PhD Course

Machine Learning

block course: 21.-22.11.2024, 9-18 Uhr

Raum 0029 in der Moorweidenstraße 18

Course Instructor: **Prof. Dr. Martin Spindler**

Course Value: **1 SWS or 2,5 LP**

Assessment/Student evaluation: Home assignment; grading will be pass/fail.

Course Language: English.

Software: N/A

Prerequisites: Basic knowledge in Linear Regression and Statistics / Econometrics

Registration: **Please register via STiNE.** For all organizational matters please contact e-mail andrea.buekow@uni-hamburg.de.

Course Overview & syllabus:

The course will consist of two parts: In the first part, the standard machine learning algorithms for prediction are introduced, namely Lasso, Regression Trees, Random Forest, Boosted Trees and Deep Learning. In the second part of the course, we will show how causal effects can be estimated with machine learning methods and valid inference can be conducted (Causal Machine Learning). For this we will introduce the so-called Double Machine Learning approach. Moreover, modern machine learning methods will be used to estimated heterogenous treatment effects in complex data (S-Learner, T-Learner, Meta Learner and others; Causal Forest). This is a very important topic for empirical research.

Literature:

Chernozhukov, V. & Hansen, C. & Kallus, N. & Spindler, M. & Syrgkanis, V. (2024): Applied Causal Inference Powered by ML and AI. CausalML-book.org; arXiv:2403.02467, causalml-book.org

Facure, M. (2023): Causal Inference in Python. O'Reilly.

	Day 1	Day 2
Morning session (9am - 12am)	Introduction	Recap
	Penalization Methods (Lasso)	Double Machine Learning
Lunch Break		
Afternoon session (1pm – 5pm)	Regression Trees, Random Forest Boosted Trees	Heterogenous Treatment Effects
	Deep Learning	Outlook & Closing