Name of the Course : M.Sc. Data Science

Course Code : CSD-509

Title of the Course : Reinforcement Learning (Practical)

Number of Credits : 2 (0L-0T-2P)

Contact hours : 60 hours (0L-0T-60P)

Effective from AY : 2023-24

Pre-requisites for the course	Linear algebra, multivariable calculus, Basic machine learning knowledge and programming background.	
Course Objectives	To understand the theory by carrying out the lab assignment based on the key ideas of reinforcement learning.	
Content	1. RL task formulation (action space, state space, environment definition)	**7 hours**
	2. Tabular based solutions (dynamic programming, Monte Carlo, temporal-difference)	**7 hours**
	3. Function approximation solutions (Deep Q-networks)	**7 hours**
	4. Policy gradient from basic (REINFORCE) towards advanced topics (proximal policy optimization, deep deterministic policy gradient, etc.)	**7 hours**
	5. Model-based reinforcement learning	**7 hours**
	6. Imitation learning (behavioral cloning, inverse RL, generative adversarial imitation learning)	**7 hours**
	7. Meta-learning	**8 hours**
	8. Multi-agent learning, partial observable environments	**10 hours**
Pedagogy	Lab assignments/ mini project	

References/ Readings	1. Sutton, R. S., & Barto, A. G. (2018). Reinforcement learning: An introduction. MIT press. 2. Li, S. E. (2023). Deep reinforcement learning. In Reinforcement Learning for Sequential Decision and Optimal Control (pp. 365-402). Singapore: Springer Nature Singapore.). 3. Wiering, M. A., & Van Otterlo, M. (2012). Reinforcement learning. Adaptation, learning, and optimization, 12(3), 729. 4. Russell, S. J., & Norvig, P. (2010). Artificial intelligence a modern approach. London. 5. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press. 6. David Silver's course on Reinforcement Learning (link).
Course Outcomes	1. Practical implementation of reinforcement learning algorithms in lab exercises. 2. Experimental evaluation and analysis of reinforcement learning algorithms. 3. Application of reinforcement learning techniques to real-world problems. 4. Systematic problem-solving approach in reinforcement learning.

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