The Hong Kong University of Science and Technology

UG Course Syllabus

[Course Title] Reinforcement Learning

[Course Code] COMP4901Z

[No. of Credits] 3

[Any pre-/co-requisites]

Math: You should have some background in Linear Algebra and Probability.
Machine Learning: Basic machine learning knowledge (e.g., gradient backpropagation) and deep learning knowledge (e.g., MLP) as needed.
Programming: Python, PyTorch (better)

Name: [Instructor(s) Name] CHEN, Long

Email: [Your Email Address] longchen@ust.hk

Course Description

[Briefly describe the course content, key topics or themes, objectives, methods of instruction, e.g., lectures, discussions, projects].

Reinforcement learning (RL) is a computational learning approach where an agent tries to maximize the total amount reward it receives while interacting with the complex and uncertain environment. It not only shows strong performance in lots of games (such as Go), but also becomes an essential technique in many today's real-world applications (such as LLM training, embodied AI). This course aims to teach the fundamentals and the advanced topics of RL. The course content includes the introduction of basic RL elements (including MDP, dynamic programming, policy iteration), value-based approaches (DQN), policy-based approaches (policy gradient), model-based RL, multi-agent RL, other advanced topics, and the applications of RL techniques in today's computer vision or AI applications. To better enhance the understanding, we will also contain some Python/Pytorch implementations.

Syllabus

- Markov Decision Processes
- Dynamic Programming
- Monte Carlo and Temporal Difference Learning
- Q-Learning
- DQN and advanced techniques
- Policy Gradient
- Actor Critic
- Advanced Policy Gradient
- Continuous Controls
- Imitation Learning
- Model-based RL

- Multi-Agent RL
- RL in CV/NLP (e.g., RLHF)

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage]

Assessment Task	Contribution to Overall Course grade (%)
In-class Quiz	20%
Assignment	30%
Final examination	50%

Required Texts and Materials

[List required textbooks, readings, and any other materials]

Richard S. Sutton. Reinforcement Learning: An Introduction. Second Edition.

[Optional] Additional Resources

[List any additional resources, such as online platforms, library resources, etc.]