Gradient flows in measure spaces

Topics in Analysis, Spring 2011

Program

Lecture	Topic
Feb 2	Introduction, Probability measures on metric spaces: narrow convergence
Feb 9	Probability measures on metric spaces: bounded Lipschitz metric, Prohorov's theorem
Feb 16	Probability measures on metric spaces: push forward, marginals, disintegration
Feb 23	Optimal transportation: introduction, existence of optimal plans
Mar 2	Optimal transportation: optimal transport maps
Mar 9	Gradient flows in Hilbert spaces: Evolution Variational Inequality
Mar 16	Gradient flows in metric spaces: convexity properties
Mar 30	Gradient flows in metric spaces: existence and uniqueness
Apr 6	Wasserstein spaces: basic properties
Apr 13	Wasserstein spaces: curves and convexity
Apr 20	Gradient flows in Wasserstein spaces
Apr 27	Stochastic differential equations (SDE)
May 11	SDE and gradient flows in Wasserstein spaces, Fokker-Planck equation

Assignments

There will be five homework assignments, which will be graded.

Number	Posted	Due
1	Feb 16	Mar 9
2	Mar 2	Mar 30
3	Mar 16	Apr 13
4	Apr 6	Apr 27
5	Apr 20	May 18

There will also be an oral exam. The final grade will be composed of 70% assigments and 30% oral exam.

Literature

Lecture notes will become available. They are based on the following sources.

- Ambrosio, L., Gigli, N., and Savaré, G., *Gradient flows in metric spaces and in the space of probability measures*, Lectures in Mathematics, ETH Zürich, Birkhäuser Verlag, Basel - Boston - Berlin, 2005.
- P. Clément, An introduction to gradient flows in metric spaces, Leiden University, MI-report 2009-09, 2009.
  `http://www.math.leidenuniv.nl/nl/reports/1171/`
- Jordan, R.; Kinderlehrer, D.; Otto, F. The variational formulation of the Fokker-Planck equation, *SIAM J. Math. Anal.* 29 (1998), No. 1, 1-17.
- Villani, C. *Topics in optimal transportation.* Graduate Studies in Mathematics, 58, American Mathematical Society, Providence, Rhode Island, 2003.
- Onno van Gaans, Notes of the seminar Evolution Equations in Probability Spaces and the Continuity Equation, 2006.
  `http://www.math.leidenuniv.nl/~vangaans/semEEPSCE_12_4.pdf`
- Igor Stojković, PhD thesis (preliminary version), 2011.

Lectures

On Wednesdays, 11:15–13:30h, Room 401, Leiden University, Snellius building, Niels Bohrweg 1.

Contact

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