

DeepRacer

RoboMaker 로 DeepRacer 자율 주행차 만들기

유정열

BespinGlobal SRE & AWSKRUG

AWS
re:Invent

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AWS re:Invent 2018

셋째 날 키노트...

NEW!

AWS DeepRacer

Fully autonomous 1/18th scale race car,
driven by reinforcement learning

AVAILABLE FOR PRE-ORDER ON AMAZON.COM



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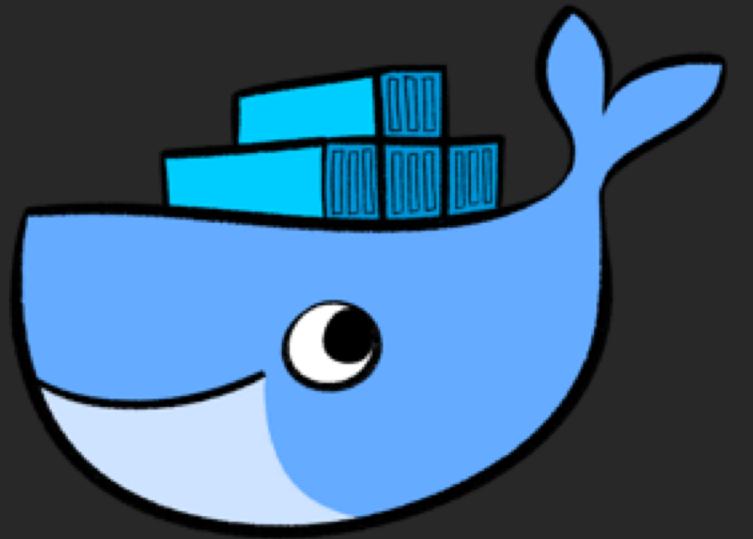
올해는 이거다!



아이템을 획득 하였습니다!



AIOps?



AWS DeepRacer

AWS DeepRacer

1/18 스케일

강화 학습에 의한

완전 자율주행 자동차

AWS
re:Invent



AWS DeepRacer Console

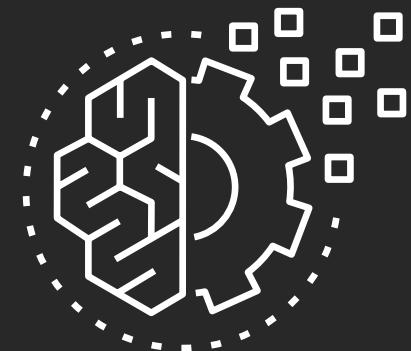
가상 레이싱 시뮬레이터

- 훈련
- 평가
- 반복

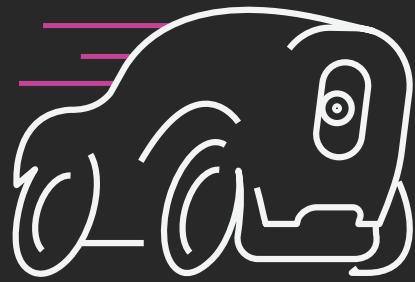
Amazon SageMaker &
AWS RoboMaker



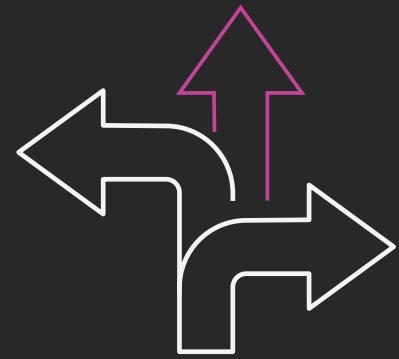
What is Reinforcement Learning?



