Assignment – 3
CS 662: Mobile Virtual Reality and Artificial Intelligence
2024

Note: This is a group assignment. Please mention all team member names and roll numbers on your solution. Please submit a single solution per group in pdf format with still photos of your game for different question and their parts. Also, please provide a link to the zipped project folder for Q1 and Q2 via a Google drive link.

Submission Deadline: Submit before 11:59 PM on 25th September 2024.

Question 1: Please do the following in Unity 3D: [10]

a. Make the RollerBall environment as shown in the lecture consisting of a blue floor, green sphere, and a yellow cube.
b. Now, program the sphere to be able to move with heuristic keyboard arrow controls of left – right and forward – back on the floor.
c. Now, add suitable observations for the sphere position, cube (target) position, and velocity of the sphere on the floor. Furthermore, add suitable reward that is delivered when the sphere is able to touch the cube (target). Also, set the actions for the sphere such that it can be controlled by Unity ML agents library.
d. Now, please use the parameter settings in the .yaml file here:

```
behaviors:
  RollerBall:
    trainer_type: ppo
    hyperparameters:
    batch_size: 10
      buffer_size: 100
      learning_rate: 3.0e-
      4 beta: 5.0e-4
      epsilon: 0.2 lambd:
      0.99 num_epoch: 3
    learning_rate_schedule:
    linear beta_schedule:
    constant epsilon_schedule:
    linear network_settings:
    normalize: false
    hidden_units: 128
    num_layers: 2
    reward_signals:
      extrinsic:
```

gamma: 0.99
strength: 1.0
max_steps: 500000
time_horizon: 64
summary_freq: 10000

e. Please train the sphere agent for 50,000 steps and then stop the training by hitting the CTRL + C. Please plot the cumulative reward for this run in TensorBoard.

Question 2: Please do the following in Unity 3D (installing Unity ML Agents): [05]

a. Please take the agent in Q1 above and make the following changes: - Set a -1 reward when the sphere falls out of the floor.
   - Remove the sphere velocity from observations. -
     Make the hidden_units: 64 and num_layers: 1.

b. Now, please train the agent from scratch for 50,000 steps and plot the cumulative rewards in TensorBoard with respect to the cumulative reward in Question 1. What do you infer about the sphere's training in Question 2 with respect to the sphere's training in Question 1?