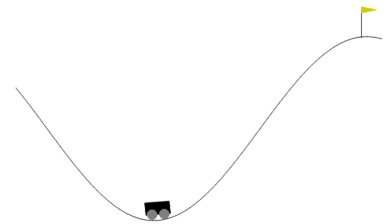


# Advanced Reinforcement Learning for the Mountain Car Problem

*Shicheng Zhou's Project Proposal for CSCI5525*

## Motivation:

The Mountain Car problem is a classic reinforcement learning environment where an underpowered car must find a way to reach the flag at the top of a mountain. The car doesn't have enough power to drive up the mountain directly, so it must learn to leverage momentum by rocking back and forth. This problem serves as a benchmark for many reinforcement learning algorithms and provides a platform to explore advanced techniques in the field.



## Problem to Solve:

The primary challenge is to train an agent that can solve the Mountain Car problem in the least number of steps. The agent should be able to learn an optimal policy that allows the car to reach the flag efficiently.

## Why Use Machine Learning?:

Traditional rule-based or heuristic methods may not be able to find the optimal strategy for this problem due to its continuous state space and the need to leverage momentum. Machine learning, specifically reinforcement learning, allows the agent to learn from its interactions with the environment and adapt its strategy over time to improve performance.

## Initial Idea on How to Solve It/Algorithms:

While basic Q-learning can provide a solution, we aim to explore more advanced algorithms. The idea is to leverage neural networks to approximate the Q-values or policies and compare the performance of these algorithms on the Mountain Car problem.

## Data Needed:

The primary data source will be the interactions of the agent with the OpenAI Gym's Mountain Car environment. Each interaction provides a state, action, reward, and next state tuple, which will be used to train and update our models.

## Implementation Plan:

1. Set up the Mountain Car environment using OpenAI Gym.
2. Implement the basic Q-learning algorithm as a baseline.
3. Implement and train agents using advanced algorithm