

FA21: CS-271 Sec 02 - Top Machine Learn

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Course Information

- Instructor: Genya Ishigaki
 - Office Location: MH 215
 - Email: genya.ishigaki@sjsu.edu (<mailto:genya.ishigaki@sjsu.edu>)
- Office Hours:
 - Monday 1:30 - 3 PM (In-person)
 - Thursday 3:30 - 5 PM (Zoom)
 - By appointment
- Class Days/Time: Monday & Wednesday 10:45 AM - 12 PM
- Classroom: MacQuarrie Hall 225
- Prerequisites: Graduate standing. Allowed Declared Major: Computer Science, Bioinformatics, Data Science.

Course Description

Introduction to reinforcement learning, deep reinforcement learning, federated learning, and their applications in networking research.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

- Understand different types of reinforcement learning algorithms and when to use them.
- Understand theoretical aspects of reinforcement learning.
- Understand the basis of deep reinforcement learning.
- Understand architectural benefits of federated learning.
- Build a machine learning project to solve a social or technical issue.
- Develop reinforcement learning applications.

Textbook

- Richard S. Sutton and Andrew G. Barto, *Reinforcement learning: An introduction* (Second edition), MIT press, 2018.
 - This book is [available online for free](http://incompleteideas.net/book/RLbook2020.pdf) (<http://incompleteideas.net/book/RLbook2020.pdf>) on the authors' page.
 - We do not cover all the topics in the book as it is a comprehensive textbook. Appropriate sections will be indicated in syllabus and classes.
- Open AI, [Spinning Up in Deep RL](https://spinningup.openai.com/en/latest/) (<https://spinningup.openai.com/en/latest/>)
 - While the page says "Deep" RL, many of their resources explain the basics of RL itself.
- For the Federated Learning and application parts, a set of papers will be listed in the course schedule.
- (Optional) Yoav Shoham and Kevin Leyton-Brown, *Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations*, Cambridge University Press, 2009.

- This book is [available online for free](http://www.masfoundations.org/download.html) [_\(http://www.masfoundations.org/download.html\)_](http://www.masfoundations.org/download.html).

Other equipment

- Computer
- Python development environment
 - [Google Colab](https://colab.research.google.com/notebooks/intro.ipynb?utm_source=scs-index) [_\(https://colab.research.google.com/notebooks/intro.ipynb?utm_source=scs-index\)_](https://colab.research.google.com/notebooks/intro.ipynb?utm_source=scs-index)
- LaTeX (*Recommended for Project Paper)
 - [Overleaf](https://www.overleaf.com/) [_\(https://www.overleaf.com/\)_](https://www.overleaf.com/)

Grading

Exams, Assignments, and Projects

- This course is designed as a research-oriented course so that students can experience a simplified process of machine learning projects: problem formulation, modeling, method selection, and development.
 - The project requires students to apply (deep) reinforcement learning to some practical problems.
 - It is recommended to form a group of TWO students. I may approve exceptions (individual or group of three) with a valid reason.
 - Some example topics will be presented and discussed during a class, but students can choose any topic that they found interesting.
 - Major programming contribution from **each** group member is required for a passing grade. Details will be explained in class.
- Assignments may include both theoretical and programming questions.

Item	% in Final Grade
Exam 1	16 %
Exam 2	16 %
Assignment 1	13 %
Assignment 2	13 %
Assignment 3	13 %
Project Idea/Proposal Presentations	5 %
Project Final Presentation	8 %
Project Paper	16 %

Grading Table

Total Grade	Letter Grade
92 and above	A
90-91	A-
87-89	B+
82-86	B
80-81	B-
77-79	C+

Total Grade	Letter Grade
72-76	C
70-71	C-
67-69	D+
62-66	D
60-61	D-
59 and below	F

Late Submission

Late submissions within 24 hours will be deducted 10% of its final grade. Submissions over 24 hours late will have 20% grade deducted. Late submissions over 2 days will not be accepted.

Attendance

I do not take attendance except for the first two classes. Students not attending either of the first two classes will be dropped to make room for students on the waiting list. Attempting to get marked as present (by have someone else attend in your place or using technological deceptions) will be considered academic dishonesty and at a minimum will result in you getting dropped from the course.

Grading Policy

The University Policy S16-9, Course Syllabi (<http://www.sjsu.edu/senate/docs/S16-9.pdf> (<http://www.sjsu.edu/senate/docs/S16-9.pdf>)) requires the following language to be included in the syllabus:

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as **academic integrity**, **accommodations**, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at <http://www.sjsu.edu/gup/syllabusinfo/> (<http://www.sjsu.edu/gup/syllabusinfo/>). Make sure to review these policies and resources.

