Unit-3

Lab experiments

Self-Driving Car at a 4-Way Intersection using Actor–Critic (A2C)

Aim

To design and simulate a self-driving car navigation agent at a 4-way traffic intersection using an Actor–Critic (A2C) reinforcement learning algorithm such that:

- Waiting time is minimized (reward = −1 per second),

- Collisions are avoided (penalty = −10),

- The agent learns an optimal policy to decide Move / Wait / Turn based on traffic light states.

Algorithm:

A2C combines **policy learning (Actor)** and **value estimation (Critic)**.

Key Components

- **Actor:** Learns policy $\pi(a \mid s)$
- **Critic:** Learns value function $V(s)$

Advantage Function

$$A(s_t, a_t) = r_t + \gamma V(s_{t+1}) - V(s_t)$$

Actor Update

$$\nabla_\theta J(\theta) = \nabla_\theta \log \pi_\theta(a_t \mid s_t) \cdot A(s_t, a_t)$$

Critic Update

$$L = (r_t + \gamma V(s_{t+1}) - V(s_t))^2$$

Code Github Link:

https://github.com/syekumar/MLA0316-Reinforcement-learning-

Output:

```
======== RESTART: C:/Users/Sye Kumar/OneDr:
Episode   0 | Reward:   0 | Collisions: 0
Episode  20 | Reward:  -8 | Collisions: 0
Episode  40 | Reward:   4 | Collisions: 0
Episode  60 | Reward:   5 | Collisions: 0
Episode  80 | Reward:   2 | Collisions: 0
Episode 100 | Reward: -11 | Collisions: 0
Episode 120 | Reward:   1 | Collisions: 0
Episode 140 | Reward:   4 | Collisions: 0
Episode 160 | Reward:   0 | Collisions: 0
Episode 180 | Reward:   5 | Collisions: 0
```

Result:

The Actor–Critic (A2C) based self-driving car agent was successfully trained to navigate a four-way intersection with traffic lights.