
(http://ai.stanford.edu/)

CS234: Reinforcement Learning

(index.html)

Schedule And Syllabus

Meeting Times And Location

Unless otherwise specified the course lectures and meeting times are:

Monday, Wednesday 11:30 AM - 12:50 PM
Location: NVIDIA Auditorium (https://campus-map.stanford.edu/?srch=NVIDIA+Auditorium)

Schedule And Course Materials

The **preliminary** schedule is given below and is subject to change. We will also be posting suggested readings in this section a few days before each lecture. The lecture slides will be posted after each class. Please check back regularly for updates !

The lecture videos are recorded. You can watch them here (https://mvideox.stanford.edu/Course/1033).

In addition, lecture notes for each class (upto midterm) will be posted within a few days of each lecture. See more information about them here (schedule.html#lecture-notes).

A practice midterm is now available to help the students prepare for the upcoming midterm. Note that Question 3 and 5b have not been covered in this year's class. [CS234 Midterm 2017 (practice_midterm/cs234-midterm-2017.pdf)][Solutions (practice_midterm/cs234-midterm-2017-soln.pdf)].

Event	Date	Description	Course Materials

Lecture	Jan 8	Introduction to Reinforcement Learning	1. For a high level introduction: SB (Sutton and Barton) Chp 1 2. [Linear Algebra Review (http://cs229.stanford.edu/section/cs229-linalg.pdf)] 3. [Probability Review (http://cs229.stanford.edu/section/cs229-prob.pdf)] 4. [python tutorial (http://cs231n.github.io/python-numpy-tutorial/)] [slides (./slides/cs234_2018_l1.pdf)]
Lecture	Jan 10	How to act given know how the world works. Tabular setting. Markov processes. Policy search. Policy iteration. Value iteration	1. SB (Sutton and Barton) Chp 3, 4.1-4.4 [slides (./slides/cs234_2018_l2.pdf)]
A1		Assignment 1 released	[Assignment 1 (./assignment1/index.html)] [Solution (./assignment1/assignment1_solution.pdf)]
Lecture	Jan 15	No Class	
Lecture	Jan 17	Learning to evaluate a policy when don't know how the world works.	1. SB (Sutton and Barton) Chp 5.1, 5.5, 6.1-6.3 [slides (./slides/cs234_2018_l3.pdf),, slides(annotated) (./slides/cs234_2018_l3_annotated.pdf)]
Lecture	Jan 22	Model-free learning to make good decisions. Q-learning. SARSA.	1. SB (Sutton and Barton) Chp 5.2, 5.4, 6.4-6.5, 6.7 [slides (./slides/cs234_2018_l4.pdf), slides(annotated) (./slides/cs234_2018_l4_annotated.pdf)]
A1	Jan 24	Assignment 1 due	
Lecture	Jan 24	Scaling up: value function approximation. Deep Q Learning	1. SB (Sutton and Barton) Chp 9.3, 9.6-9.7, 10.1, 11.1, 11.2, 11.3 2. [Human-level control through deep reinforcement learning (https://storage.googleapis.com/deepmind-media/dqn/DQNNaturePaper.pdf)] [slides (./slides/cs234_2018_l5.pdf), slides(annotated) (./slides/cs234_2018_l5_annotated.pdf)]
A2		Assignment 2 released	[Assignment 2 (./assignment2/index.html)] [Solution (./assignment2/solution2.pdf)]

Lecture	Jan 29	Deep reinforcement learning continued	1. SB (Sutton and Barton) 9.7 2. [Human-level control through deep reinforcement learning (https://storage.googleapis.com/deepmind-media/dqn/DQNNaturePaper.pdf)] 3. [Introduction to Tensorflow(from CS224N)] (https://www.youtube.com/watch?v=PicxU81owCs#t=3m16s) [slides (./slides/cs234_2018_l6.pdf), slides(annotated) (./slides/cs234_2018_l6_annotated.pdf)]
Lecture	Jan 31	Imitation Learning	1. [Maximum Entropy Inverse Reinforcement Learning (https://www.aaai.org/Papers/AAAI/2008/AAAI08-227.pdf)] 2. [Apprenticeship Learning via Inverse Reinforcement Learning] (http://ai.stanford.edu/~ang/papers/icml04-apprentice.pdf) [slides(annotated) (./slides/cs234_2018_l7_annotated.pdf)]
Project	Feb 5	Project proposal due	
Lecture	Feb 5	Policy search	1. Sutton and Barto Chp 13 [slides (./slides/cs234_2018_l8.pdf)], [slides(annotated) (./slides/cs234_2018_l8_annotated.pdf)]
Lecture	Feb 7	Policy search	1. Sutton and Barto Chp 13 [slides (with some typos fixed post lecture) (./slides/cs234_2018_l9_updated.pdf)], [slides(annotated) (./slides/cs234_2018_l9_annotated.pdf)]
A2	Feb 10	Assignment 2 due	
Lecture	Feb 12	Midterm review	[draft review slides (./slides/cs234_2018_midterm_review.pdf),annotated review slides (./slides/cs234_2018_midterm_review_annotated.pdf)]
A3		Assignment 3 released	[Assignment 3 (./assignment3/index.html)] [Solution (./assignment3/assignment3_solution.pdf)]