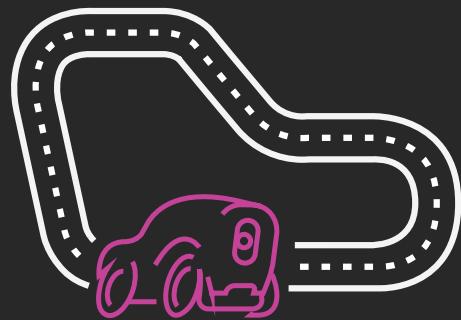
MODEL



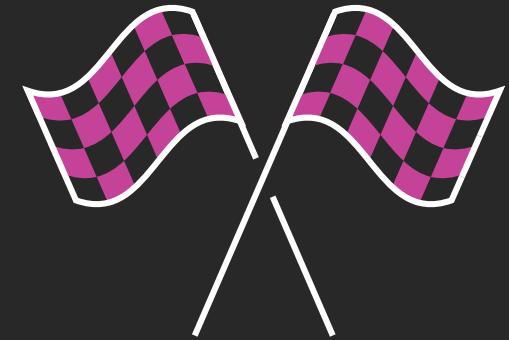
AGENT



ACTION

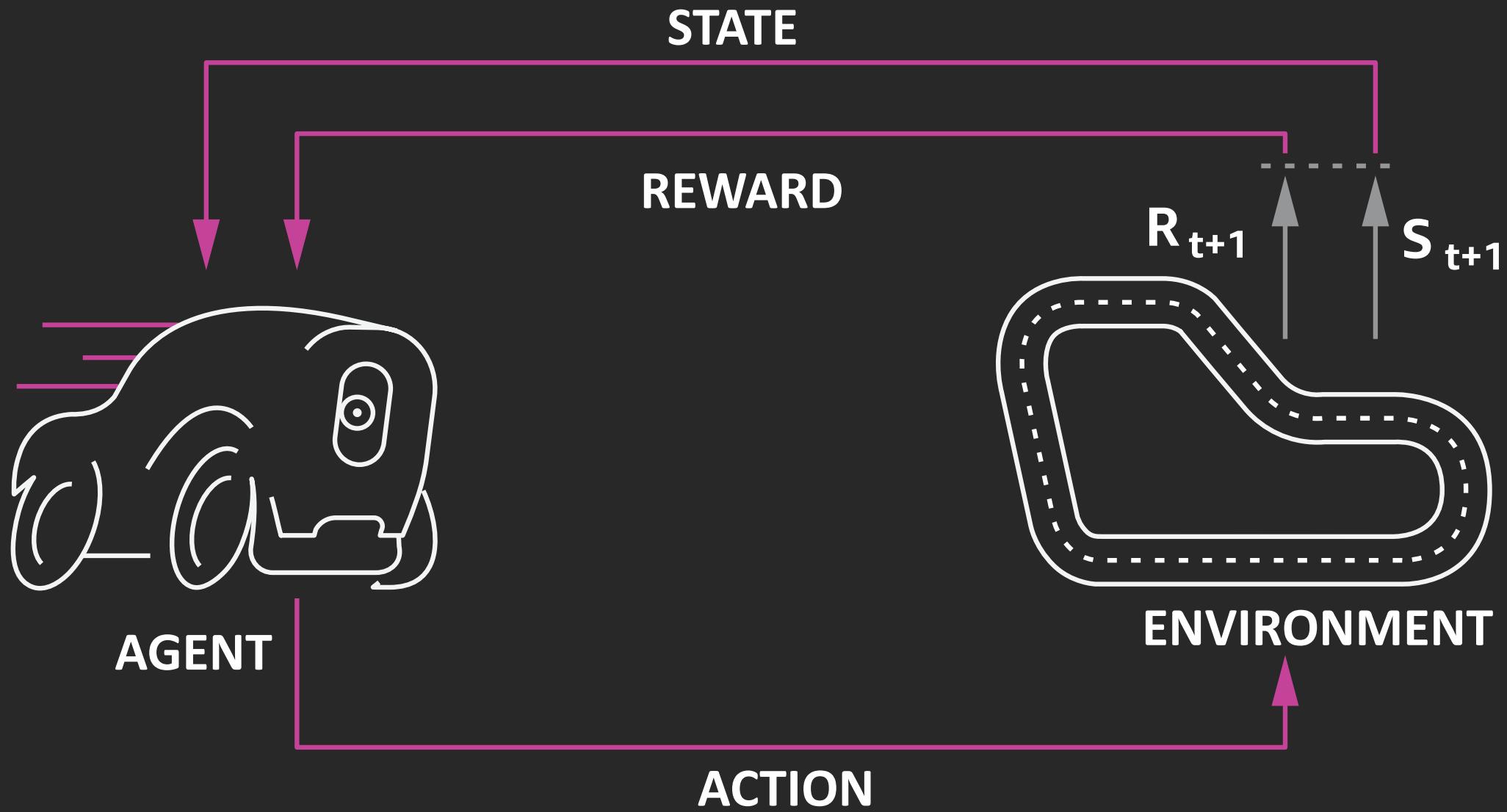


ENVIRONMENT



GOAL

How does learning happen?



