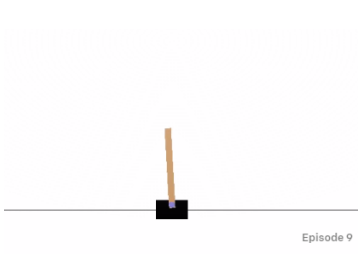
Term-project **Train Q-learning or Deep Q-Network (DQN) to balance Open AI CartPole**

Due date 2023-June-05

1. **Introduction :**



Open AI CartPole : A pole is attached by an unactuated joint to a cart, which moves along a frictionless track. The system is controlled by applying a force of +1 or -1 to the cart. The pendulum starts upright, and the goal is to prevent it from falling over. A reward of +1 is provided for every timestep that the pole remains upright. The episode ends when the pole is more than 15 degrees from vertical or the cart moves more than 2.4 units from the center. (https://gym.openai.com/envs/CartPole-v1/)

The objective of this task is to apply forces to a cart moving along the track to keep a pole hinged to the cart from falling over: A failure is said to occur if the pole falls, the pole is reset to vertical after each failure. This task could be treated as episodic, where the natural episodes are the repeated attempts to balance the pole. For parameters like discount rate, select a proper value by yourself.

2. **Implementation:**

   First of all, Implement a working SW code of value based methods to balance Open AI CartPole.
   When you implement, You can use any of SW framework to train the Open AI Cartpole and select proper value of parameters like discount factor by yourself to train the Cartpole efficiently.
   To balance Open AI CartPole, SW code with
   (1) Q-learning, (2) Deep Q-Network (DQN),

   (3) Policy Gradient methods

3. **Experiments and performance Evaluation:** Once you have a working implementation of RL with four different methods, you will run experiments to get a feel for how different algorithms impact the performance of Open AI CartPole.
   A. How fast do the RL networks learn? (refer from Fig. 3 to Fig. 8 in the attached article, Balancing a CartPole System with Reinforcement Learning - A Tutorial, by Swagat Kumar)
   B. Analyze and discuss the Advantage and disadvantages of each method.

4. **Your report** should be a document containing (submitting zip file with pdf format report)

   A. All graphs and answers to short explanations and questions requested for Experiments and evaluation.
   B. Program code and command-line expressions you used to run your experiments.

########## **The End of Question** ##########