STOR 566: INTRODUCTION TO DEEP LEARNING, FALL 2022

Course Information

This course is designed for senior undergraduate and Masters-level graduate students who are interested in deep learning and would like to gain some hands-on experience working with deep neural networks. Deep learning skills are valued in a variety of industries and people with such skills are in high demand. The goal of this course is to help students understand the success of deep learning by studying the foundation concepts and doing projects related to deep learning. Upon completion of this course, students will be able to:

- Understand basic machine learning and deep learning concepts and use deep learning models to solve some problems, such as classification and clustering.
- Demonstrate understanding of basic and some advanced architectures of deep neural networks and algorithms used to optimize and train the models.
- Implement certain of these architectures and algorithms using the Python programming language.
- Understand the limitations of deep neural networks.
- Identify real-world problems where deep learning models can be applied.

Lecture:	TTH 8:00am - 9:15am, Sitterson F009
Optional Textbook:	*Deep Learning*, by Ian Goodfellow, Yoshua Bengio, Aaron Courville.
Course Website:	`https://liyao880.github.io/stor566/`

Instructor

Instructor:	Yao Li
Office:	Hanes 334
Email:	yaoli@email.unc.edu
Office Hours:	TTH 11:00 am - 12:00pm.
Website:	`https://liyao880.github.io/yaoli/`

Teaching Assistant

Name:	Minji Kim
Email:	mkim5@unc.edu
Office Hours:	W 10:00am - 12:00pm
Zoom:	`https://zoom.us/j/5869650522?pwd=bHJOcnVscFIvblJaSk5idFVuWXFXUT09`
Passcode:	stor566

Prerequisites

Basic knowledge in numerical linear algebra, probability, and calculus.

Programming language: Python.

Topics

Deep neural networks (DNNs) have been widely used for tackling numerous machine learning problems that were once believed to be challenging. With their remarkable ability of fitting training data, DNNs have achieved revolutionary successes in many fields such as computer vision, natural language progressing, and robotics. This is an introduction course to deep learning. Topics covered by this course include but are not limited to:

- Machine Learning Overview
- Optimization
- Theory of generalization
- Non-linear models
- Multilayer perceptron
- Convolutional neural network
- Generative models
- Recurrent neural network
- DNN pre-training
- Transformer
- Vision transformer
- Graph neural network
- Security of DNN

Grading

Homework	Final Project	Participation	Total
40%	50%	10%	100%

Homework

- Around 4 to 5 homeworks will be assigned and will be collected via Sakai.
- Late homework will receive a grade of 0.
- You are allowed to work with other students but identical solutions will receive 0.
- Questions regarding HW grade should be addressed to the grader.

Final Project

This course includes a final project in lieu of a final exam. Projects will be completed in groups of **four** and consist of:

- Project proposal (10%)
- Project presentation (30%)
- Project paper (50%)
- Peer review score (10%)

I will meet with each group to discuss the final project topic. Project topics can be:

- Solve an interesting/new problem with existing method
- Develop a new algorithm/model
- Compare state-of-the-art algorithms on some problems
- ...

Project proposal: The project proposal is limited to 2-page and contains:

- Problem to solve

- Review of existing studies in this field
- Your proposed method/Methods you would like to compare
- Evaluation metric

Project presentation: All groups will present their final projects during the last week or two weeks of classes. Every group member is expected to join the presentation. The length of the presentation depends on the number of groups (10–20min) and will be announced later.

Project paper: Each team must submit a written project report. It is recommended to include a discussion of how your research work can be further extended. It is required to use the NeurIPS Latex style files and submit the report in PDF format. The report should be less than 8 pages without references (no minimum requirement).

Participation

There will be around 10 in-class quizzes. The final participation score would be $n \times \frac{m}{n}$, where n is the total number of quizzes and m is the number of quizzes completed by the students.

Notes

The Instructor reserves the right to make any changes she considers academically advisable.

Attendance

Regular class attendance is a student obligation, and a student is responsible for all the work, including tests and written work, of all class meetings. No right or privilege exists that permits a student to be absent from any class meetings except for excused absences for authorized University activities or religious observances required by the student's faith. If a student misses three consecutive class meetings, or misses more classes than the course instructor deems advisable, the course instructor may report the facts to the student's academic dean. (See details at `https://catalog.unc.edu/policies-procedures/attendance-grading-examination/#text`)

Honor Code

`http://instrument.unc.edu/`

Accessibility

`https://ars.unc.edu/`

Counseling

`https://caps.unc.edu/`

Title IX

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.