

# Assignment 1: Implementing DQN Agent for CartPole-v1 Environment

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## Objective:

In this assignment, you will train and assess a Deep Q-network (DQN) agent to solve the CartPole-v1 environment. Initially, you will implement simple policies (where the current state directly determines actions) to understand the environment's behavior. Then, you will use the DQN agent to train it and enable it to solve the environment.

## Policies and Their Implementation

### 1. Angle-Based Policy

Action:

- If the pole's angle is negative, move the cart left (action 0).
- Otherwise, move the cart right (action 1).

Threshold: 0 (angle of the pole).

### 2. Position-Based Policy

Action:

- If the cart's position is negative, move the cart left (action 0).
- Otherwise, move the cart right (action 1).

Threshold: 0 (position of the cart).

### 3. Velocity-Based Policy

Action:

- If the cart's velocity is negative, move the cart left (action 0).
- Otherwise, move the cart right (action 1).

Threshold: 0 (velocity of the cart).

### 4. Combined Policy (Angle + Velocity)

Action:

- If the pole's angle and the cart's velocity are negative, move the cart left (action 0).
- If the pole's angle and the cart's velocity are positive, move the cart right (action 1).
- Otherwise, choose a random action (either 0 or 1).

Thresholds:

- Angle: 0 (angle of the pole).
- Velocity: 0 (velocity of the cart). <https://forms.gle/axRQz1Lik84dA4u89>

## DQN Agent

### Model:

Build a neural network with 2 hidden layers of 24 units each and a linear activation function in the output layer to predict Q-values.

### Agent:

Use **BoltzmannQPolicy** to select actions based on Q-values.

Use **SequentialMemory** to store experiences with a limit of 50,000 steps.

### Training:

Compile the agent with the Adam optimizer and a learning rate of 0.001.

Test the trained agent over 100 episodes.

### Evaluation:

Test the trained agent by running it for 100 episodes and print the average reward across all episodes.

Visualize the trained agent interacting with the environment for 20 episodes to see the performance.

You can refer to [OpenAI Gym Documentation](#) to understand the CartPole-v1 environment.

## Submission

Please submit your work [here](#). The Deadline for this assignment is 30<sup>th</sup> December