MATH 566 101 2021W1 Theory of Optimal Transportation

PIMS online course on Optimal Transport and Machine Learning

(Sep 30 - Nov 30, 2021)

The course is one of the online courses PIMS hosts: https://courses.pims.math.ca (https://courses.pims.math.ca)

- Classes will be held Tuesdays and Thursdays in the evening 5:30 p.m. till 7:00 p.m. It will be taught over the ZOOM.
- The first class is on Sep 30 and the last class is on Nov 30.
- There are no mandatory textbooks. We will provide all the materials needed for the lectures.
- There are no exams in this class although we will supplement the lectures with occasional homework.

The course instructors are

Zaid Harchaoui (teaching) (University of Washington) ,

Soumik Pal (teaching) (University of Washington). **soumikpal@gmail.com**

For administrative questions you can contact:

Young-Heon Kim (WDA administrator) (University of British Columbia): yhkim@math.ubc.ca

IMPORTANT: Please contact Prof. Soumik Pal <soumikpal@gmail.com>

at the beginning of the term to add you to the Canvas webpage for notes and videos.

Zoom links will be provided to students once they are added to the course canvas at the U. Washington.

Course Website

https://sites.math.washington.edu/~soumik/OTML.html
(https://sites.math.washington.edu/~soumik/OTML.html)

Prerequisites

Prior knowledge of real analysis

Prior knowledge of probability

Prior knowledge of statistics

Prior knowledge of and machine learning

Familiarity with coding in Python or R is a plus

Abstract:

In the second installment of OT+X series we take X=ML or machine learning. A number of problems equivalent or related to the Monge-Kantorovich Optimal Transport (OT) problem have appeared in recent years in machine learning, and data science at large. The fruitful connections between the two fields have led to several important advances impacting both. The Wasserstein metric defines a metric between probability measures, used to describe distributions over data or distributions over models, that improves upon existing metrics based on Hilbertian metrics and f-divergences, and that is now more easily amenable to efficient numerical computation.

The first part of the course will cover the mathematical basics of OT and introduce the geometry of Wasserstein spaces. The second part of the course will cover computational aspects of OT and describe the central role played by OT in convergence analysis of stochastic algorithms for deep learning, in distributionally robust statistical learning, and in combinatorial or geometrical problems arising in data science applications. The course is meant for a wide audience including graduate students and industry professionals. Prior knowledge of real analysis, probability, statistics, and machine learning will be particularly helpful. The course will be interspersed with numerical illustrations. Familiarity with coding in Python or R is a plus.

Course Summary:

Date	Details	Due