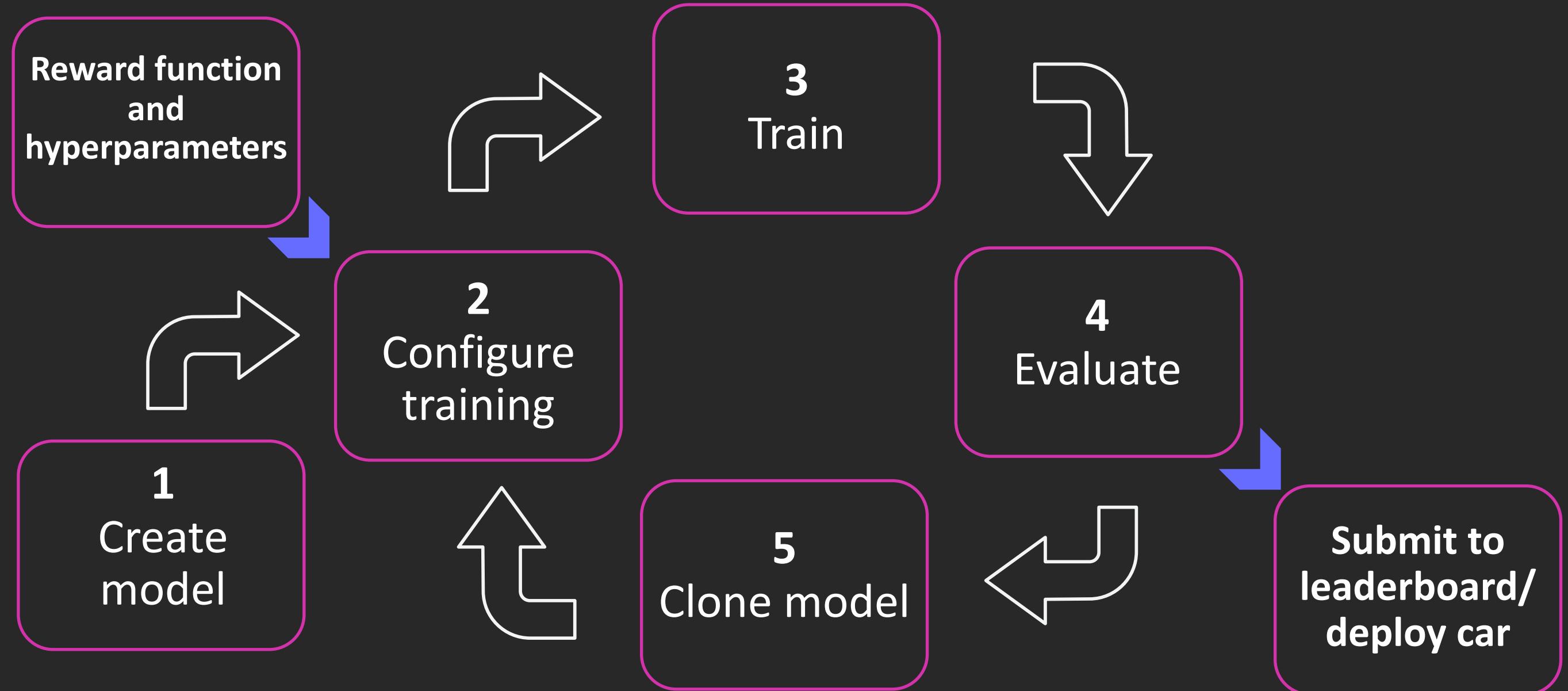
VALUE FUNCTION



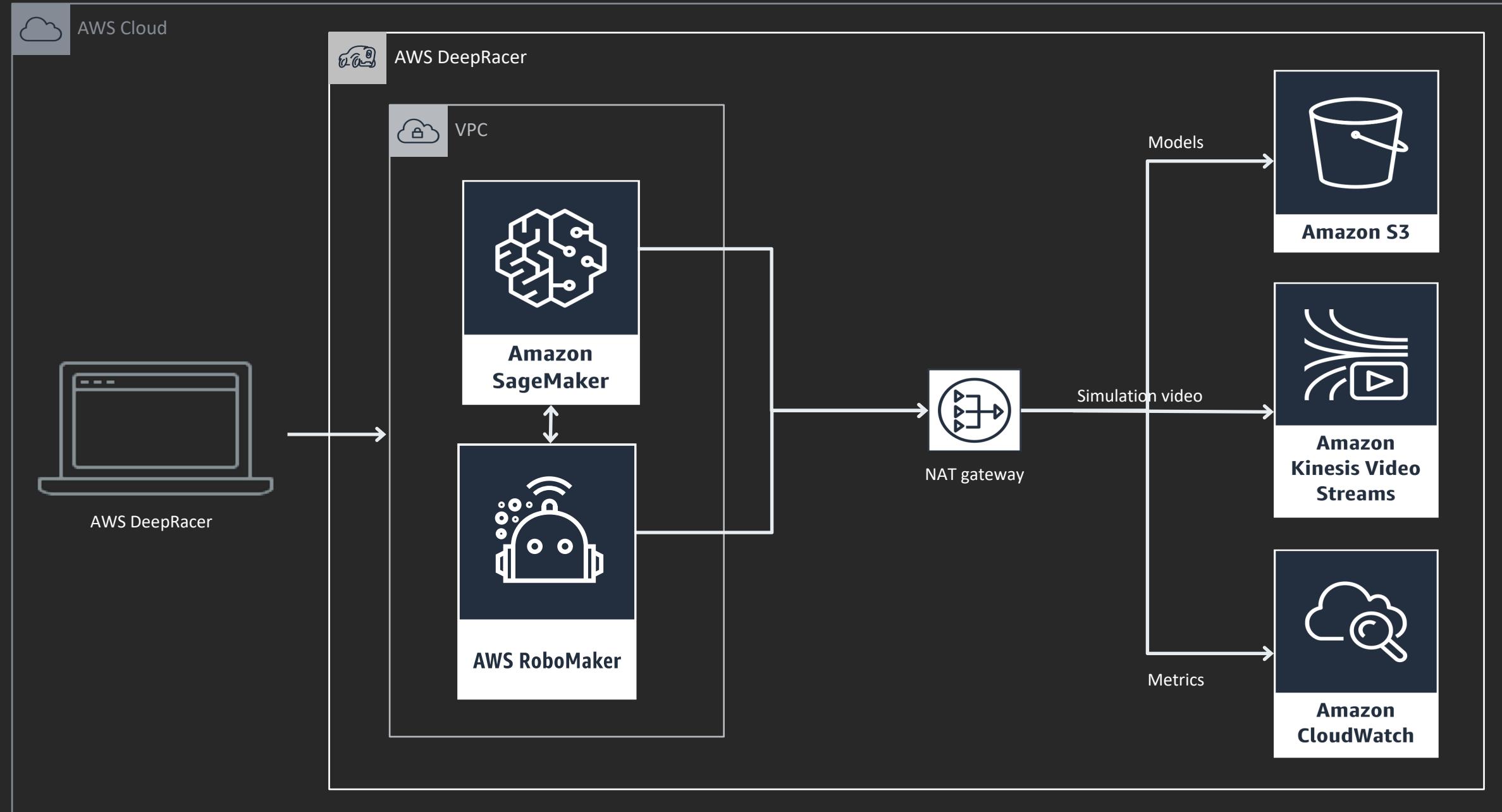
POLICY FUNCTION



DeepRacer Console

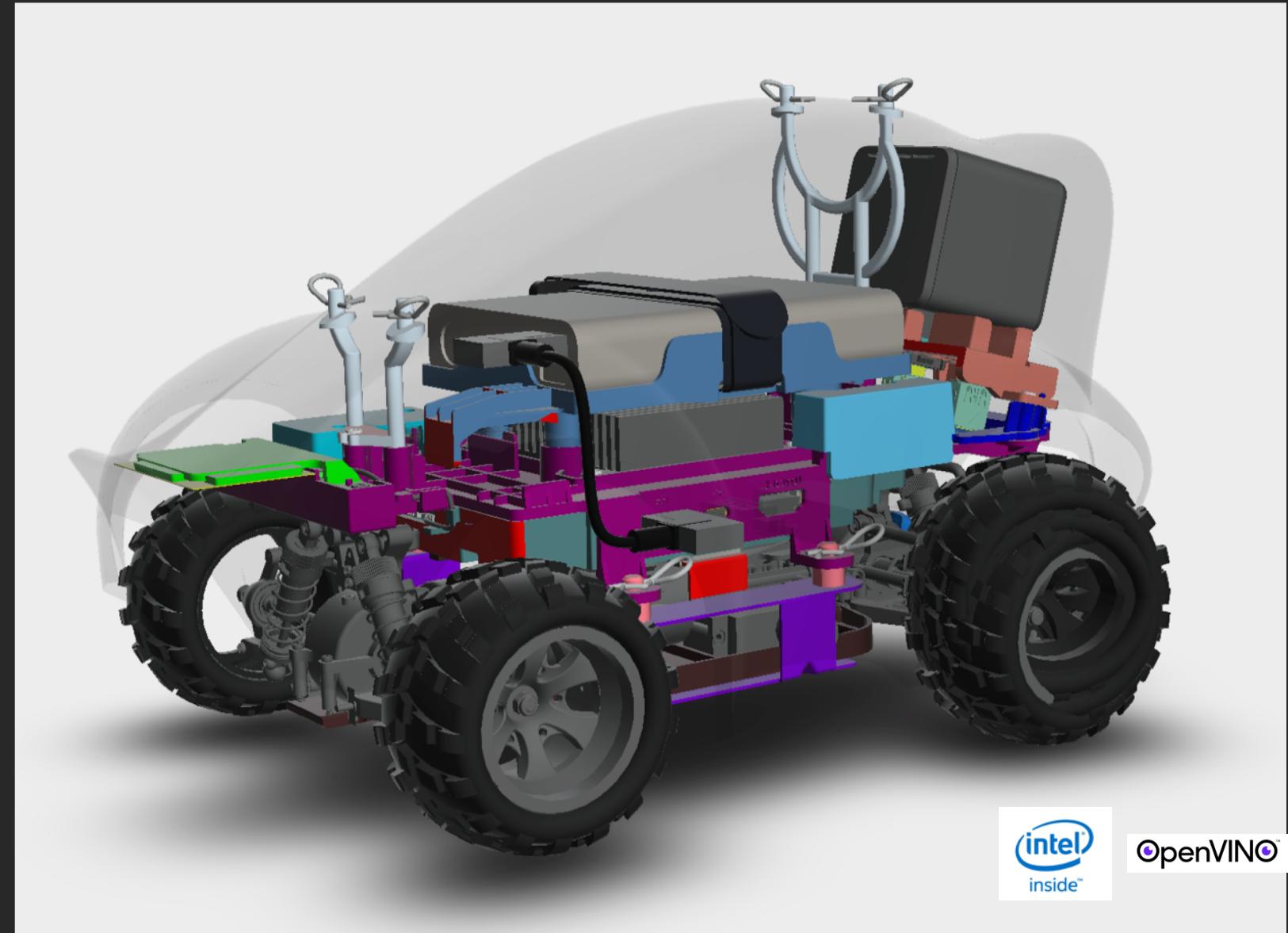


DeepRacer Simulator Architecture



DeepRacer Specifications

- 1:18 4WD scale car
- Intel Atom™ Processor
- System Memory: 4GB RAM
- System Storage: 32GB (expandable)
- 802.11ac WiFi
- 4 MP Camera (MJPEG)
- Ubuntu 16.04.3 LTS
- ROS Kinetic
- Intel OpenVINO™ toolkit
- Car Battery: 7.4V/1100mAh Lithium Polymer Battery
- Computer Battery: 13600 mAh USB-C PD
- 4x USB-A, 1x USB-C, 1x Micro-USB, 1x HDMI



DeepRacer Console

aws-deepracer-workshops/Lab X DeepRacer X +

https://console.aws.amazon.com/deepracer/home?region=us-east-1#models

AWS Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

AWS DeepRacer Reinforcement learning

