AWS re:Invent

AIM225

How to build a car that does an 8.64-second lap with AWS DeepRacer

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AWS DeepRacer League Hong Kong Champion

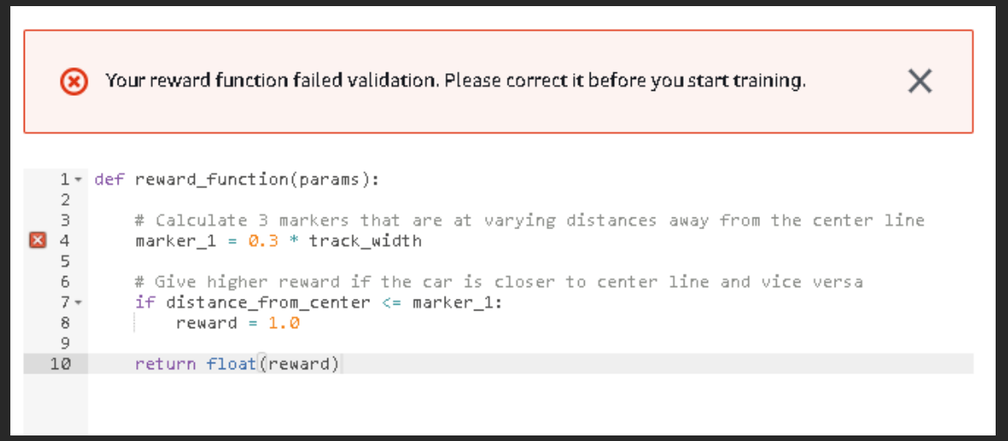
IVE

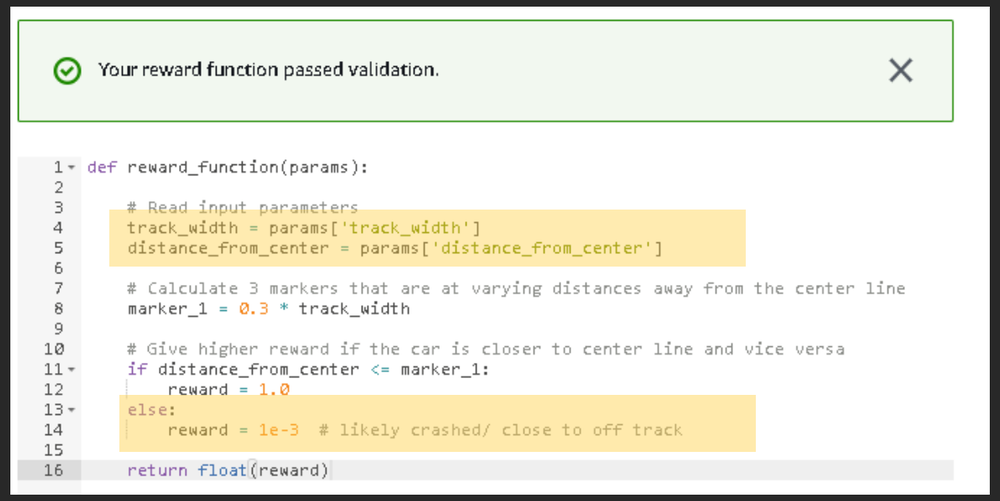
We are just a group of *non-degree students* and 100% newbie!