Tentative Schedule and Topics

- Please note the following is a tentative schedule.

Week	Date	Topic	Reference	Note
1	8/23	Overview		
1	8/25	What is Learning?	Shoham & Leyton-Brown Chap 7 Paper (https://arxiv.org/abs/0712.3329)	
2	8/30	MDP	Sutton & Barto Chap 3	

Week	Date	Topic	Reference	Note
2	9/1	Policies and Value Functions	Sutton & Barto Chap 3	
3	9/6	No Class (Labor Day)		
3	9/8	Dynamic Programming	Sutton & Barto Chap 4	
4	9/13	Dynamic Programming		Assignment 1 due
4	9/15	Monte Carlo Method	Sutton & Barto Chap 5	
5	9/20	Monte Carlo Method		
5	9/22	TD Learning	Sutton & Barto Chap 6	
6	9/27	TD Learning: Q-learning		
6	9/29	Taxonomy and Review	Spinning Up in Deep RL: Taxonomy (https://spinningup.openai.com/en/latest/spinningup/rl_intro2.html#a-taxonomy-of-rl-algorithms)	Assignment 2 due
7	10/4	Exam 1		
7	10/6	Deep RL	Spinning Up in Deep RL (https://spinningup.openai.com/en/latest/)	
8	10/11	Deep RL and Baseline Implementation		Project Pair due
8	10/13	MAB	Sutton & Barto Chap 2	
9	10/18	MAB and Regret	Shoham & Leyton-Brown Chap 7	
9	10/20	Application of RL	Paper 1 (https://ieeexplore.ieee.org/document/9109339) Paper 2 (https://ieeexplore.ieee.org/abstract/document/9110932)	
10	10/25	Application of RL	Paper 3 (https://ieeexplore.ieee.org/document/9109571) Paper 4 (https://ieeexplore.ieee.org/document/9110857)	Assignment 3 due
10	10/27	Integrating Learning and Planning	Sutton & Barto Chap 8	
11	11/1	Project Discussion		Project Idea Slides due
11	11/3	Policy Gradient Methods	Sutton & Barto Chap 13	
12	11/8	Policy Gradient Methods		

Week	Date	Topic	Reference	Note
12	11/10	Proposal Presentation		Project Proposal Slides due
13	11/15	Actor-Critic and Review	Sutton & Barto Chap 13	
13	11/17	Exam 2		
14	11/22	Federated Learning	Article (https://ai.googleblog.com/2017/04/federated-learning-collaborative.html) Paper (https://arxiv.org/abs/1602.05629) Survey (https://arxiv.org/abs/1907.09693)	
14	11/24	No Class (No Instruction Day)		
15	11/29	Federated Learning		
15	12/1	Final presentation		Final Presentation Slides due
16	12/6	Final presentation		
	12/10			Project Paper due

Useful Links

- When you are struggling to find a space to study
 - "San Jose State University offers many classrooms in various buildings across campus, Peer Connections space, and library resources for student study and workspace purposes."
 - Fall 2021 - <https://www.sjsu.edu/learnanywhere/campus-resources/study-resources.php>
(<https://www.sjsu.edu/learnanywhere/campus-resources/study-resources.php>)
- If you do not have right equipment (laptop, etc.)
 - "SJSU students, faculty, and staff can borrow laptops, iPads, and more from SCS at no charge. Laptops will be available for week-long and semester-long loan."
 - <https://library.sjsu.edu/student-computing-services/student-computing-services>
(<https://library.sjsu.edu/student-computing-services/student-computing-services>)
- If you want to talk to someone
 - "Whether you are struggling with stress, depression, anxiety or relationship problems, Counseling and Psychological Services is here to provide the support you need to succeed at SJSU. In our current state of remote online instruction, CAPS is providing all of its services through confidential telehealth sessions."
 - <https://www.sjsu.edu/counseling/> (<https://www.sjsu.edu/counseling/>)
- If you need additional accommodation for your learning
 - "The Accessible Education Center (AEC) proudly presents its vision of redefining ability at San Jose State University by providing comprehensive services in support of the educational development and success of student with disabilities."
 - <https://www.sjsu.edu/aec/> (<https://www.sjsu.edu/aec/>)

- If you find a financial challenge
 - "SJSU Cares is here to provide assistance when you need it most. We provide resources and services for SJSU students facing an unforeseen financial crisis. If you're having trouble paying for food, housing or other bills, face homelessness, food insecurity, etc."
 - <https://www.sjsu.edu/sjsucares/> [\(https://www.sjsu.edu/sjsucares/\)](https://www.sjsu.edu/sjsucares/).

Course Summary:

Date

Details

Due
