

Seminar on Resampling Methods

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General Information I

Teacher:

- Carsten Jentsch

Module requirements:

- Ideally the course “Bootstrap Methods” or other knowledge about resampling methods, but good knowledge in probability and statistics together with some domain knowledge should be sufficient.

Place and Time:

- Seminar presentations in a block seminar after the semester

Language:

- English

First date:

- Seminar kick-off meeting: **First** week of the semester
- Meeting to assign seminar topics: **Second** week of the semester

General Information II

Exam admission

- none

Type of examination

- term paper, seminar presentation

ECTS points

- 4

Module can be credited for:

- MSc Statistik: MS 4
- MSc Data Science: MD 4
- MSc Econometrics: ME 7

Binding registration

- until 25.02.2026 via the link in the mail from the dean's office

What are resampling methods?

Resampling (Statistics) (engl. Wikipedia):

In statistics, **resampling** is any of a variety of methods for doing one of the following:

- 1.) Estimating the precision of sample statistics (medians, variances, percentiles) by using subsets of available data (**jackknifing**, **subsampling**) or drawing randomly with replacement from a set of data points (**bootstrapping**)
- 2.) Exchanging labels on data points when performing significance tests (**permutation tests**, **randomization tests**, or **re-randomization tests**)
- 3.) Validating models by using random subsets (**bootstrapping**, **cross validation**)

Aims and scope

- The aim of the seminar is to get you acquainted with resampling methods (mainly bootstrap methods) in different application fields (domains) for different statistical tasks.
- Learn and understand why a certain bootstrap approach is valid under the imposed assumptions in a certain context.
- Implement the resampling algorithm and run simulations that demonstrate the usefulness of the model and (maybe) replicate a real data application.

Possible tasks

In many applied and theoretical contexts, resampling methods have been used for different statistical tasks:

- variance estimation
- bias estimation/correction
- construction of confidence intervals
- constructing critical values for testing
- model/variable selection
- predictive inference
- tuning parameter selection
- ...

You can choose from a (non-exhaustive and to be updated) list of topics consisting of (recent) papers on the application of resampling methods in various application domains or statistical subfields.

I give a couple of examples in the following...

Examples of papers (seminar topics) from different fields I

Causal inference:

- Lia, J. (2023). Are we bootstrapping the right thing? A new approach to quantify uncertainty of Average Treatment Effect Estimate. arXiv:2310.11683v4+

Spatial Statistics:

- Arthur, R. (2024). A General Method for Resampling Autocorrelated Spatial Data. arXiv:2401.05728v1

Data Privacy:

- Chadha, K., Duchi, J. and Kuditipudi, R. (2024). Resampling methods for private statistical inference. arXiv:2402.07131v2

Time Series:

- La Vecchia, D., Moor, A. and Scaillet, O. (2022). A Higher-Order Correct Fast Moving-Average Bootstrap for Dependent Data. arXiv:2001.04867v2

Examples of papers (seminar topics) from different fields II

Econometric Theory:

- Cavaliere, G. and Georgiev, I. (2020). Inference under random limit Bootstrap measures. *Econometrica* 88 (2), 2547 - 2574.

High-dimensional inference:

- Giessing, A. and Fan, J. (2023). A Bootstrap Hypothesis Test for High-Dimensional Mean Vectors arXiv:2309.01254v1

Missing data:

- Robbins, M. Burgette, L. and Bauhoff, S. (2023). Resampling Methods with Imputed Data. arXiv:2311.13815v1

Functional (time series) data:

- Paparoditis, E. and Shang, H. L. (2021). Bootstrap Prediction Bands for Functional Time Series. arXiv:2004.03971v2

Computational aspects:

- Liu, K., Blanchet, J., Ying, L. and Lu, Y. (2024). Orthogonal Bootstrap: Efficient Simulation of Input Uncertainty. arXiv:2404.19145v1

Summary

Milestones

- First week of semester: kick-off meeting
- Second week of the semester: assignment of the topics
- Middle of semester: In-person meetings to discuss progress
- After the semester: presentation, submitting term papers

Contact

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Office hours

- by appointment and ask questions per email

Further questions?