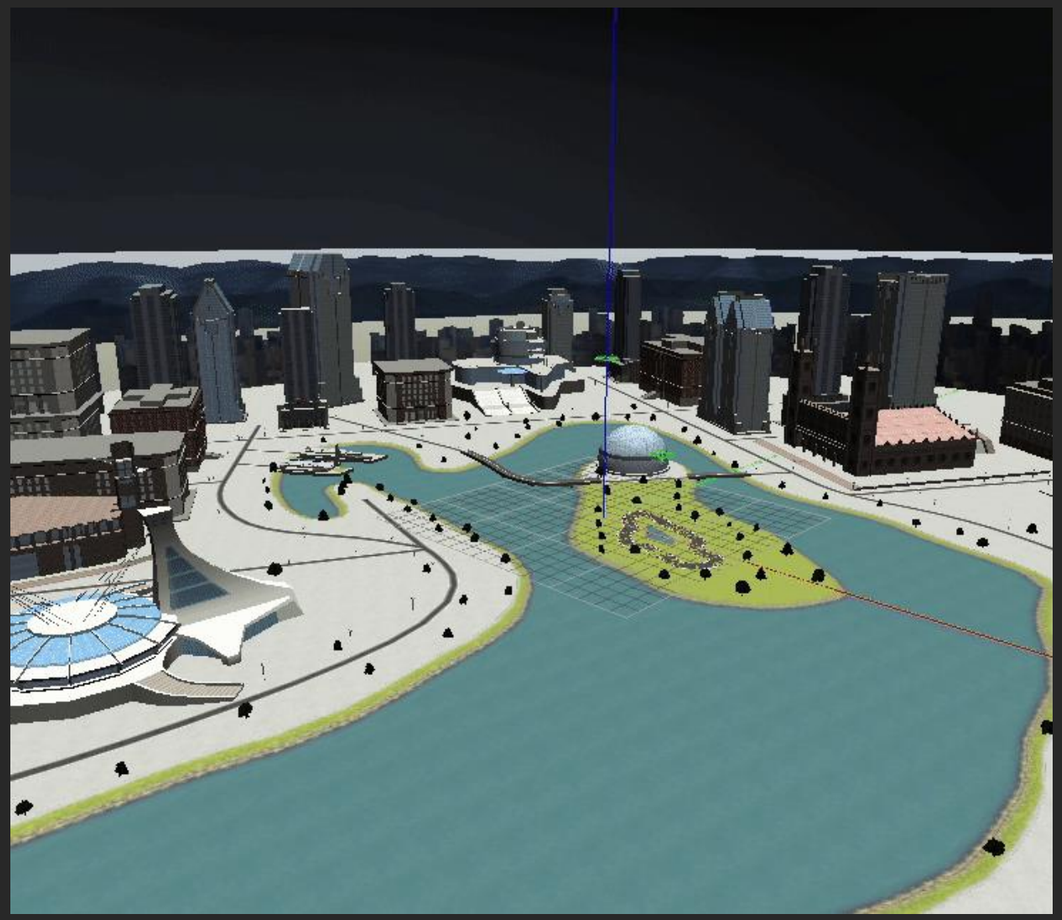
Simulation environment



AWS RoboMaker

Gazebo environment

Meshes

Models

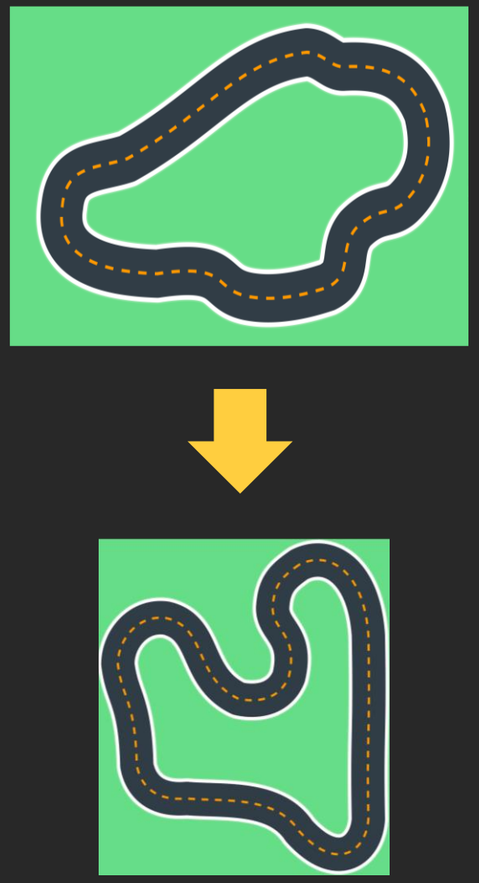
World

Waypoints

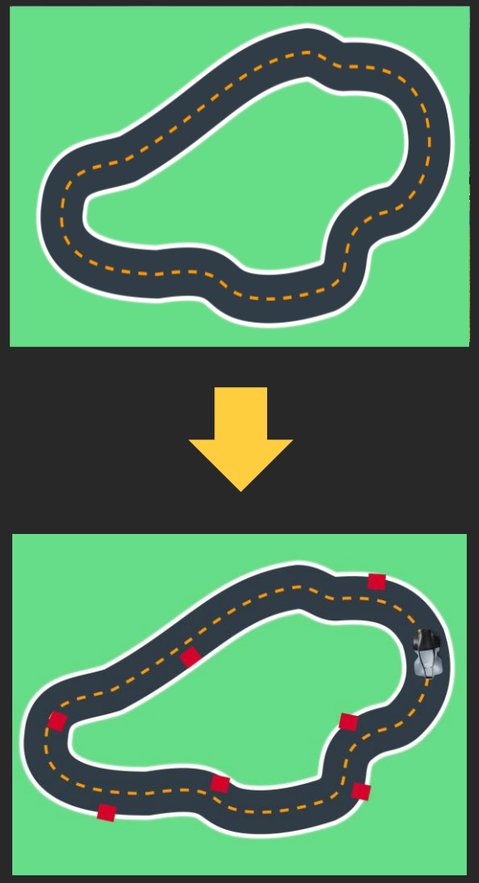
Agent + sensors

Environment manipulations

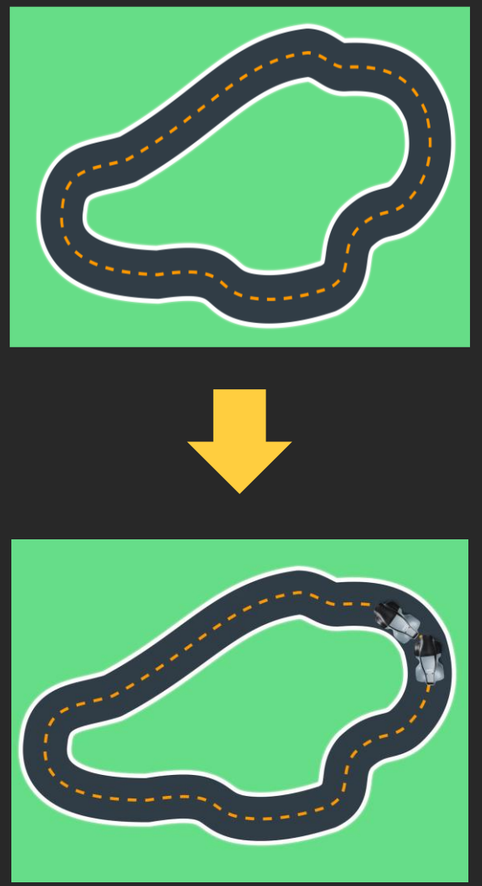
Change track



