

00103335: Deep Learning and Reinforcement Learning Fall 2022

Lectures: Fridays 3:10–5:00 pm and even Wednesdays 1:00–2:50 pm, 106 Science Classroom Building

Instructor: Wei Lin (weilin@math.pku.edu.cn)

Office hours: Wednesdays 3:00–4:30 pm, 1547 Science Building 1

Teaching Assistants: Xuyang Zhao (xuyangzhao@pku.edu.cn)

Office hours: Mondays 3:00–5:00 pm, 259 Science Building 5

Course Description:

As highly successful and widely applied machine learning methods, deep learning and reinforcement learning are the core techniques underlying the latest major breakthroughs in the field of AI. Building on the general principles and methodology of machine learning and motivated by important practical problems, this course will introduce the basic concepts and methods, mathematical foundations and theory, optimization algorithms, and applications and case studies of deep learning and reinforcement learning. The part on deep learning will cover feedforward neural networks, regularization and optimization for deep learning, convolutional neural networks, recurrent neural networks, and autoencoders and generative models; the part on reinforcement learning will cover multi-armed bandits, Markov decision processes, dynamic programming, Monte Carlo methods, temporal difference learning, and deep reinforcement learning.

Primary Texts:

1. Goodfellow, I., Bengio, Y. and Courville, A. (2016). *Deep Learning*. MIT Press.
2. Sutton, R. S. and Barto, A. G. (2018). *Reinforcement Learning: An Introduction* (2nd ed.). MIT Press.

Supplementary Texts:

1. Stevens, E., Antiga, L. and Viehmann, T. (2020). *Deep Learning with PyTorch*. Manning.
2. Puterman, M. L. (1994). *Markov Decision Processes: Discrete Stochastic Dynamic Programming*. Wiley.
3. Powell, W. B. (2022). *Reinforcement Learning and Stochastic Optimization: A Unified Framework for Sequential Decisions*. Wiley.

Homework:

There will be about five homework assignments due in class. If you missed the class, contact the TA to turn in your homework by the end of the day. No late homework will be accepted.

Exams:

There will be one two-hour, closed-book midterm exam on Friday, November 18. There will be no final exam, but students need to form groups of two to four and complete a final project on a topic of their own choice. Proposals of project topics are due by Friday, November 25. Oral presentations of projects are scheduled on Fridays, December 9 and 16.

Grading:

The course grade breaks down as follows: homework 30%, midterm exam 30%, and project 40%.

Website:

Lecture topics and homework assignments will be posted on the course website at <http://www.math.pku.edu.cn/teachers/linw/3335f22.html>.