Models (2)

Download model Action Create model

Search models < 1 > ⚙️

Name	Description	Status	Creation time
nalbam-16-180		Ready	Sat, 01 Dec 2018 21:28:22 GMT
advanced-2		Ready	Sat, 01 Dec 2018 19:10:54 GMT

aws-deepracer-workshops/Lab X DeepRacer X + https://console.aws.amazon.com/deepracer/home?region=us-east-1#createModel OFF

AWS Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

AWS DeepRacer > Reinforcement learning > Create model

Create model

Model details

Model name [Info](#)

The model name must be unique and can have up to 64 characters. Valid characters are a-z, A-Z, 0-9, and - (hyphen). No spaces.

Model description - *optional*

Permissions and storage [Info](#)

The S3 bucket will be used to store your model and reward function. The IAM roles will give AWS DeepRacer permission to perform actions in other AWS services on your behalf, including your AWS DeepRacer S3 bucket. These IAM roles will grant permissions described by the IAM policy.

- You have the required IAM roles
- You have the required S3 bucket
- You have the required account resources

Environment simulation

Simulated environment emulates a track to train your model.

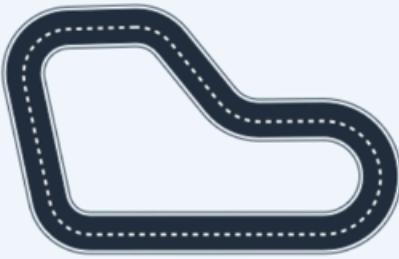
aws-deepracer-workshops/Lab X DeepRacer X + https://console.aws.amazon.com/deepracer/home?region=us-east-1#createModel OFF

Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

Environment simulation

Simulated environment emulates a track to train your model.

Choose an option [Info](#)

re:Invent 2018
This is the preseason track, available exclusively to re:Invent attendees.