Add objects

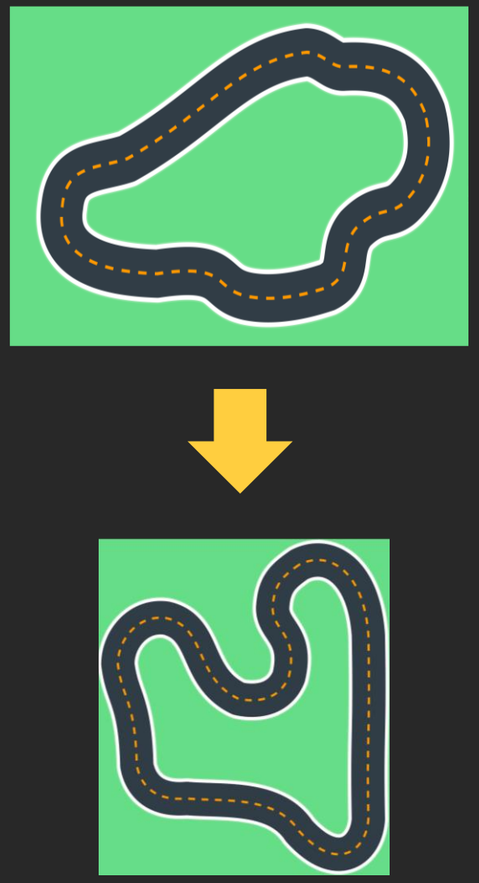


Add bot cars

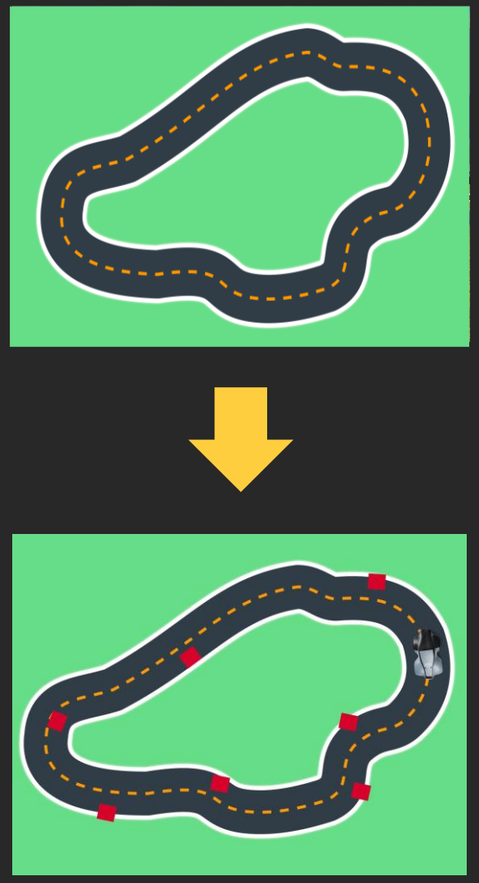


Environment manipulations

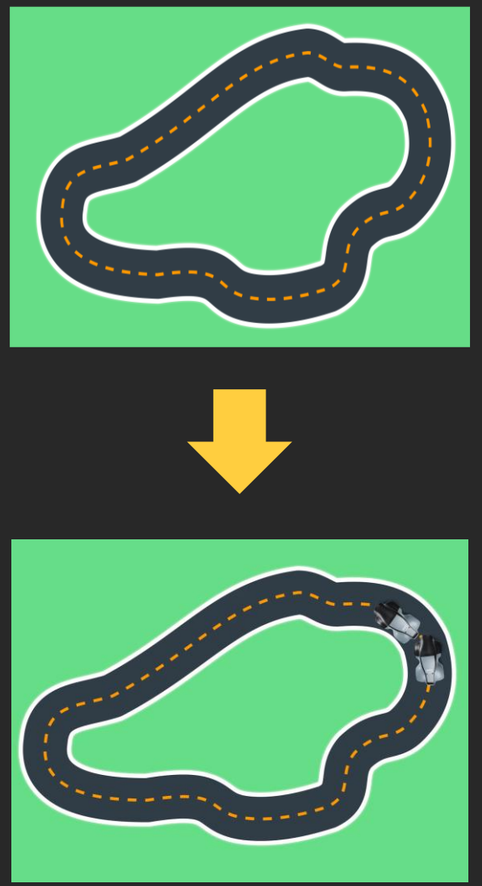
Change track



Add objects



Add bot cars



Lab – environment manipulation

Complete up to the end of Section 1 in your SageMaker Notebook

