

BACHELOR SEMINAR ON OPTIMAL TRANSPORT

Preliminary meeting: Wednesday, February 4, 4:15 p.m., room 2.040

Lecturer: Prof. Dr. K.T. Sturm

Contact: Dr. M. Bormann (mbormann@uni-bonn.de)

Time: Fridays 2 - 4 p.m.

Room: NN

Start: April 17 2026

The seminar will provide an introduction to the theory of optimal transportation. Going back to the work of Gaspard Monge, this theory is based on the following problem:

Given two mass distributions μ on a space X and ν on a space Y and a cost function c on $X \times Y$, the aim is to transport μ to ν under minimal costs.

Today there is a vast theory on optimal transportation connecting different fields such as analysis, probability, geometry and partial differential equations that is additionally of interest for applications in economics, data science, machine learning, imaging, and physics.

Topics treated in the seminar will include the formulation of the Monge and Kantorovich problems, Kantorovich duality, theory of existence and uniqueness of solutions, and characterisation of optimisers. A further focus will be on optimal transport in one dimension and monotone transport, as well as the Wasserstein metric on the space of probability measures and the study of curves in this space. Further possible topics may include applications and numerical methods in optimal transport.

The seminar will mainly follow the books by C. Villani and F. Santambrogio listed below. The seminar is aimed at Bachelor students, the seminar language is English.

REFERENCES

- [1] F. Santambrogio. *Optimal transport for applied mathematicians*, volume 87 of *Progress in Non-linear Differential Equations and their Applications*. Birkhäuser/Springer, Cham, 2015. Calculus of variations, PDEs, and modeling.
- [2] C. Villani. *Topics in optimal transportation*, volume 58 of *Graduate Studies in Mathematics*. American Mathematical Society, Providence, RI, 2003.