Coming soon
More to come


Reward function

In reinforcement learning for AWS DeepRacer, the **agent** (vehicle) learns from an **environment** (a track) by interacting with it and receiving rewards for performing specific actions. This is how you specify what **actions** have certain **rewards**. What you do here will affect the performance of your model, as well as how long it takes to train a good model.

Experiment, you can always clone a model and iterate on it. [Info](#)

Code snippets | Code editor | [Reset](#) | [Validate](#)

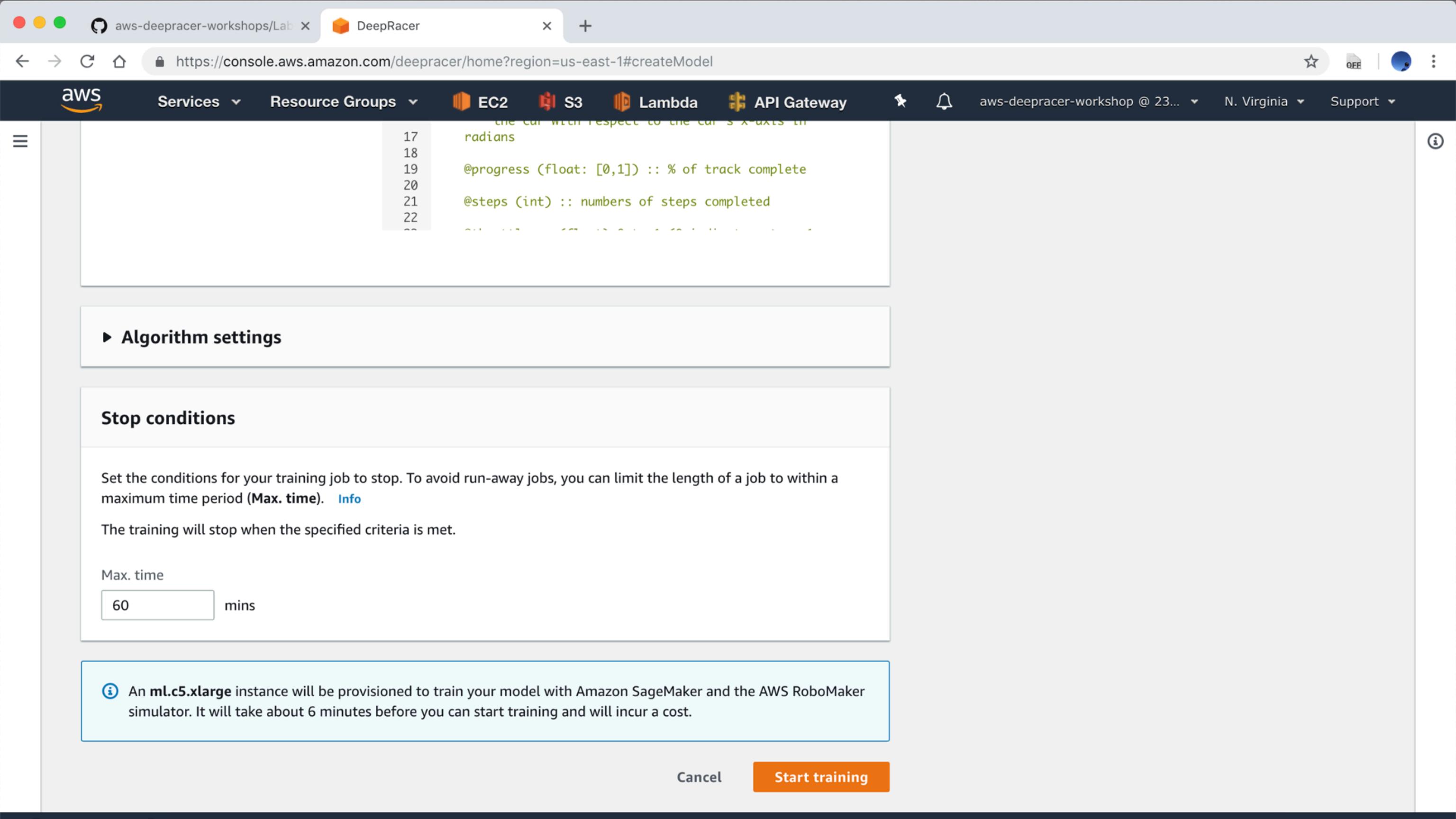
```
def reward_function(self, on_track, x, y, distance_from_center, car_orientation,
                    progress, steps, throttle, steering, track_width, waypoints,
                    closest_waypoints):

    if distance_from_center >= 0.0 and distance_from_center <= 0.02:
        return 1.0

    elif distance_from_center >= 0.02 and distance_from_center <= 0.03:
        return 0.3

    elif distance_from_center >= 0.03 and distance_from_center <= 0.05:
        return 0.1

    return 1e-3 # like crashed
```



aws-deepracer-workshops/Lab X DeepRacer X + https://console.aws.amazon.com/deepracer/home?region=us-east-1#model/demo

