Mathematical Foundations of Machine Learning
CS 4783/5783

News :
1. Welcome to first day of class!
2. Join ED for Discussions: here (https://edstem.org/us/join/TQ8dXH)

Location and Time :
Location : Bill and Melinda Gates Gall, G01

Online: The class will also be available via zoom at same time at:
Join Zoom Meeting (only cornell ID will be allowed):
https://cornell.zoom.us/j/97223565682?pwd=TzhNS1BqYlV6d1hRbWo4S200YU8wQT09
(https://cornell.zoom.us/j/97223565682?pwd=TzhNS1BqYlV6d1hRbWo4S200YU8wQT09)

Meeting ID: 972 2356 5682
Passcode: 142211

Time : Mon-Wed: 9:40 AM to 10:55 AM (EST)

Office Hours :
Karthik Sridharan: Tue 1:30-2:30PM, EST
Zoom Link: [Link] (https://cornell.zoom.us/j/93677382570?
pwd=TlpWbURXaGZGT0xSNll2UzhjMHc5UT09)

Gregory Yauney: Wed: 1-2PM, EST
Zoom Link: [Link] (https://cornell.zoom.us/j/96638608049?
pwd=NEtBdDNTUzhYc2U1emlMQTNsTFVWZz09)

Isay Katsman: Fri: 5-6PM, EST
Zoom Link: [Link] (https://cornell.zoom.us/j/97287465491?
pwd=RjRXSW9wQzNNZFlkMXNoNHdRck5pZz09)

DEI Statement :

Description :

Machine Learning (ML) is a ubiquitous technology. This course, which is a follow up to an introductory course on ML will cover topics that aim to provide a theoretical foundation for designing and analyzing ML algorithms. This course has three basic blocks. First block will provide basic mathematical and statistical toolset required for formalizing ML problems effectively and analyzing them. This block will include topics like generalization, sample complexity of learning algorithm and understanding the inherent challenges in various ML frameworks and models. The second block will provide the foundations in algorithms design and optimization techniques required for building and analyzing various ML algorithms. This block will cover topics like gradient descent, stochastic gradient descent, algorithm design for online learning and computational challenges in ML. ML algorithms are deployed in real world and make decisions that affect real world users. The third block, will cover topics on how to formally reason about and how to design ML methods that address social and user related concerns that ML algorithms need to deal with. This block will cover topics such as fairness, privacy, the right to be forgotten and other such issues and how to build ML algorithms that address or assuage these concerns.

Pre-requisite : Prerequisite: CS 4780, CS 4820 or equivalent.

Outcomes :

Students will be able to reason about Machine Learning(ML) problems and algorithms in a principled fashion, to identify what makes learning hard and how to design algorithms that would provably work well. Students will be able to analyze new machine learning algorithms they might encounter or even design their own methods that can address specific requirements that they might encounter in their applications. Through completion of the term project students will demonstrate what it entails to formally analyze and reason out an end-to-end topic in the theory of ML and give them a taste of a real research project. Students will be aware of the social implications ML method choices can have in the real world and demonstrate to them tools that can help them identify and tackle such real world social challenges that any ML based system needs to deal with.

Grading :

4 assignments, one term project and course prelims. 3% For class participation.
For CS 5783 students, there will be an additional two reading assignments where you read two assigned research papers and quiz on them will follow.

Assignments :

There will be a total of 4 assignments covering 40% of your grade.

Prelim :

This course has one prelim worth 30% of your grade.

Term project :

There will be a term project due by the end of the course. The project is worth 27% of your grade.

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