Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

FAKULTÄT
FÜR BETRIEBSWIRTSCHAFT

PhD Course

Recent Developments in Causal Inference

Block course

Time: Jan 31st – Feb 2nd 2018, Place: Moorweidenstr. 18, room 0005

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) or written summary of a paper (for non-local students) or presentation / written summary of a research project / idea

Registration: by email to martin.spindler@uni-hamburg.de

Date	Times	Location	Topics
Day 1	8:30 – 10:00 10:15 - 11:45 13:30 - 15:00		Introduction, Basics of Causal Inference, RCT, Diff-in-Diff, Instrumental Variables Estimation, Regression Discontinuity, Panel Data Methods, Propensity Score Matching
Day 2	8:30 – 10:00 10:15 - 11:45 13:30 - 15:00		Repetition / Introduction to ML methods (Lasso, Neural Nets, Random Forest and Regression Trees) Estimation of Treatment Effects in a high-dimensional setting
Day 3	8:30 – 10:00 10:15 - 11:45 12:30 –13:30		Current research papers and recent developments

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, Susan, and Guido Imbens. "Machine learning methods for estimating heterogeneous causal effects." arXiv preprint arXiv:1504.01132 (2015).

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.

Imbens, Guido W., and Donald B. Rubin. Causal inference in statistics, social, and biomedical sciences. Cambridge University Press, 2015.

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.