

Review of Coursera Reinforcement Learning Specialization [NOTES]

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1. Reinforcement Learning Specialization

- <https://www.coursera.org/specializations/reinforcement-learning>
- From University of Alberta, Canada
- Taught by professors Martha White and Adam White, a husband/wife team.
- Highly rated: 4.7/5.0 overall
- First 3 Courses: 4.8/5.0
- Capstone project 4.6/5.0
- Course says 4-6 hrs/week work, however, my experience is 10 hrs/week, but I am reading more of the book, taking detailed notes and thinking about how to use the material for presentations and future projects.

2. If you are interested in reinforcement learning, this is a high-quality resource.

- The course provides a broad overview of RL presenting basic principles and a survey of fundamental algorithms.
- It finishes with a soup-to-nuts project combining RL and neural networks.
- It closely follows the book: "Reinforcement Learning: An Introduction" by Sutton and Barto, the "bible" of RL.
- Rich Sutton is a professor at University of Alberta and is a resource for the course.
- The teachers are clear and organized.
- The quizzes and projects are substantial and help you learn the material.
- While the course does not cover every aspect of the book, it gives you enough background so that you can read the rest of it.
- The course provides Python software called **rl-glue**, which provides a framework for combining an RL agent and an environment for development and testing.

3. Video:

- Course 3: 2.10 Deep Reinforcement Learning – David Silver

4. The Book: *Reinforcement Learning: An Introduction*

- <http://incompleteideas.net/book/RLbook2020.pdf>

5. First Two Courses Use State Tables

- **Course 1: Fundamentals of Reinforcement Learning**
 - <https://www.coursera.org/learn/fundamentals-of-reinforcement-learning>
 - From chapters 2, 3, 4
 - K-armed Bandits
 - Markov Decision Processes
 - Value Functions and Bellman Equations
- **Course 2: Sample-based Learning Methods**
 - <https://www.coursera.org/learn/sample-based-learning-methods>
 - From chapters 5, 6 and 8
 - Monte-Carlo Methods
 - Temporal Difference Learning
 - Model-free algorithms
 - SARSA algorithm (on-policy, learn optimal policy)
 - Q-learning algorithm (off-policy, learn optimal policy)
 - Expected SARSA algorithm (off-policy, learn expected policy)
 - DynaQ algorithm (Q-learning with sample-based model)

6. Last Two Courses Use Function Approximation

- **Course 3: Prediction and Control with Function Approximation**
 - <https://www.coursera.org/learn/prediction-control-function-approximation>
 - From chapters 9, 10 and 13
 - Parameterized functions
 - Gradient descent
 - State aggregation
 - Constructing Features
 - Coarse coding
 - Tile coding
 - Neural Networks
 - Deep NNs
 - Algorithms
 - Episodic SARSA with function approximation
 - Expected SARSA with function approximation
 - Average Reward
 - Policy Gradient
 - Learn policies directly
 - Actor-Critic algorithm
- **Course 4: A Complete Reinforcement Learning System (Capstone)**
 - <https://www.coursera.org/learn/complete-reinforcement-learning-system>
 - Formalize problem as a Markov Decision Process
 - Choose an algorithm
 - Identify key performance parameters
 - Implement an agent
 - Study parameters

7. RL-GLUE

- Example: assignment C2M3
- A set of classes for combining an RL agent and an environment for development and testing.
- The code simple and clean.
- Gives you a simple model that you can use directly and to help understanding more sophisticated frameworks.
- *agent.py* provides an abstract class *BaseAgent* that you instantiate.
- *environment.py* provides abstract class *BaseEnvironment* that you instantiate.
- *rl_glue.py* joins them together.

8. Videos: The reward hypothesis (15m 10s)

- Course 1: 2.3 The goal of reinforcement learning (3m 8s)
- Course 1: 2.4 The reward hypothesis – Michael Littman (12m 2s)

9. Videos: Temporal Difference Learning (11m 14s)

- Course 2: 3.1 What is Temporal Difference Learning? (4m 56s)
- Course 2: 3.2 The Importance of Temporal Difference Learning (6m 28s)

10. Videos: The History of Reinforcement Learning: Barto and Sutton (20m 6s)

- Course 1: 3.3 Rich Sutton and Andy Barto: A Brief History of RL (7m 57s)
- Course 2: 3.5 Andy Barto and Rich Sutton: More on the History of RL (12m 9s)