

# Special Topics Course

## STATS 710: Optimal transport and statistical inference

Instructor: Long Nguyen  
Department of Statistics  
Fall 2022  
11:30–1pm MW, 2150 SKB

**Course description.** This course provides an introduction to optimal transport and some applications to statistics and machine learning fields.

**Prerequisites.** The prerequisites are previous courseworks in graduate-level probability (at the level of Stats 620 and 621), or the instructor’s approval (Contact Prof. Nguyen for details).

**Structure/Evaluation.** The class will meet twice a week and will follow a regular lecture format. There will be exercises and a course project.

**Course homepage.** All announcements, reading materials and project information will be posted at the course’s Canvas site.

**Textbooks.** Lecture notes and relevant papers will be provided. The main textbooks are:

1. C. Villani, Optimal transport, Springer 2008.
2. L. Ambrosio, N. Gigli and G. Savaré. Gradient flows in metric spaces and in the space of probability measures, Birkhauser, 2008.
3. G. Peyré and M. Cuturi. Computational optimal transport. Foundations and trends in Machine Learning, 2019.

Other useful references include

1. F. Santambrogio. Optimal transport for applied mathematicians. Birkkhauser, 2015.
2. V. Panaretos and Y. Zemel. An invitation to Statistics in Wasserstein space. Springer Open, 2020.

**Topics and schedule.**

- Overview of optimal transport and applications
- Basic formulations of OT
- Kantorovich duality and Brenier theorem
- Computational algorithms

- Wasserstein spaces
- Continuity equation and tangent space
- Convex functionals
- Applications in statistics and ML