

CISC 8999 Reinforcement Learning

Spring 2019

(3 Credits)

Instructor: Damian M. Lyons, dlyons@cis.fordham.edu, x4485

Course Dates: Jan 14 to May 18, 2019.

Course Times: Thursday 4:00-5:00pm in LL 610A

Location: **TBA**

Office Hours: Thursday 3:00-4:00pm in LL 610A & by appt.

Texts: *Reinforcement Learning: An Introduction*, Richard S. Sutton and Andrew G. Barto Second Edition, MIT Press, Cambridge, MA, 2018
Artificial Intelligence: A Modern Approach. Peter Norvig and Stuart J. Russell. 3rd Edition, Prentice-Hall 2010.

Supplemental: Blackboard content including articles and references.

Course Description: Reinforcement learning is a powerful paradigm by which artificially intelligent agents can learn to make good decisions. RL is relevant to an enormous range of tasks, including robotics, game playing, consumer modeling and healthcare. This class will provide a solid introduction to the field of reinforcement learning and students will learn about the core challenges and approaches, including generalization and exploration. Students will become well versed in key ideas and techniques for RL. The class will be project oriented. Assignments will include the basics of reinforcement learning as well as imitation learning and deep reinforcement learning. In addition, students will advance their understanding and the field of RL through an open-ended class project.

Prerequisites: CS1, CS2 & Data Structures or equivalent course or work experience.

Specific Goals for the Course: The student will demonstrate the ability to

- Define how RL differs from AI and other kinds of ML
- Given an application, formulate as an RL problem
- Decide which RL algorithms are best suited for an application
- Implement some common RL algorithms
- Apply RL methods in a non-trivial individual research project

Policies:

- Communications for the class will take place through Blackboard.
- Class attendance is mandatory. However, illness, injuries and job interviews happen. Please inform the instructor of any absence, in advance if possible. If you miss class, get notes from a classmate. **If you feel you are falling behind, please contact the instructor and arrange for a meeting.** It's better to ask for help sooner rather than later!
- You may discuss any of the assignments with your classmates (or anyone else) but all the class work you submit should be your own. **Any sharing or copying of assignments will be considered plagiarism.**
- Failure to cite sources is plagiarism. The internet may be used for doing background research but not to solve homework problems; that is also plagiarism and will be treated as such.
- No late assignments or make-ups without the *prior* agreement of instructor and without very strong cause.
- Assignments will be approximately every two weeks. The written portions should be answered in good English (i.e., complete sentences, correct spelling, etc).
- **Your first assignment will contain the information for submission of programming assignments.**
- Content and submission of final project reports needs to follow the procedure in the final projects handout. Unless otherwise agreed, any submitted code must follow the general guidelines for submitting programming assignments (e.g., must work on Erdos etc).
- Any student with a disability who may need accommodations in this class must present the instructor with an accommodation letter from the Office of Disability Services (718) 817-0655/(212)636-6282.

Grading:

- Assignments 60%
- Final Project 40%

Brief, approximate list of topics to be covered and when (This is a guideline only and may change due to events during semester):

Week of	Topic
1 1/17	AI, Machine Learning, Reinforcement learning

2 1/24	Multiarmed bandits <i>Project description due</i> <i>Assignment 1 Out</i>
3 1/31	Markov Processes/AIMA
4 2/7	Markov Processes/Sutton <i>Assignment 1 Due.</i> <i>Assignment 2 Out</i>
5 2/14	Monte Carlo Tree search
6 2/21	Q-Learning <i>Assignment 2 Due</i> <i>Assignment 3 Out</i>
7 2/28	SARSA <i>Assignment 3 Due</i> <i>Assignment 4 Out</i>
8 3/7	Actor-Critic
9 3/14	Deep Q
3/21	<i>No class – Spring Recess</i>
10 3/28	Deep Q
11 4/4	Policy Gradient <i>Assignment 4 Due</i>
12 4/11	Policy Gradient
4/18	<i>No class - Easter recess</i>
13 4/25	Imitation Learning
14 5/2	Imitation learning
15 5/9	<i>Final projects due</i>