Timing: 15 min

Manipulate observation of state

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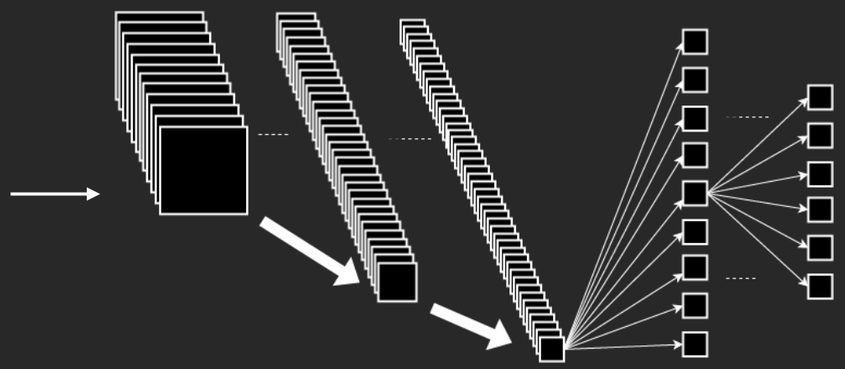
Observation of agent's current state is network input

Camera sensor



Neural Network

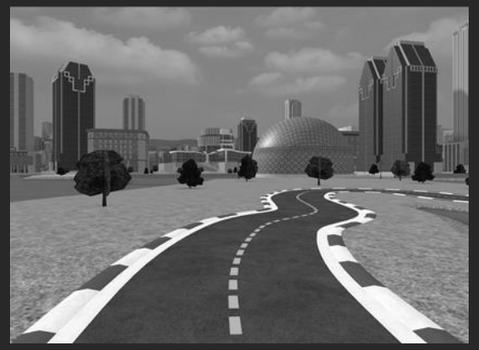
Common input manipulations

