UBC CPEN 400D (2022 Winter Term 2): Deep Learning

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Overview

Deep Learning has revolutionized many fields, e.g., computer vision, speech recognition, and natural language processing. It has become the vital pillar underpinning the modern machine learning and AI and is one of the most highly sought after skills in industries.

In this course, we will study the fundamentals of deep learning, including architectures (e.g., MLPs, CNNs, RNNs, Transformers, and GNNs) and learning algorithms under different paradigms (supervised / unsupervised / reinforcement learning), with an emphasis on motivating applications, design principles, and practical and or theoretical limitations.

Course Information

Instructor	**Renjie Liao**
TA	Qi Yan, Sadegh Mahdavi, Jiahe Liu
Time	12:30pm to 2:00pm, Tue. and Thu.
Location	Hugh Dempster Pavilion 310
Piazza	https://piazza.com/ubc.ca/winterterm22022/cpen400d
Canvas	CPEN 400D 206 2022W2
Office Hour	2:30pm to 3:30pm Wed. KAIS 3047 (Ohm)
Email	rjliao@ece.ubc.ca

Announcements

- **Jan. 9 2023**: The course will be in person in this semester by default unless specially announced.

Pre-requisites

- Basic knowledge in linear algebra, probability, and calculus.
- Proficiency in a programming language: preferably Python.
- Proficiency in a deep learning library: preferably PyTorch, JAX, Tensorflow, etc.
- Proficiency in LaTex.

Grading

- [30%] Homework (i.e., Written Assignments, 3X, each with 10%). Guideline & Policy
- [30%] Programming Assignments (3X, each with 10%). Guideline & Policy
- [40%] Project (1X). Guideline & Policy
- [3% Extra Credits] Participation Guideline & Policy

Important Notes

1. All course-related questions should be sent and handled via Piazza. Canvas is only used for submitting homework, assignments, and projects. Try to avoid sending me emails directly as it is likely to be buried in my inbox.

2. All homework, assignments, and projects must be done **individually**. A **20% (non-hourly based) penalty** is applied to any late submission. Any submission that is later than **3 days after the deadline** will **not be evaluated**. E.g., if your homework is late but within 3 days after the deadline, your receive 80% of the grade for the homework. If it is beyond 3 days, then you get 0 grade.

3. **UBC values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Discipline**.

Schedule

This is a tentative schedule, which will likely change as the course goes on. Changes will be announced on Piazza and this website.

Lecture	Dates	Topic	Slides	Suggested Readings
1	Jan. 10 Jan. 12	**Introduction & Linear Models & ML Basics**	slides	Chapter 5 of **DL** book & Chapter 10

Lecture	Dates	Topic	Slides	Suggested Readings
				and 11 of **PML** book
Assignment 1	Jan. 13 (out) **Jan. 27 (due)**	*1st Homework*		
2	Jan. 17 Jan. 19	**Multilayered Perceptron & Back-Propagation**		
3	Jan. 24 Jan. 26	**Autograd and Pytorch**		
Assignment 2	Jan. 27 (out) **Feb. 10 (due)**	*1st Programming Assignment*		
4	Jan. 31 Feb. 2	**Convolutional Neural Networks**		
5	Feb. 7 Feb. 9	**Recurrent Neural Networks**		
Assignment 3	Feb. 10 (out) **Feb. 24 (due)**	*2nd Homework*		
6	Feb. 14 Feb. 16	**Transformers**		
Assignment 4	Feb. 24 (out) **Mar. 10 (due)**	*2nd Programming Assignment*		
7	Feb. 28 Mar. 2	**Graph Neural Networks**		
8	Mar. 7 Mar. 9	**Autoencoders & Denoising Autoencoders & Variation Autoencoders (VAEs)**		
Assignment 5	Mar. 10 (out) **Mar. 24 (due)**	*3rd Homework*		
9	Mar. 14 Mar. 16	**Deep Generative Models: Energy Based Models (EBMs)**		
10	Mar. 21 Mar. 23	**Deep Generative Models: Auto-regressive & Reversible Models**		
Assignment 6	Mar. 24 (out) **Mar. 7 (due)**	*3rd Programming Assignment*		

Lecture	Dates	Topic	Slides	Suggested Readings
11	Mar. 28 Mar. 30	**Deep Generative Models: Generative Advesarial Networks (GANs)**		
12	Apr. 4 Apr. 6	**Deep Reinforcement Learning**		
Project	**Apr. 16 (due)**			

FAQ

Can I audit or sit in?

I am very open to auditing guests if you are a member of the UBC community (registered student, staff, and/or faculty). I would appreciate that you first email me. If the in-person class is too full and running out of space, I would ask that you please allow registered students to attend.

Is there a textbook for this course?

While there is no required textbook, I recommend the following closely relevant ones for further reading:

- **DL** book: "Deep Learning" by Ian Goodfellow, Yoshua Bengio, Aaron Courville. Free online version
- **PML** book: "Probabilistic Machine Learning: An Introduction" by Kevin Murphy. Free online version
- **PRML** book: "Pattern Recognition and Machine Learning" by Christopher Bishop. Free online version

I also recommend students who are self-motivated to take a look at similar courses taught at other universities:

- UofT CSC413/2516, Winter 2022: Neural Networks and Deep Learning
- University of Amsterdam, 2022: Deep Learning
- EPFL EE559, Spring 2022: Deep Learning
- Stanford CS231n, Spring 2022: Deep Learning for Computer Vision

Previous Version

UBC CPEN400D 2022 W1 Taught by Prof. Brad Quinton and Prof. Scott Chin.