Common reward function mistakes

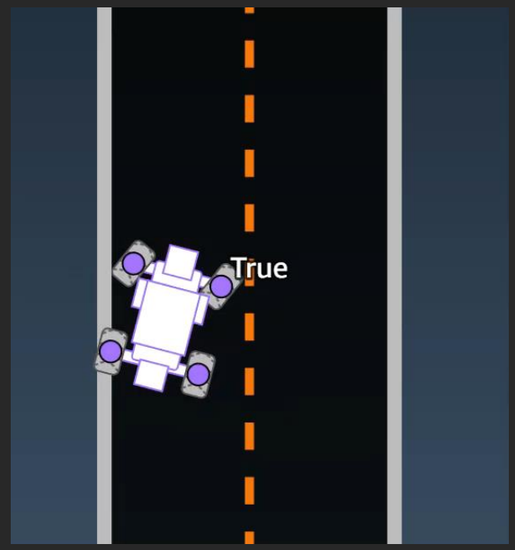
Missing variables

An outcome without a reward



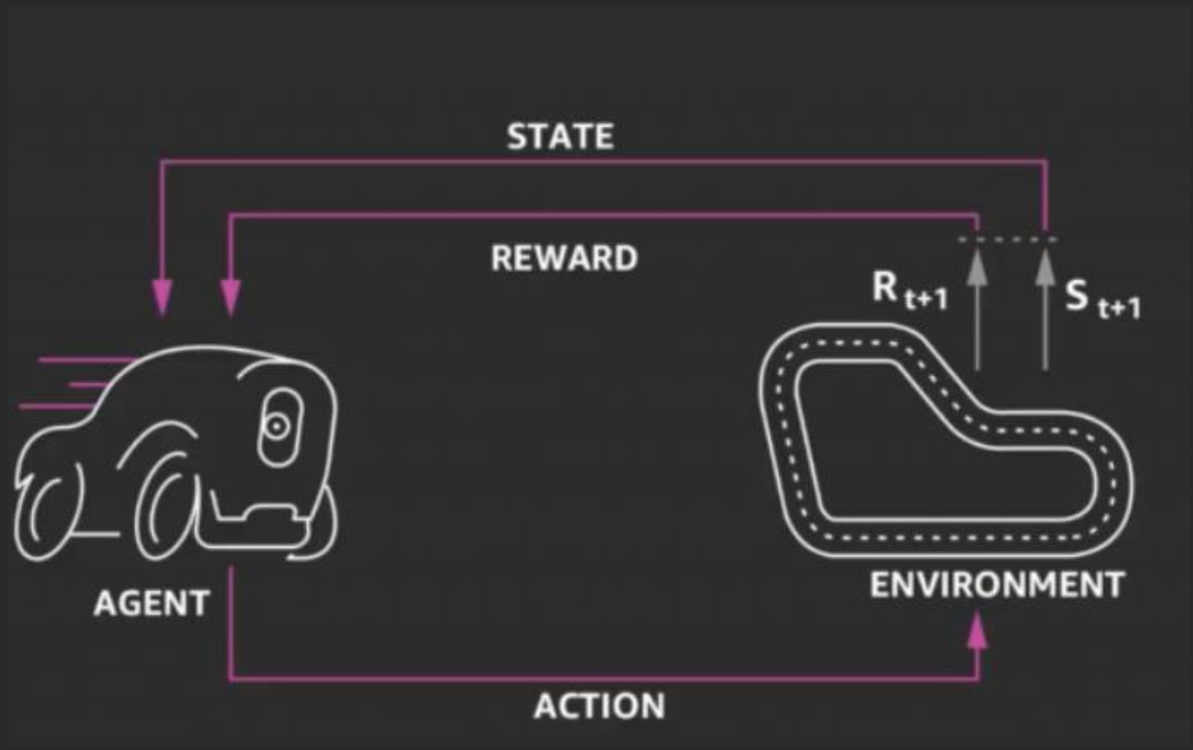


Useful input parameter: Steps

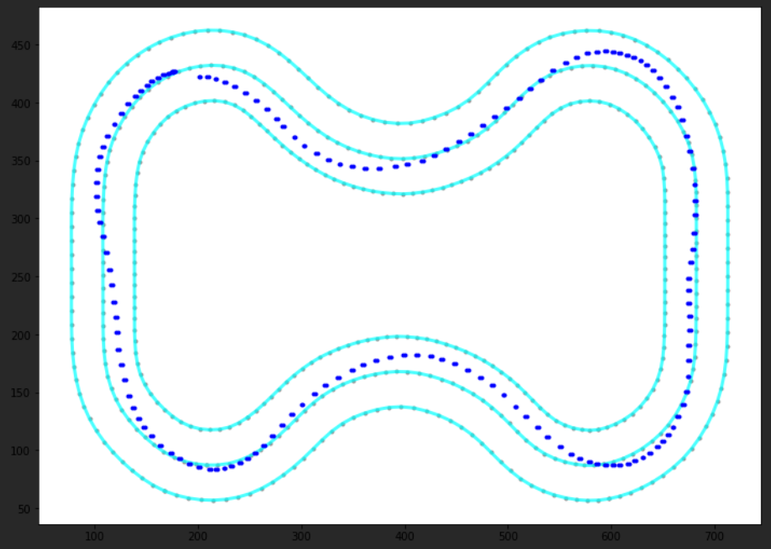


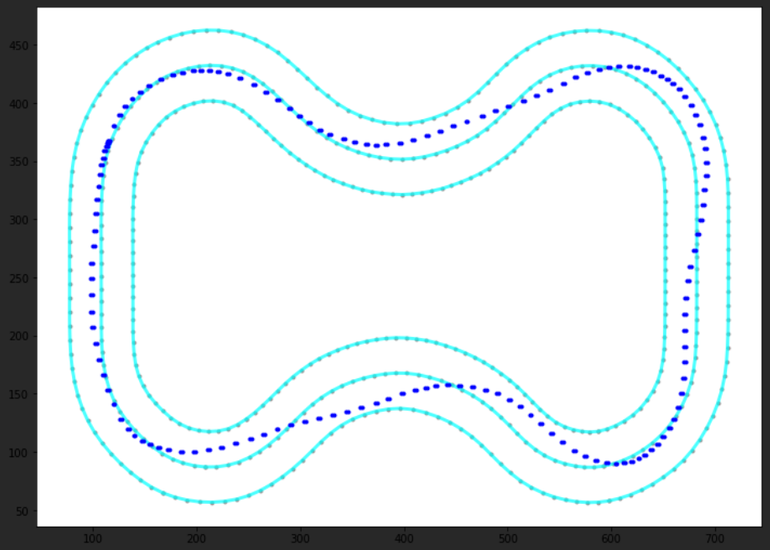
Number of steps completed; will be reset when off track

