Project: Navigation

1) Goal:

To train an agent to navigate through an environment which has lots of bananas (blue and yellow colored). The agent should learn to collect as many yellow bananas as possible. A reward of +1 is provided for a yellow banana and -1 for blue banana. A snapshot of the environment is shown in Figure 1. The goal of the agent is to maximize the reward by collecting yellow bananas.

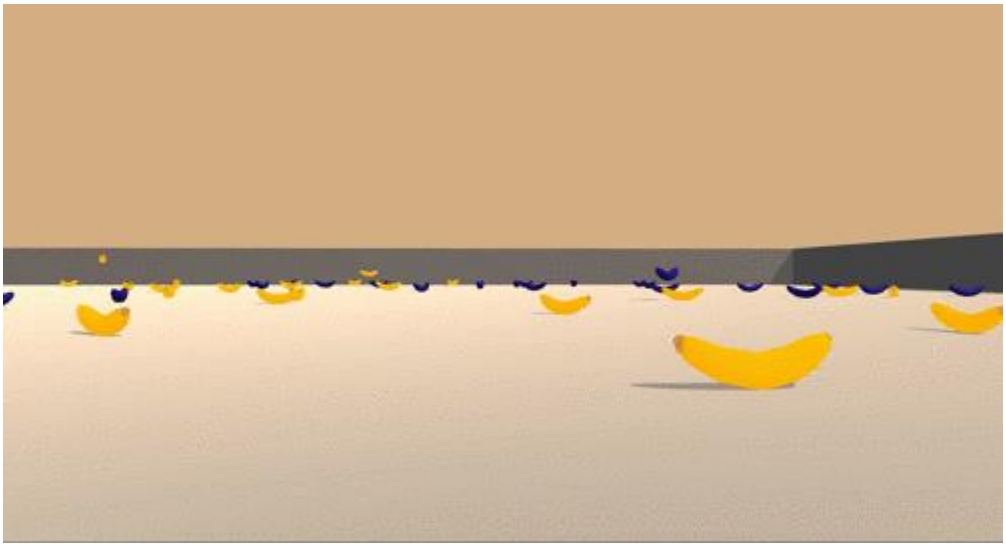


Figure 1 Snapshot of the environment

2) Algorithm:

DQN [4] algorithm was used to solve this environment. State size is 37 (velocity of the agent and ray perception of the objects around it). Action size is 4 (left, right, forward, backward). The architecture used to train this agent is shown in Figure 2.

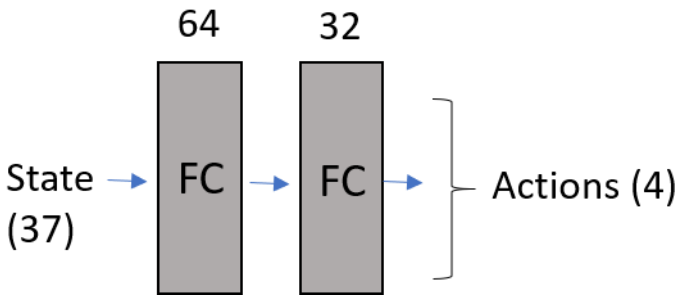


Figure 2 Architecture of the DQN Agent.

