Deep Learning Decal
Fall 2017

Introduction:

Are you a recent graduate of CS 189/289A? Did the awesomeness of introductory machine learning leave you yearning for more? Do you ever wonder about the amazing things deep learning can do? Say no more - welcome to the Deep Learning Decal! In this class, you will learn about modern practical deep neural networks, current deep learning research topics, and more!

Contact information:

Website:
https://ml.berkeley.edu/decals/DLD
Email : dld@ml.berkeley.edu

* The website will be our main form of communication. Please check it regularly.

Units:

2 Units

Book:

The main book for this course is:
Deep Learning, by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

We will cover roughly all of chapters 6 through 20. In addition, we will be supplying accompanying resources for each topic.

Time and location:

Time : Wednesday 5:00 - 7:00 PM
Location : Wurster 102

Office Hours:

TBD; OH for facilitators are also available by appointment

Prerequisites:

This class is a project-based class that assumes a solid grasp of basic machine learning. This means you must have taken CS 189/289A or demonstrate competence with the material covered. You are expected to be able to conduct a large-scale project that will require a lot of outside research on your part.

Class structure:

Deep learning is a relatively new field which is rapidly expanding. With that, we want to give you the foundational knowledge to understand, implement, and perhaps even develop new learning algorithms, but we also wish to expose you to the state-of-the-art and give you the ability to digest and communicate about new ideas.

The first hour of the course will be lecture-based where we discuss the important ideas in the seminal *Deep Learning* book. In the following hour, we will switch gears and form a reading group in which a presenter leads the discussion about an important, modern, or interesting paper, and the audience participates by preparing questions and discussing ideas.

Grading:

- 60% from one of two options (see below for further information)
    - Project option
    - Reading group option
- 40% Attendance (~3.33% per lecture)

In order to pass the class, you must earn at least a 70% cumulative score.

Project Option:

This is a project-based course. We will supply you with the background material and current state-of-the-art research and methods, but you are expected to go above and beyond to construct an interesting project. You will work in groups of 2-3 on a project of your choice, to be confirmed by us. A tentative timeline is:

- Proposal (5% of grade)
    - 1 page proposal, due during week 6
- Milestone 1 (5% of grade)
    - 1 page showing progress and what you plan to do, due during week 8
- Milestone 2 (10% of grade)
    - 2 pages, write up of preliminary results, due during week 10
- Final project submission (40% of grade)
    - Research paper of at least 5 pages, due during week 12

Please see the publicly-archived projects from CS294-129 for some ideas and inspiration: https://bcourses.berkeley.edu/courses/1453965/pages/projects

Reading Group Option:

Starting the second week of class, students will pick a paper to present in front of their peers. Each week, 3-4 students will team up to prepare a presentation. Students choosing the reading group option are required to **submit 3 good questions** about the paper before class each week, as well as lead at least one reading group throughout the semester. The 60% grade component will be split up as follows:

- 40% for 10 weekly question submissions (4% eachl)
- 20% for leading the reading group

To earn the full grade for the question submissions, the questions must be well-thought. Note that those participating in the project option are still encouraged to read the papers and engage in the discussion. We anticipate that both grading options require similar time commitments.

Reading group leaders will be in charge of leading the week's discussion in front of a subgroup of the full class.

Attendance:

As noted above, 40% of your grade is attendance. The reason for this is to hold you accountable and make sure you actually learn this stuff.

Extra Resources:

While our main resource is the awesome Deep Learning book, we will also provide you with extra resources for certain topics. These may include blog posts, course lecture notes, videos, research papers, and more. Stay tuned!

Class Schedule:

Part 1: Modern Practical Deep Networks

- Week 1 - Deep feedforward networks, regularization, and optimization (Ch 6 & 7 of DL book)
- Week 2 - Convolutional neural networks (Ch 9 of DL book)
- Week 3 - Recurrent neural networks (Ch 10 of DL book)
- Week 4 - Optimization for training neural networks, practical methodology, and applications (Ch 8, 11, and 12 of DL book)

Part 2: Deep Learning Research

- Week 5 - Linear factor models (Ch 13 of DL book)
- Week 6 - Autoencoders and representation learning (Ch 14 & 15 of DL book)
- Week 7 - Structured probabilistic models and Monte Carlo methods (Ch 16 & 17 of DL book)
- Week 8 - Partition function and approximate inference (Ch 18 & 19 of DL book)
- Week 9 - Deep generative models (Ch 20 of DL book)
  Week 10 - Deep generative models cont. (Ch 20 of DL book)

Part 3: Special topics

- Week 11 - Applied kernel methods: choosing the right kernel and applications; deep kernel machines
- Week 12 - Deep reinforcement learning