Easy way to improve the finish time



Comparison and sample code



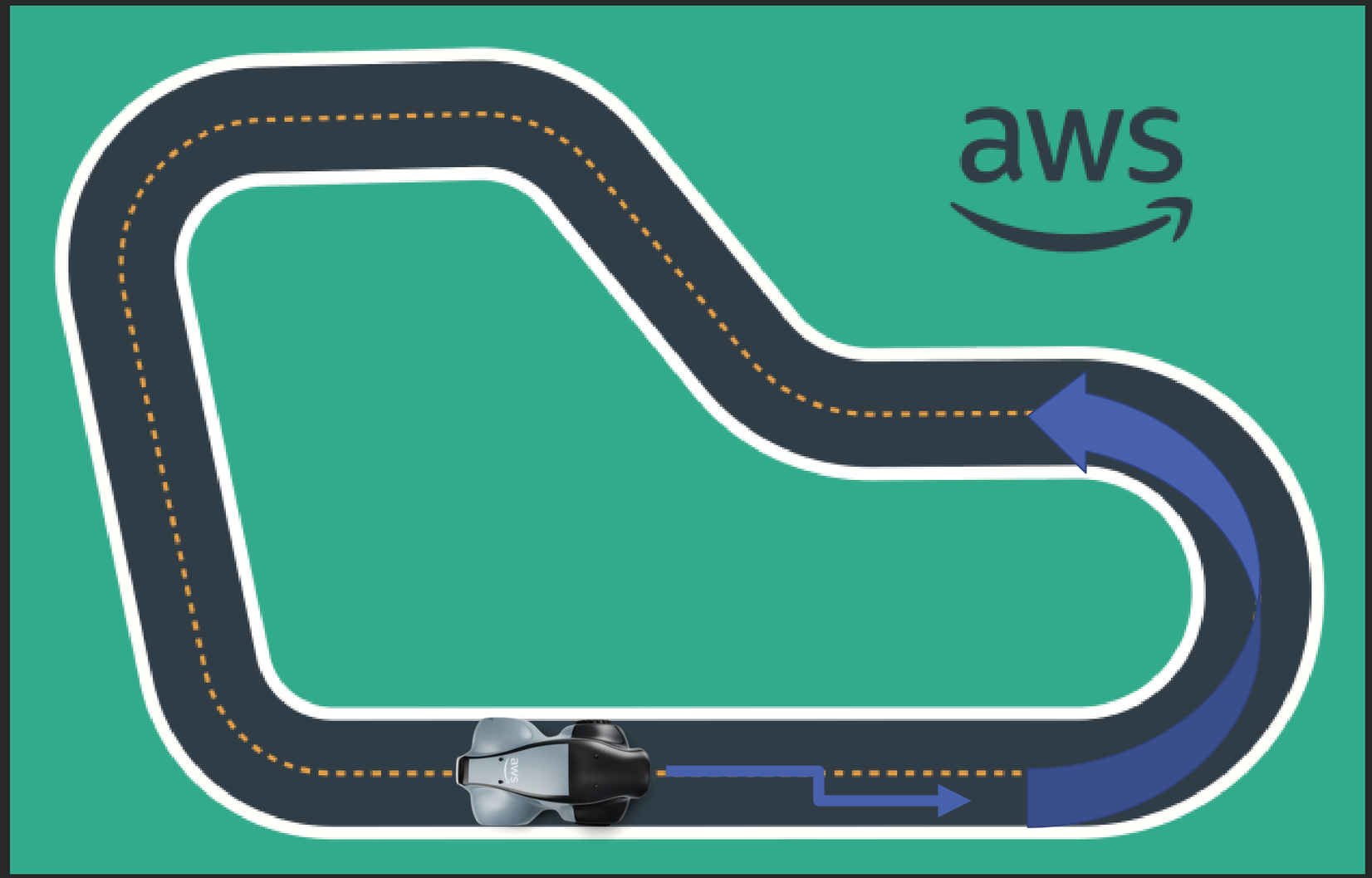



```
16
17      if steps > 0:
18          reward = ((progress*150)/steps)**2
19      else:
20          reward= 1
21
```

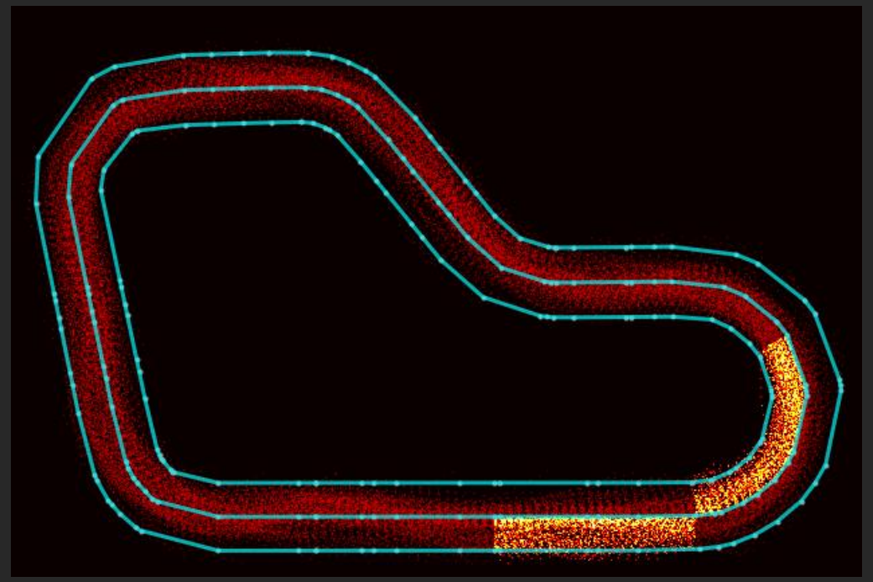
Useful input parameter: Waypoints

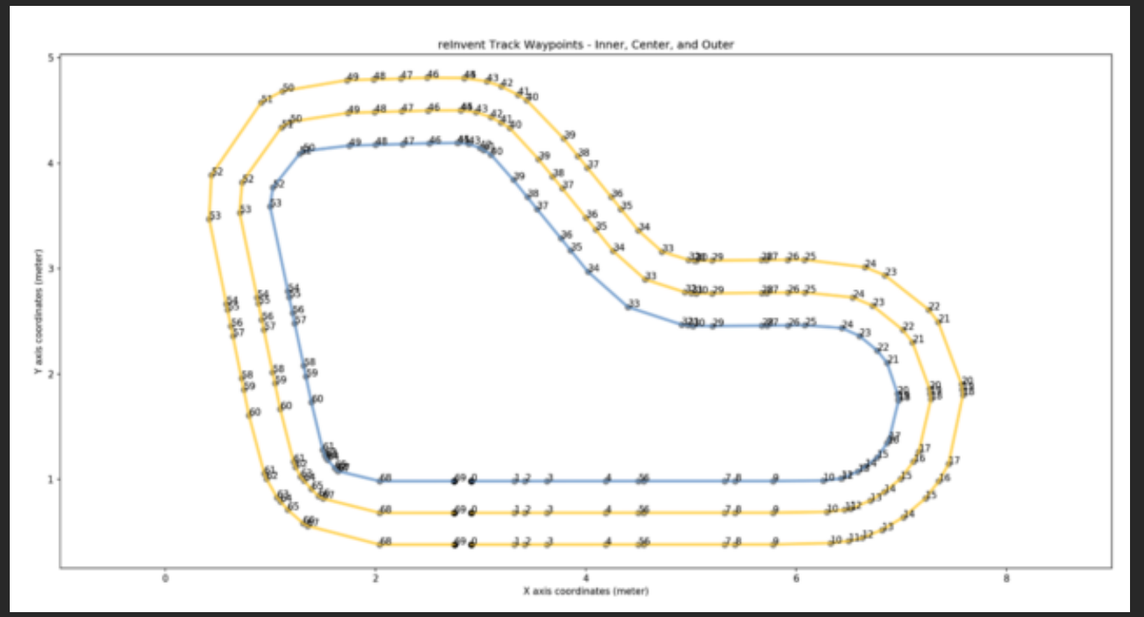
An ordered list of track-dependent max milestones along the track center

Let you set different criteria at different positions



Reward distribution and sample code



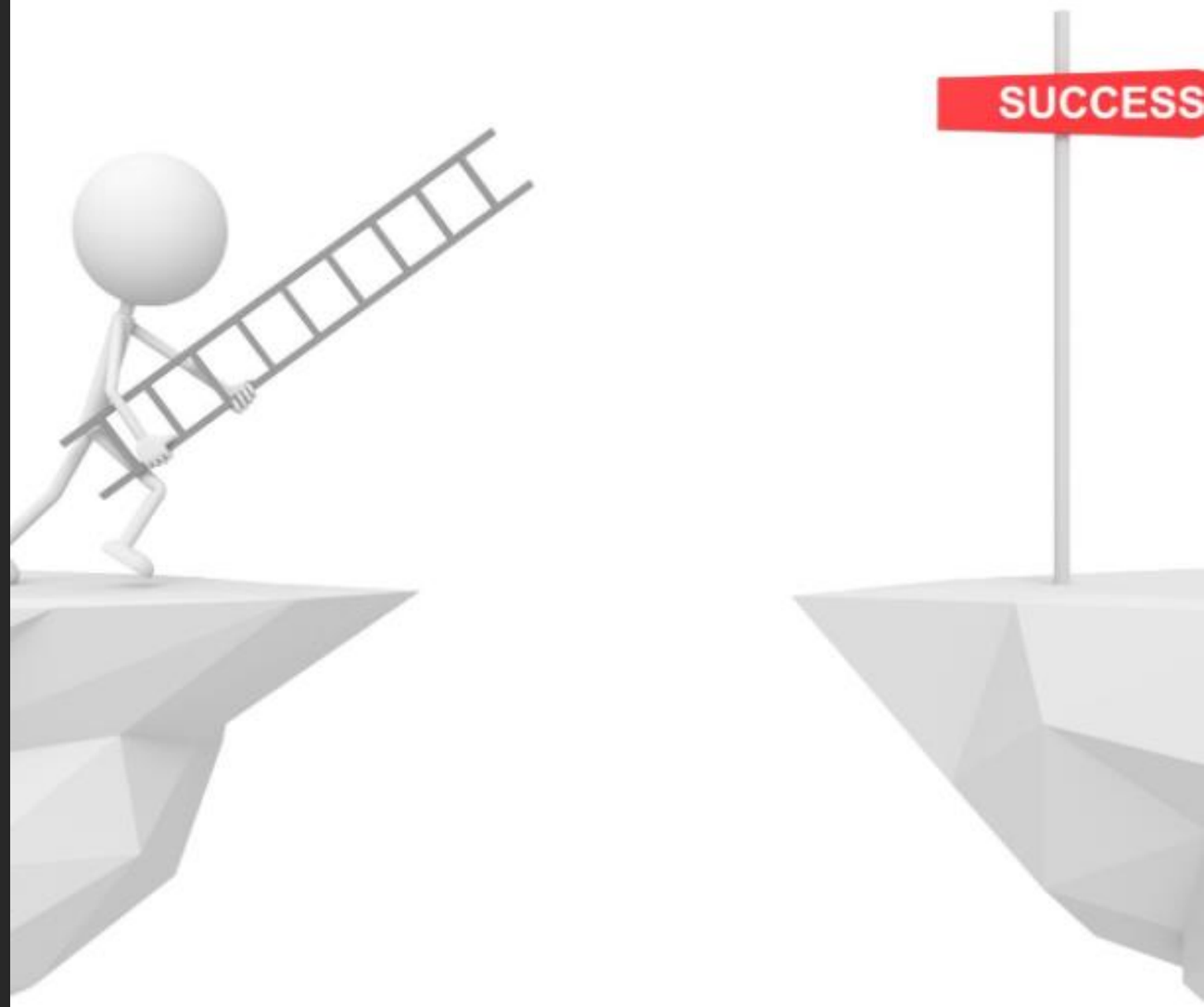



```
21
22      R = [5,6,7,8,9]
23      L = [10,11,12,13,14,15,16,17,18,19,20]
24
25      if (closest_waypoints[0] in (L)) and (is_left_of_center == True):
26          reward = 1
27      elif (closest_waypoints[0] in (R)) and (is_left_of_center == False):
28          reward = 1
29      else:
30          reward = 0.3
31
32
```

Simulation-to-real domain transfer

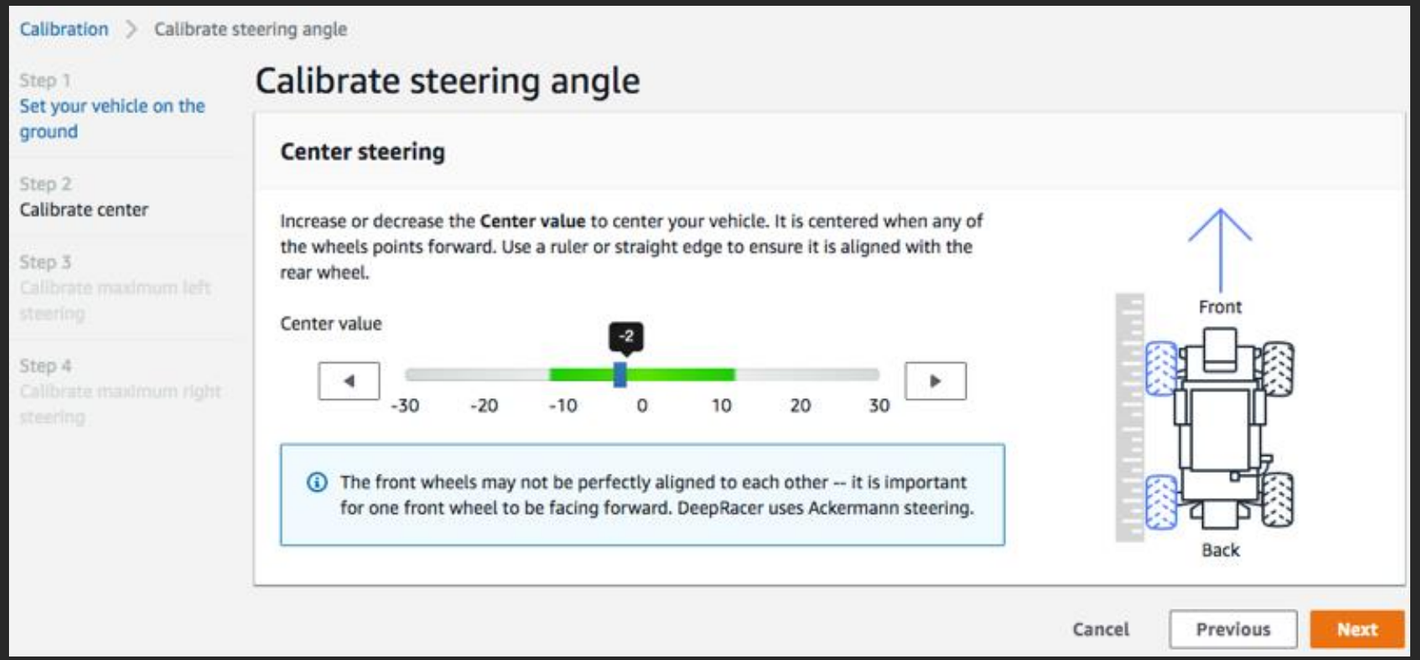
Train model in virtual world using simulated images

