Race Track Env Inspiration

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1 Physical Setup

1.1 The Track

The default track in the race_track environment modeled after typical oval tracks present in the United States (Figure 2), with two straightaways connected by two enormous semi-circular turns.

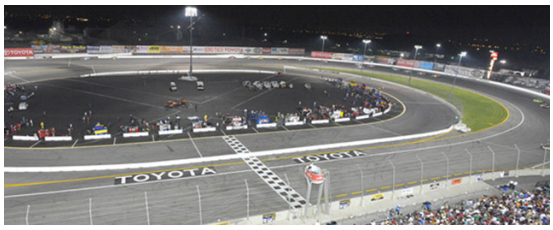

Figure 1: A typical Oval Racetrack (Irwindale Speedway) located Southern California

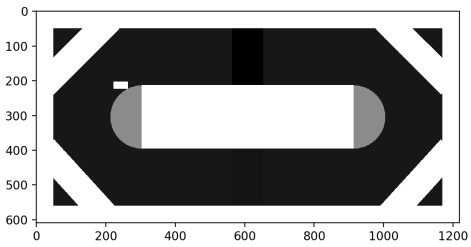

Figure 2: The track environment built to the Gym interface

I decide to build the environment to permit a bird eye view. In this setting, the whole track area is initialized to a two dimensional array, the values are filled in the following way:

- Black areas are the track surfaces, filled with value 0
- White areas in the perimeter and the center are barriers and filled with value 1. In multi-agent mode, the cars will also have value very close to 1, but minor decimal differences to distinguish them from the barriers
- Grey areas are soft shoulders with less traction filled with value 0.5

1.2 The Car

The Car maneuvering agent has two control channels: steering ([-1.0, 1.0]), and throttle ([-1.0, 1.0]). To further demonstrate the non-linearity of control, I will slightly elaborate on the physical properties.

- 1.0 in steering channel means the steering is fully cranked to the right, but if the car is stationary (has speed 0), full steering will not generate movement.
- The car will accelerate when throttle input is above 0 and the current speed is below the fraction of top speed car is running. If the car has speed ≥ 0. In addition, 0.0 in the throttle channel will still cause the car to coast at its previous speed. Negative value in throttle input will cause the car to slow down or stop, but will never put the car in reverse.

Both throttle and steering are subject to physical limitation, which are modeled in the environment in the following way

- If the car attempt to accelerate more aggressively than possible, it will only accelerate up to the limit where traction permit, which is modeled after ”wheel spin” in the real racing world
- If the car attempt to steer more aggressively than possible, it will lose speed and achieve the maximum steering angle allowed by traction, which is modeled after ”under-steer” in the real racing world.

In race_track environment, the location and velocity of the car is updated every 0.1 second in environment-time.

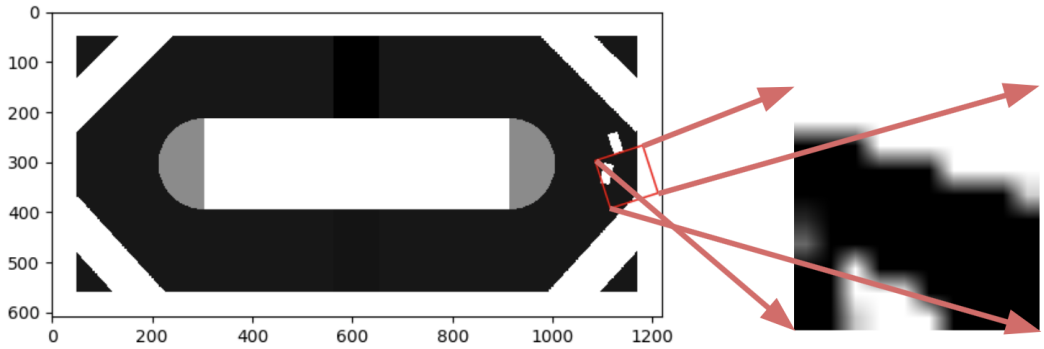

Figure 3: Observation with homography

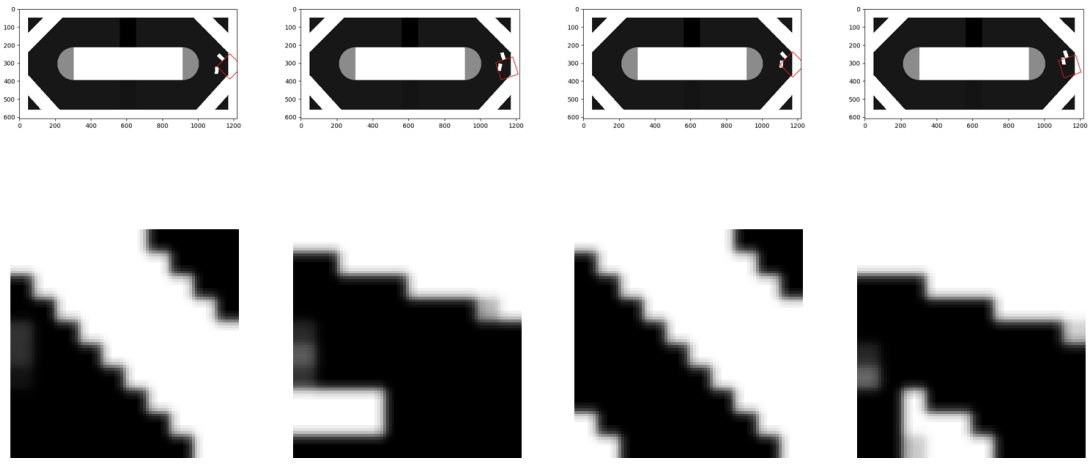

Figure 4: Some examples of observation at consequent time steps