Single Camera

Left Camera

Right Camera

Grayscale



Stacked

Stereo

Lab – input manipulation

Complete up to the end of Section 2 in your SageMaker Notebook

Timing: 15 min

Modify Neural Network

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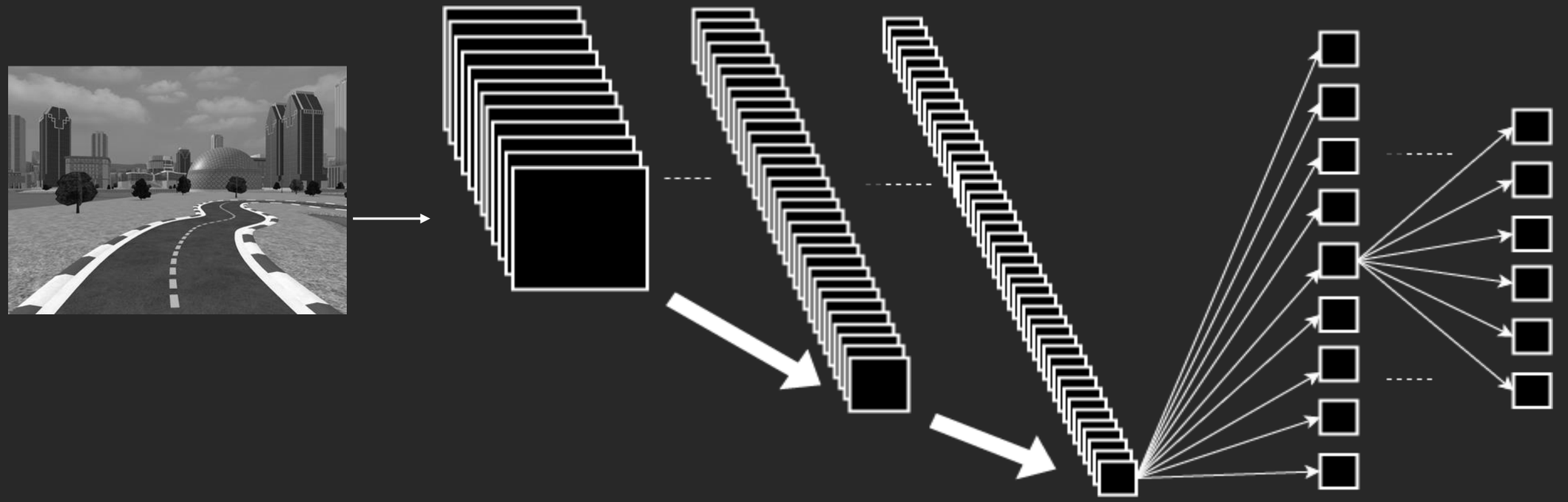
Neural Network components



