Development Document

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Project: Race car

Project Goal: Develop an agent that can drive around racetracks as quickly as possible.

Development Steps: (Setup)

Cloned the GitHub repo

Added MyAgent.py

Ran the program using this:

python run.py MyAgent.py 8 -g 600

Development Log 1(Till June 4th)

- At first, I just tried to make the car move forward.
- If the obstacle is close to right or left turn away
- If stuck then action =right, accelerate.
- If road is clear go straight and accelerate.

Design Decisions

- Threshold: 1.7 detects close obstacles.
- Speed checks: if speed < 0.2, car is stuck.
- Stuck fix: after 10 steps stuck force the car to turn right and accelerate.
- Obstacles avoid: if front blocked then turn opposite and brake.

Performance Results:

Average speed	0.150
Maximum speed	0.200
Time taken to complete the track	2.03 min

Development Log 2 (June 5)

Goal: Improve speed and total distance covered by changing velocity behaviour.

Design Decisions :

- Set threshold to 1.5 it detects close obstacles. Works better than 1.7.
- Speed checks = If < 0.7, keep speeding.

Code changes:

1. Increased target speed:
   Threshold = from 1.7 to 1.5
   low_speed = from 0.3 0.7

2. Added Else block:
   if velocity<min_velocity:
   if ('straight','accelerate') in possibleActions:
   action=('straight','accelerate')
   elif velocity<low_speed:
   action=('straight','accelerate') if ('straight','accelerate') in possibleActions else action

Tested:

- Set low_speed =0.7 and min_velocity=0.3 =>carshed
- Set low_speed =0.7 and Threshold = 1.6=> carshed
- Set low_speed =0.7 and Threshold = 1.5 => Pass

Observed:

- Car speed
- Whether it crashed
- Time taken for turns

Performance and results:

- Car moved faster covered the track.
- Turns were smoother with much faster speed.
- No crashes in multiple runs.

Average speed	0.180
Maximum speed	0.260
Time taken to complete the track	1.30 min

Development Log 3 (June 6)

Goal: Make car move faster and reduce total time.

Design changes:

- Still using threshold = 1.5 for obstacle checks.
- Added goal_velocity = 3.0 to move with higher speed.
- Let car keep accelerating even when close to goal speed.

Code changes:

1. Set goal_velocity = 3.0
2. In speed control added:

   elif velocity < goal_velocity:

   action = ('straight','accelerate') if ('straight','accelerate') in possibleActions else action

   else:

   action = ('straight','accelerate') if ('straight','accelerate') in possibleActions else action

   (This makes the car always try to accelerate unless the car is already maximum to its speed.)

Testing done:

- Tried different values for goal_velocity.
- Tried with min_velocity:3.0 => crashes
  Observation:
- Sometimes crashes so kept the same min_velocity=0.2
- Checked how long it took to complete.

Performance and results:

- Car moved faster covered the track.

Average speed	0.200
Maximum speed	0.300
Time taken to complete the track	1.15 min

Development Log 4 (June 8)

Goal: Make car smarter at avoiding obstacles and make it faster.

Design Changes:

Threshold : changes to 1.6

Improved **obstacle avoidance** by turning/braking away from close objects.

Code Changes:

1. Set goal_velocity = 8.0, added high_speed_goal_velocity = 11.0, min_velocity = 0.35.
2. Implemented smarter obstacle reactions:

- Turn away from obstacles with braking if very close.
- Coast away when slightly close.

3.Tried to **accelerate straight** when front is clear and speed is below target.

if close_to_left_obstacle and ('right','coast') in possibleActions:

return ('right','coast')

if close_to_right_obstacle and ('left','coast') in possibleActions:

return ('left','coast')

if close_to_front_left_obstacle and ('right','coast') in possibleActions:

return ('right','coast')

if close_to_front_right_obstacle and ('left','coast') in possibleActions:

return ('left','coast'

#This will speed when the front is clear

if front>3.5 and velocity<high_speed_goal_velocity:

if ('straight','accelerate') in possibleActions:

return ('straight','accelerate')

Testing Done:

- Tired Updating min_velocity dynamically it crashed.
- Ran simulation with updated agent logic.
- Measured speed behaviour and completion time

Performance and Results:

- Car is moving fast

Average speed	0.245
Maximum speed	0.350
Time taken to complete the track	1.0min