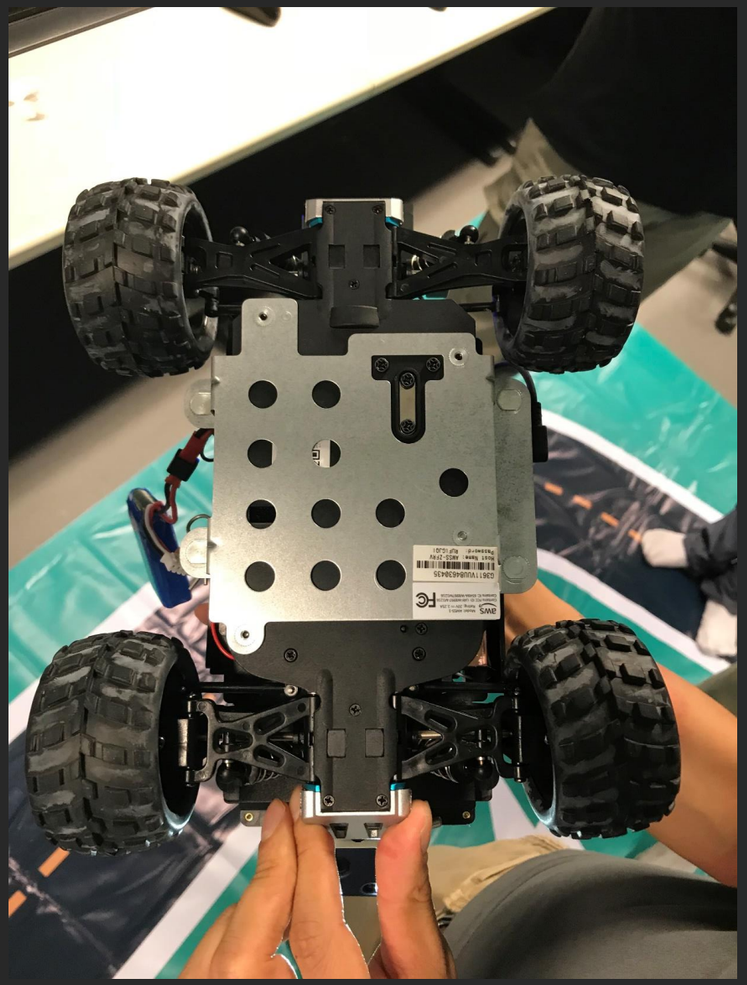
Race model in the real world using real world images



Calibrate first

Calibrate the steering regularly





Surround the track with barrier

Items outside the track may confuse the model and lead to incorrect actions, so we should surround the track with a barrier

Don't use something that is reflective since this may also confuse the model

Reflection of the track

- The reflection of the track will affect the performance of AWS DeepRacer. Aim for matte finish to reduce glare.

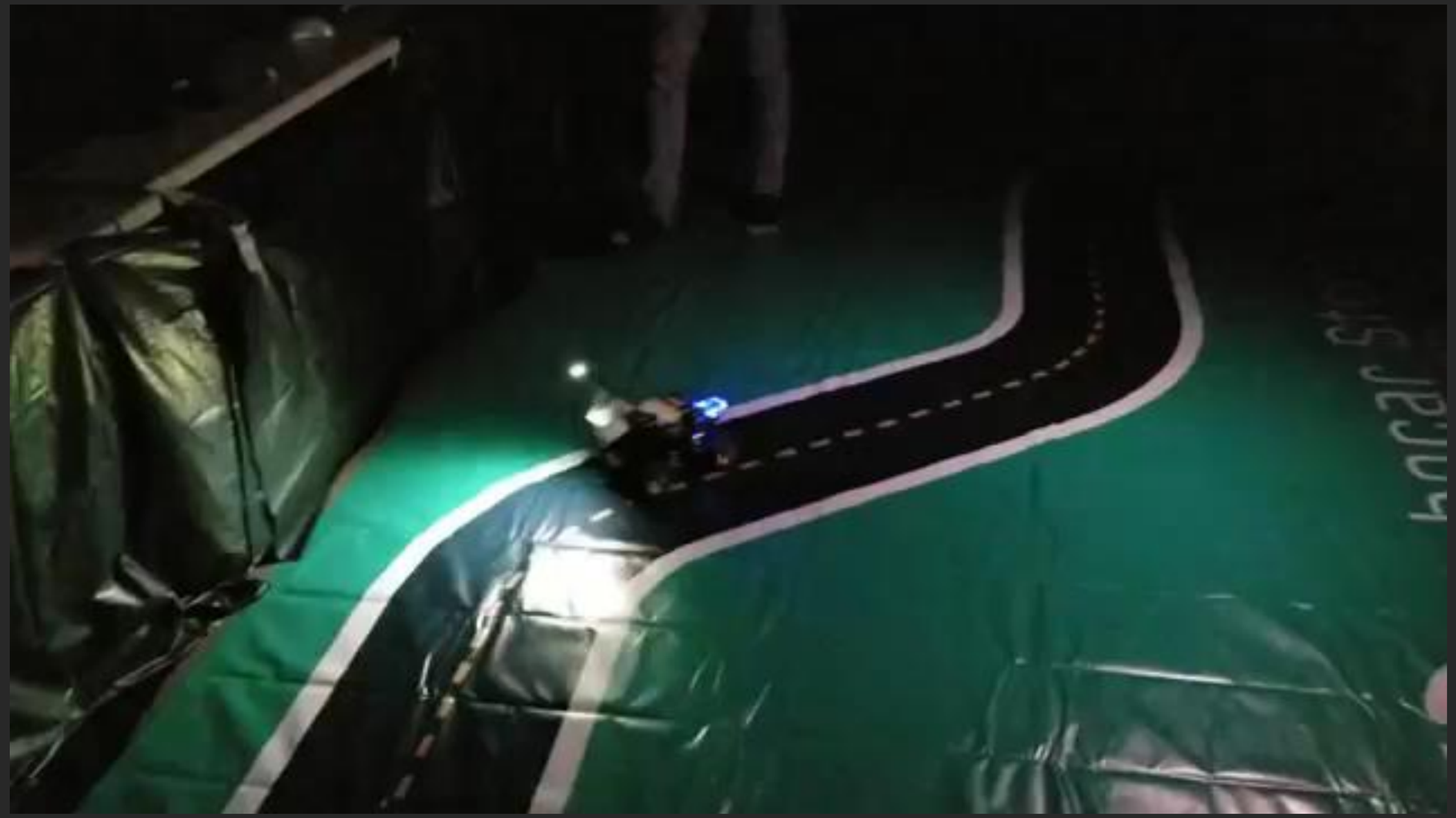
- You can watch streaming from the AWS DeepRacer webpage to understand what DeepRacer really sees.

Midnight AWS DeepRacer

Inspired by the idea of “no server and no server down!”, we get “no light, no reflection!”

You can turn off the lights in the room and install USB-powered headlights at the front of the car if you cannot resolve the reflection issue. You will find the view from the AWS DeepRacer is very similar to the view of the AWS RoboMaker simulator.

First time to finish a lap



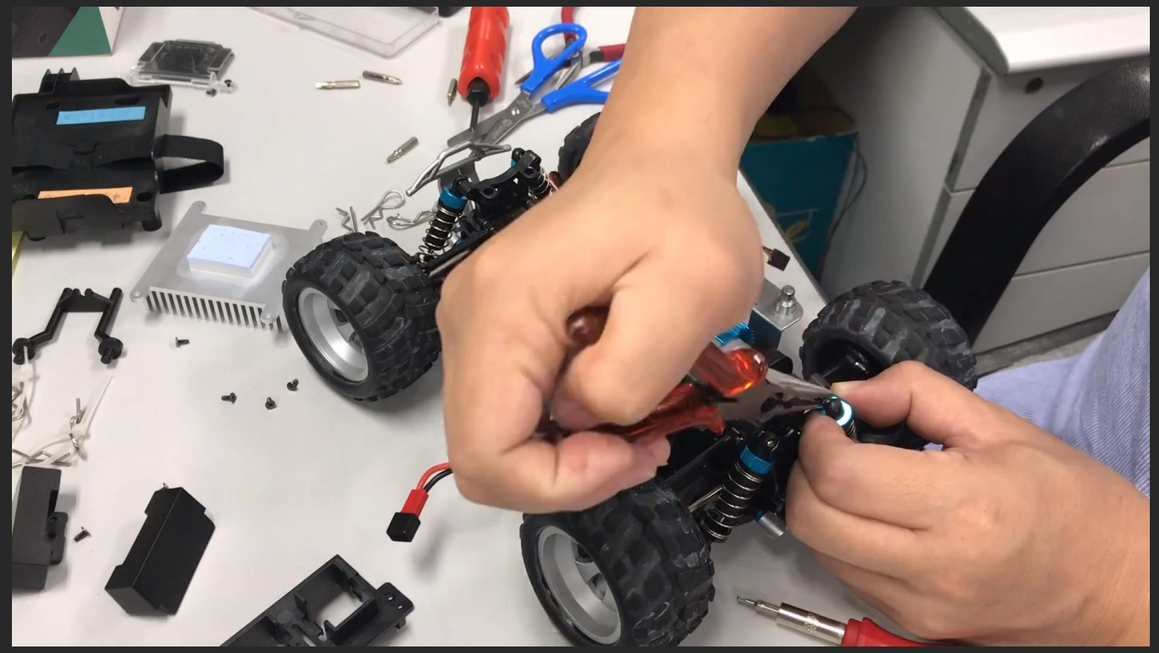
Track size

Follow AWS track specifications when you build the track, which can help prevent glare

Pay attention the size of track if you look at any online providers

AWS DeepRacer is not a bumper car

Another reason to put a barrier around the track is to prevent crashes. Take car of the car.