Filtered Input

CNN image input embedder

FC middleware

Action output

Network depths – Coach presets

Image Embedder	Shallow	Conv2d(32, 3, 1)
	Medium*	Conv2d(32, 8, 4) Conv2d(64, 4, 2) Conv2d(64, 3, 1)
	Deep	Conv2d(32, 5, 2) Conv2d(32, 3, 1) Conv2d(64, 3, 2) Conv2d(64, 3, 1) Conv2d(128, 3, 2) Conv2d(128, 3, 1) Conv2d(256, 3, 2) Conv2d(256, 3, 1)

FC Middleware	Shallow	dense_layer(64)
	Medium*	dense_layer(512)
	Deep	dense_layer(128) dense_layer(128) dense_layer(128)

Lab – modify your neural network

Complete up to the end of Section 3 in your SageMaker Notebook

Objective: Add another convolutional layer to your input embedder

Timing: 15 min

Distributed roll-outs

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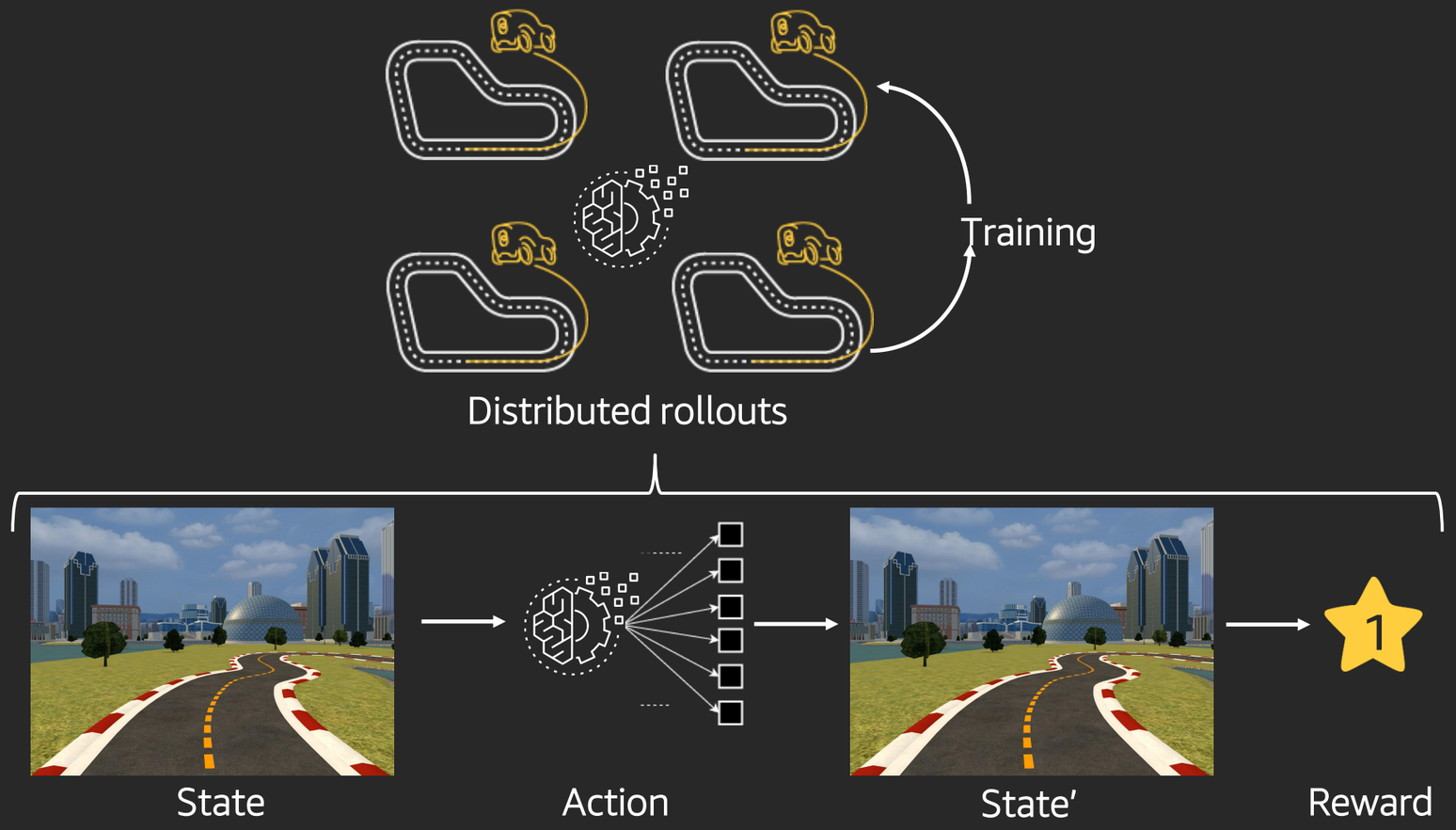
We can run many simultaneous rollouts



