

University of Cologne
Institute of Mathematics
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SS 2020: Concentration of measure and applications

We will investigate concentration phenomena of (probability) measures. One of the arguably most basic examples for such a phenomenon is Markov's inequality which you have seen in basic probability classes.

Such inequalities arise in a variety of different contexts. They are very important in probability theory and exhibit important applications to other fields such as functional analysis, statistical mechanics, and data science.

We will cover selected topics of [vH14] and also [Ver18, BLM13] and aim at building theoretical foundations as well as studying some of their applications.

The seminar is aimed at BSc and MSc students. Participants are expected to have ideally mastered the lectures 'Wahrscheinlichkeitstheorie I' or 'Wahrscheinlichkeitstheorie II'. In particular, the concept of martingales will play an important role, and participants are expected to have a basic knowledge of their theory. In order to obtain the corresponding credit points, participants have to give a presentation on one of the available topics and actively contribute to the discussions of the remaining presentations.

Presentations can be given in English or German. At <http://www.alt.mathematik.uni-mainz.de/Members/lehn/le/seminarvortrag> you can find some advice on how to prepare a valuable seminar talk which you should take serious.

The specific talks and structure of the seminar can be found on

<http://www.mi.uni-koeln.de/~drewitz/>.

Students who intend to participate in the seminar are asked to notify the lecturer via email (see above) by January 29, 2020, including

1. matriculation number,
2. relevant lectures attended and grades obtained.

The coordinates of the regular meetings are:

Room: Mathematics 314 (Seminarraum 3)

Day & time: Thursdays, 10:00 to 11:30 a.m.

References

- [BLM13] Stéphane Boucheron, Gábor Lugosi, and Pascal Massart. *Concentration inequalities*. Oxford University Press, Oxford, 2013. A nonasymptotic theory of independence, With a foreword by Michel Ledoux.
- [Ver18] Roman Vershynin. *High-dimensional probability*, volume 47 of *Cambridge Series in Statistical and Probabilistic Mathematics*. Cambridge University Press, Cambridge, 2018. Draft available at <https://www.math.uci.edu/~rvershyn/papers/HDP-book/HDP-book.html>.
- [vH14] Ramon van Handel. *Probability in high dimension*, 2014. Available at <https://web.math.princeton.edu/~rvan/APC550.pdf>.