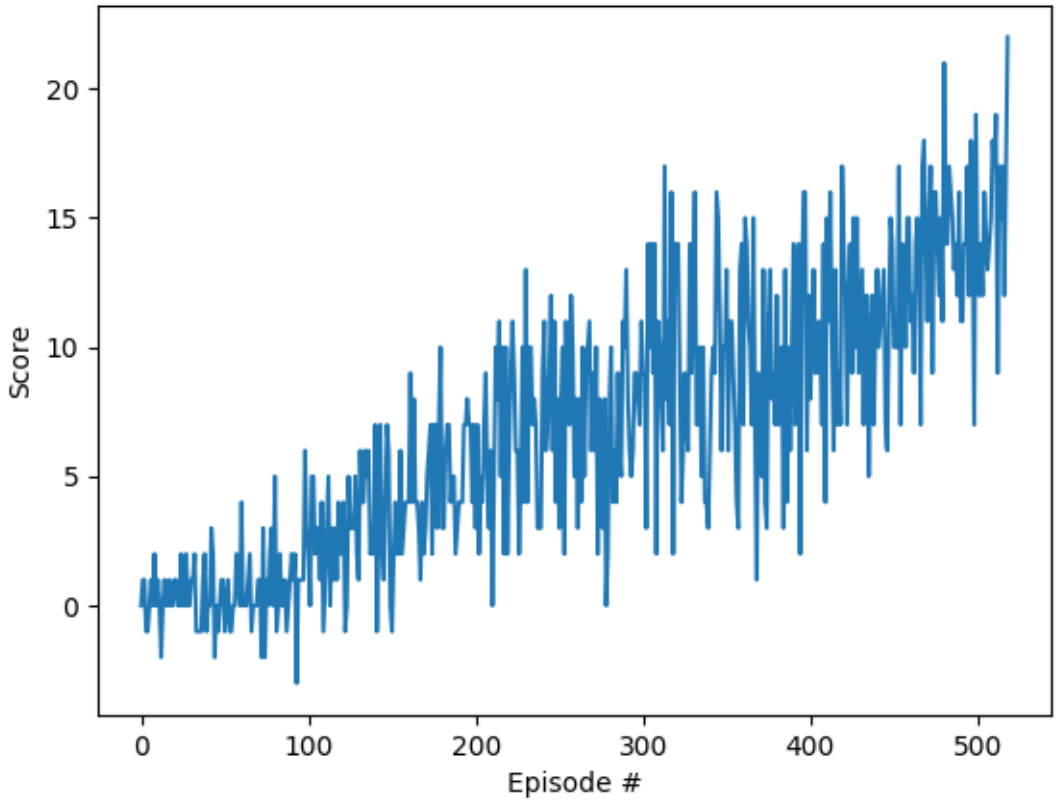
The hyperparameters for the DQN agent are as follows.

- BUFFER_SIZE = int(1e5) # replay buffer size
- BATCH_SIZE = 64 # minibatch size
- GAMMA = 0.99 # discount factor
- TAU = 1e-3 # for soft update of target parameters
- LR = 5e-4 # learning rate
- UPDATE_EVERY = 4 # how often to update the network.

We collect experience (state, action, reward, next_state) tuples and store in a replay buffer. Uniform sampling is performed and at “UPDATE_EVERY” iterations, the model is updated with the corresponding gradient updates.

3) Results:

The rewards plot during training is as shown in Figure 3.



The game was solved in 419 episodes with the average reward of 13.09.

4) Future Work:

- Implement Double DQN [1] and prioritized experience replay [2] techniques to prevent overestimation of Q-values [3].
- Analyze the effect of hyperparameters and architectures on DQN agent learning.
- To add videos of the trained agent and observe the real scores of the agent.

References

1) Van Hasselt, Hado, Arthur Guez, and David Silver. "Deep Reinforcement Learning with Double Q-Learning." In *AAAI*, vol. 2, p. 5. 2016.

2) Schaul, Tom, John Quan, Ioannis Antonoglou, and David Silver. "Prioritized experience replay." arXiv preprint arXiv:1511.05952 (2015).

3) Thrun, Sebastian, and Anton Schwartz. "Issues in using function approximation for reinforcement learning." In Proceedings of the 1993 Connectionist Models Summer School Hillsdale, NJ. Lawrence Erlbaum. 1993.

4) Mnih, Volodymyr, Koray Kavukcuoglu, David Silver, Andrei A. Rusu, Joel Veness, Marc G. Bellemare, Alex Graves et al. "Human-level control through deep reinforcement learning." Nature 518, no. 7540 (2015): 529.