Lab – launch multiple rollout training

Complete up to the end of Section 4 in your SageMaker Notebook

Objective: Kick off multiple rollout training training

Timing: 25 min

Debugging your model

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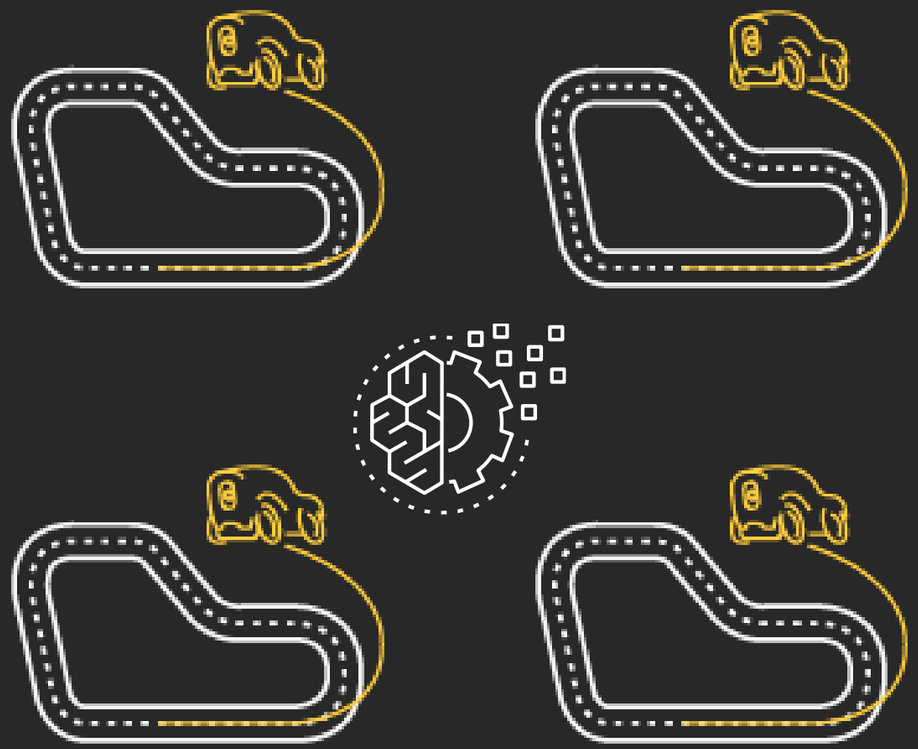
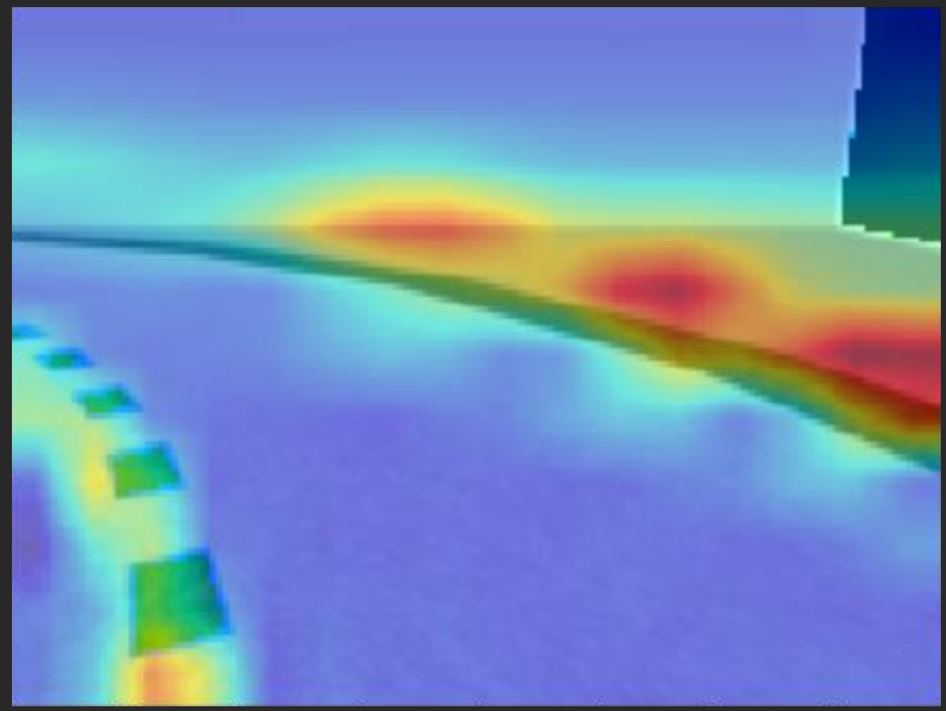
Debugging your models



Analyze distributed training



GradCam to see the model’s focus

Lab – model debugging

Complete up to the end of Section 5 in your SageMaker Notebook

Objective: Debug the example model

Timing: 20 min

Prepare for the 2020 League

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Get ready for the 2020 AWS DeepRacer League

2 ways to race	3 race formats	Prizes!
Online Virtual Circuit	Time trial	Paid trip to re:Invent!
In-person Summit Circuit	Object Avoidance	Win DeepRacer cars
	Head-to-head	

www.deepracerleague.com

Additional resources

- DeepRacer Slack Community: http://join.deepracing.io/
- GitHub: https://github.com/aws-samples/aws-deepracer-workshops/
- Free video course: https://www.aws.training/Details/eLearning?id=32143
- Tips: https://aws.amazon.com/deepracer/racing-tips/
- AWS ML Custom training blog http://bit.ly/customDRL
- Intel® Distribution of OpenVINO™ toolkit: https://software.intel.com/en-us/openvino-toolkit

Thank you!

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