AWS Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

AWS DeepRacer X Training in progress Training will stop after 60 minutes. Stop training

Reinforcement learning demo Delete Clone Download model

▼ Training Info

Reward

2018-12-01 (22:11:38) - 2018-12-01 (23:11:38) ▾

TrainingRewardScore

Simulation powered by AWS RoboMaker. [Info](#)

aws-deepracer-workshops/Lab X DeepRacer X + https://console.aws.amazon.com/deepracer/home?region=us-east-1#model/nalbam-16-180

Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

AWS DeepRacer X Evaluation was successfully completed.

Reinforcement learning

nalbam-16-180

Delete Clone Download model

▼ Training [Info](#) Completed

Reward

2018-12-01 (13:28:52) - 2018-12-01 (14:28:52) [refresh](#)

TrainingRewardScore

Time	TrainingRewardScore
21:30	40
21:35	50
21:40	80
21:45	130
22:00	50
22:05	140
22:10	210
22:15	320

Simulation powered by AWS RoboMaker. [Info](#)

Simulation video stream not available.
Video is only available during training.

aws-deepracer-workshops/Lab X DeepRacer X + https://console.aws.amazon.com/deepracer/home?region=us-east-1#model/nalbam-16-180

Services Resource Groups EC2 S3 Lambda API Gateway aws-deepracer-workshop @ 23... N. Virginia Support

AWS DeepRacer Evaluation was successfully completed.