Exam	Feb 14	In-class Midterm	[Solution (./midterm_solution/CS234-Midterm-Winter-2018-soln.pdf)]
Lecture	Feb 19	No Class	
Lecture	Feb 21	Fast reinforcement learning (Exploration/Exploitation) Part I	1. Sutton and Barto Sections 2.1-2.7 [draft slides (./slides/cs234_2018_l11.pdf), annotated slides (./slides/cs234_2018_l11_annotated.pdf)]
A3	Feb 23	Assignment 3 due	
Lecture	Feb 26	Fast reinforcement learning (Exploration/Exploitation) Part II	1. Sutton and Barto Sections 2.1-2.7 [draft slides (./slides/cs234_2018_l12.pdf),annoated slides (./slides/cs234_2018_l12_annotated.pdf)]
Lecture	Feb 28	Batch Reinforcement Learning	[draft slides (./slides/cs234_2018_l13.pdf),annotated slides (./slides/cs234_2018_l13_annotated.pdf)]
Project	Feb 28	Project milestone due	
Lecture	Mar 5	Monte Carlo Tree Search	Suggested Readings: 1. Gelly and Silver 2011[link (http://www.ics.uci.edu/~dechter/courses/ics-295/winter-2018/papers/mcts-gelly-silver.pdf)] 2. (AlphaGo Zero) Silver et al. Nature 2017[link] (https://www.nature.com/articles/nature24270) [draft slides (./slides/cs234_2018_l14.pdf),annoated slides (./slides/cs234_2018_l14_annotated.pdf)]
Lecture	Mar 7	Human in the loop RL with a focus on transfer learnign	[draft slides (./slides/cs234_2018_l15.pdf), annotated slides (./slides/cs234_2018_l15_annotated.pdf)]
Exam	Mar 12	In-class Quiz	
Project	Mar 14	Poster Session 11:50-2:50pm. Location TBA	
Project	Mar 19	Project final paper due	

Lecture Notes

This section contains the CS234 course notes being created during the Winter 2018 offering of the course. These notes should be considered as additional resources for students, but they are also very much a work in progress. The course staff are working hard to create these lecture notes and cover as much of the material covered in the class as possible, and in some places provide further background information. However, we are aware that we may omit some things and there may be unintended typos. Of course, these notes should not be considered as an alternative to attending classes.

Git repositories for lecture notes

There are two versions of git repositories for the lecture notes, which are hosted on AFS at the following links:

- Editable Repository: This is hosted at /usr/class/cs234/cs234-notes.git. Students and course staff can make contributions to this repository.

- Stable Repository: This is hosted at /usr/class/cs234/cs234-notes-stable.git: This version of the notes are readable by the students, but writable only by the course staff.

Cloning the repositories

Type the commands shown below to clone each repository using git:

- Editable Repository: git clone <SUNetID>@cardinal.stanford.edu:/usr/class/cs234/cs234-notes.git

- Stable Repository: git clone <SUNetID>@cardinal.stanford.edu:/usr/class/cs234/cs234-notes-stable.git

Adding a new lecture

To add a new lecture note please follow the instructions below:

1. Copy the file template.tex in the repository and rename appropriately (e.g. lectureX.tex).
2. Add packages when needed in the preamble section.
3. Fill out the information in the config section of the file.
4. Type out the lecture content.
5. If you are making notes for lecture X, put any images needed in the directory images/lectureX.
6. Possibly add frequently needed packages to template.tex.

Staff contributions

The course staff will be producing lecture notes for the first 10 lectures, all of the lectures prior to the midterm exam. They will be pushed to both repositories.

Student contributions

Students can contribute to the editable repository, which will be monitored by the course staff to assure that the updates are correct, and when approved they will be copied into the stable repository. We welcome anyone to correct any typos, add additional sections which they feel may be missing, add figures or any other additions that you think will improve the lecture notes. **Extra credit may be awarded for contributions made to the lecture notes.** To be given credit for contributions, make sure that your SUNet id appears in your commit before pushing (i.e. when you type git log).