Introduction to Reinforcement Learning Course - Course's Structure

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This course offers a comprehensive introduction to the principles and practices of Reinforcement Learning (RL), blending theoretical foundations with practical applications. The course is designed for students with a background in mathematics and programming who are interested in exploring the field of RL.

Course Outline

In this course, we will have 12 lectures of 1.5 hours (45 minutes, 15-minute breaks, 45 minutes). In addition, 3 asynchronous coding lectures (45 minutes each) will be provided using the course's website. The Students
The lectures' subjects are as follows:

- **Lecture 1: Introduction to Reinforcement Learning**
  An overview of RL concepts, including key definitions, problem formulations, and the required mathematical and programming background.
- **Lecture 2: Tabular MDP Planning & RL Policy Evaluation**
  Dive into Markov Decision Processes (MDPs) and explore tabular methods for planning and policy evaluation in RL.
- **Lecture 3: Q-learning**
  Study Q-learning, one of the most widely used model-free RL algorithms, focusing on its implementation and convergence properties.
- **Lectures 4-6: Policy Gradient Methods**
  A three-part series covering Policy Gradient methods, starting from the basics and advancing to more complex variations, including actor-critic methods.
- **Lecture 7: Imitation Learning**
  Learn about Imitation Learning techniques, where the goal is to mimic expert behavior using RL frameworks.
- **Lecture 8: Rewards in RL**
  Explore the design and implications of reward structures in RL, understanding how they influence agent behavior and learning outcomes.
- **Lectures 9-10: Deep Reinforcement Learning**
  Introduction to Deep RL, combining deep learning with RL techniques to solve high-dimensional and complex tasks.
- **Lecture 11: Data Efficient RL**
  Discuss strategies and algorithms for improving data efficiency in RL, making it possible to learn from fewer interactions.
- **Lecture 12: RL Evaluation**
  Learn how to evaluate RL models and algorithms effectively, focusing on performance metrics and benchmarking.

The asynchronous coding lectures' subjects are as follows:

- Designing and implementing the realistic model and simulation to train the RL model.
- Comparing RL algorithms and fine-tuning their hyperparameters.
- Debugging multi-objective multi-agent RL models.