

## PhD Course

# Recent Developments in Causal Inference

Block course

Time: Jan 31<sup>st</sup> – Feb 2<sup>nd</sup> 2018, Place: TBA

**Course instructor:** Professor Martin Spindler (UHH)

**Course value:** 2 SWS or 4 LP

### Course overview:

The main goal of this course is to give an introduction to causal inference and then focus on recent developments, in particular on the use of Machine Learning Methods for Causal Inference. Research in this field has been very active in the last years. Machine Learning Methods will be briefly reviewed, but previous knowledge on the level Efron and Hastie (2016) or in the PhD Course “Statistical Analysis of Big Data” is recommended. The last part of the course will discuss applications of Machine Learning for causal inference.

### Topics:

- 1) Introduction to Causal Inference / Basic Framework
- 2) Methods for Causal Inference (Diff-in-Diff, IV, Propensity Score Matching, Randomized Control Trials, ...)
- 3) Review Machine Learning Methods
- 4) Recent Developments

**Teaching language:** English

**Student evaluation:** presentation of a recent paper in a blocked session (April 2018)

**Registration:** by email to [martin.spindler@uni-hamburg.de](mailto:martin.spindler@uni-hamburg.de)

### References

Efron, B. and T. Hastie. Computer Age Statistical Inference. Cambridge University Press 2016.

Athey, Imbens, and Wager (2016). Approximate Residual Balancing: De-Bias Inference of Average Treatment Effects. arxiv.

Athey and Imbens (2016). Recursive Partitioning for Heterogenous Causal Effects. PNAS.

Athey and Wager (2017). Estimation and Inference of Heterogenous Treatment Effects using Random Forests. JASA.

Bloniarz et al. (2015). Lasso Adjustment of Treatment Effect Estimates in Randomized Experiments. arxiv.

Belloni et al. (2017). Program Evaluation and Causal Inference With High-Dimensional Data. Econometrica.

Künzel et al. (2017). Meta-learners for Estimating Heterogenous Treatment Effects using Machine Learning. arxiv.

Powers et al. (2017). Some Methods for Heterogenous Treatment Effect Estimation in High-Dimensions. arxiv.