MAT-280: Optimal Transport Theory and Applications
Winter 2016, UC Davis

Lectures: TR 10:30-11:50am in MSB 3106.
Instructor: Qinglan Xia, MSB 3216, qlxia@math.ucdavis.edu.

Course Description: This course aims at introducing optimal transportation theory to graduate students in both pure and applied mathematics. Suitable audiences include those who are interested in analysis (PDE and beyond), geometry, optimization, math biology, image processing etc. Participating graduate students may be required to present some of the topics. No prerequisite course is required for graduate students.

Contents:

Part I: Monge-Kantorovich optimal transportation
1. The Monge-Kantorovich problem and the Kantorovich duality
2. Geometry of optimal transportation
3. The metric theory of gradient flows
4. Geometric and functional inequalities related to optimal transportation
5. Metric measure spaces with Ricci curvature bounded from below
6. Numerical aspects of optimal transportation.
7. Application of optimal transportation in image processing.

Part II: Ramified optimal transportation
1. Introduction to ramified optimal transportation
2. Transport dimension of measures
3. The geodesic problem in quasi-metric spaces
4. Some applications in applied mathematics

Some references:

1. L. Ambrosio, N. Gigli, A user's guide to optimal transport, 2011.

2. F. Santambrogio, Optimal Transport for Applied Mathematicians, 2015.

3. C. Villani, Topics in Optimal Transportation, AMS, 2003.

4. C. Villani, Optimal Transport: Old and New, Springer, 2008.

5. Q. Xia, Motivations, ideas, and applications of ramified optimal transportation. ESAIM: M2NA. 2015.

6. Some recent journal articles and workshop presentations.