How to build a powerful reward function with AWS Lambda

AWS re:Invent

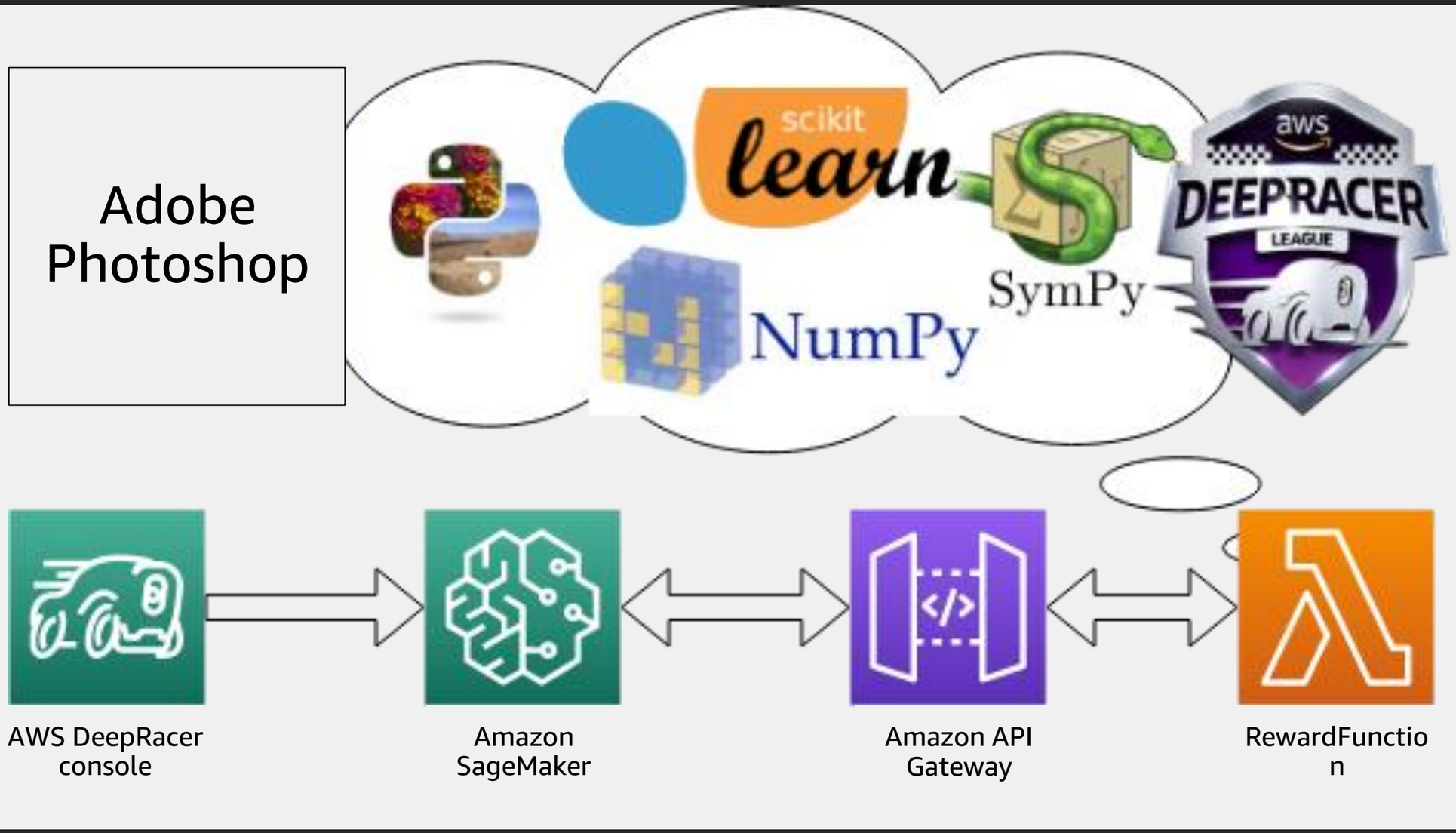
aws

Problem

If you want to build a complex reward function, you may find you need to recode a lot of functions that already exist in other libraries, e.g., geometry

It is undifferentiated heavy lifting!

Solution


Adobe Photoshop
scikit learn
NumPy
SymPy
aws DEEPRACER LEAGUE
AWS DeepRacer console
Amazon SageMaker
Amazon API Gateway
RewardFunctio n

Reward functions makes call to API Gateway only

```
import urllib.request
import urllib.parse
import json
def reward_function(params):
    url = 'https://XXXXX.execute-api.us-east-1.amazonaws.com/Prod/reward/'
    query_string = urllib.parse.urlencode({"json":json.dumps(params)})
    url = url + "?" + query_string
    with urllib.request.urlopen( url ) as response:
        response_text = response.read().decode('utf-8')
        result = json.loads(response_text)
    return float(result["reward"])
```

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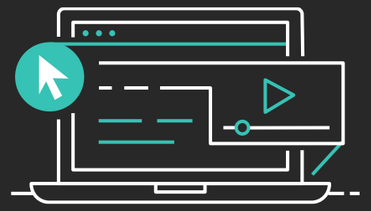

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Thank you!

Mr. Cyrus Wong, Amazon Machine Learning Hero

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