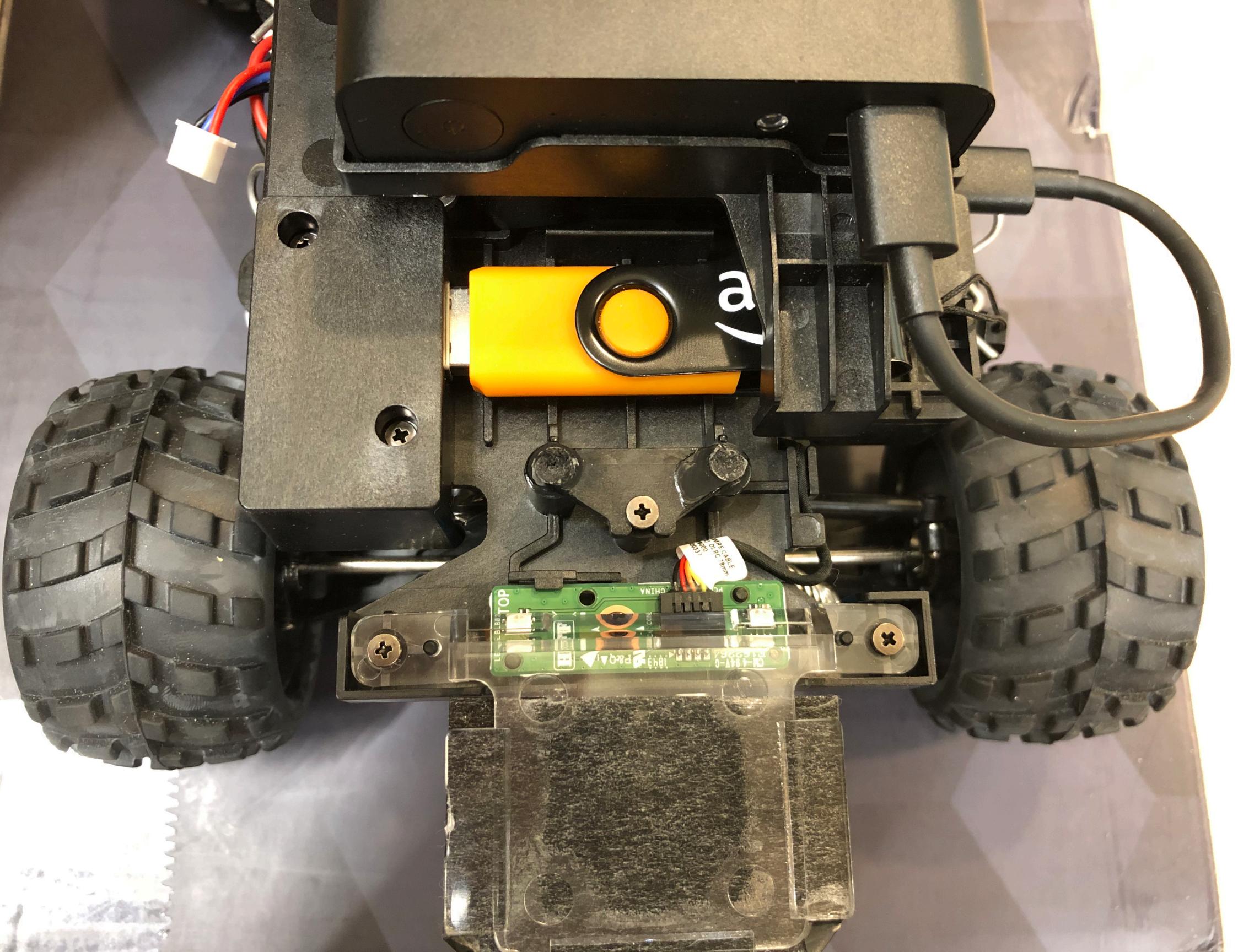
Reinforcement learning

Evaluation Info Start new evaluation Stop evaluation

Trial	Time	Trial results (% completed)
1	00:01:12	100%
2	00:01:11	100%
3	00:01:12	100%

Configuration Info

Environment simulation re:Invent 2018	Framework Tensorflow	Hyperparameter	Value
Reward function ▶ Show	Agent algorithm PPO	Batch size	64
		Entropy	0.01
		Discount factor	0.999
		Final value	1
		Epsilon steps	10000
		Exploration type	Categorical



AWS DeepRacer League

세계 최초의 자율 주행 자동차 리그:

- 가장 빠른 랩타임을 기록하도록 훈련
- AWS Summits에서 경쟁
- 각 단계의 우승자는 re:Invent 2019 DeepRacer Cup 결승 진출





<https://www.youtube.com/watch?v=ND0iobtPGmk>



POSITION RACER

TIME

#1 Jordy 00:12.2

#2 geffen 00:20.2

#3 ChangHoon Jung 00:24.0

#4 Stephen 00:24.1

#5 Yuriy 00:25.3

#6 Harish R 00:25.4

Follow the race: #AWSDeepRacer

AWS DeepRacer

- DeepRacer Home

<https://console.aws.amazon.com/deepracer/home?region=us-east-1>

- DeepRacer Workshop

<https://github.com/aws-samples/aws-deepracer-workshops>

- DeepRacer Pre-Order

<https://amzn.to/2E90yQv>

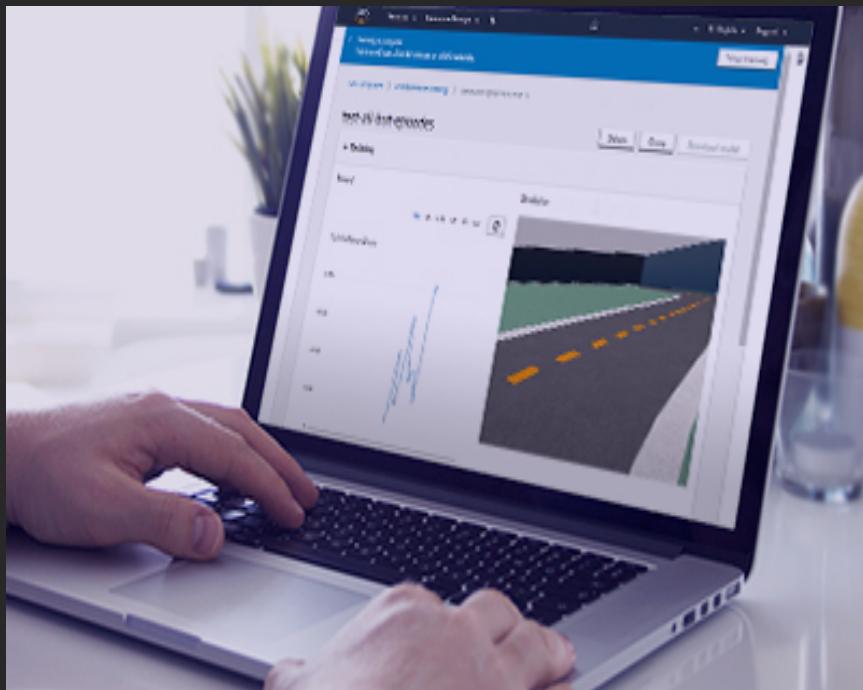
DeepRacer Demo

<https://www.youtube.com/watch?v=6Dvp82CfvZI>



<https://www.youtube.com/watch?v=6Dvp82CfvZI>

Three key elements



가상 시뮬레이터,
강화 학습



완전 자율 주행 자동차



딥레이서 리그

Thank you!

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