Econometrics IV: Machine Learning

Course instructor:
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Office hours: by arrangement

Timetable: 1st part in person: August 1, 2022 (9am to 5pm, room 2544)
2nd part in person: September 13-14, 2022 (9am to 5pm, room 2544)

Prerequisites: Ideally, Econometrics I, II and III (TUM) or equivalently solid introductory courses in econometrics. Preferably some basic knowledge of R and Python. Participants should bring their own laptop with R and/or Python installed. The target audience are PhD students.

Grading: Successful participation; details below

Registration: Until July 31, 2022, via Moodle.

Course description:
The course is part of a series of econometrics courses at TUM School of Management that also comprises
"Econometrics I: Research Design and Estimation Methods" by Prof. Dr. Hanna Hottenrott, "Econometrics II: Causal Inference" by Prof. Dr. Joachim Henkel and "Econometrics III: Advanced Econometrics" by me.
Econometrics IV will be a block lecture but conceptualized as a seminar based on student presentations. The course covers a selection of state-of-the-art methods in econometrics and machine learning. It aims to provide students with a sound understanding of the methods discussed, such that they are able to do research using modern econometric techniques, as well as critically assess existing studies.

In particular, the course will likely cover the following topics:

- Regression Shrinkage Methods (Ridge, Lasso, Elastic Net)
- Decision Trees, Random/Causal Forests
- Advanced Identification Strategies (e.g., Double Machine Learning)
- Introduction to Neural Networks

1st part of the course (in person):
In the first meeting, we will briefly discuss the econometric methods (including some applications to illustrate them). In this meeting I will also assign a (replication) project to each student, which (s)he will present at the second part of the course. Students will then apply these methods and will replicate recent research papers in economics. They are supposed to work on the replication project before the second part of the course begins.

2nd part of the course (in person):
The second part of the course will be similar to a reading course in which we will discuss the (replication) projects. All participants are expected to read the papers before the meetings. The presentation (roughly 30 minutes) together with a short report that summarizes the assigned paper (roughly 5 pages w/o figures, tables and references) will be relevant for the grading.
Recommended textbooks:

- Hansen Bruce. *Econometrics*, available here
- James Gareth, Witten Daniela, Hastie Trevor and Tibshirani Robert. *An Introduction to Statistical Learning with Applications in R*, Springer, available here

Papers you definitely should read (potential project applications):


Papers you could read if you have plenty of time:


