# Introduction to Causal Machine Learning (EHNE098)

## 1  CONTACT

Course instructor: **Anthony Strittmatter**, UniDistance Switzerland
https://www.anthonystrittmatter.com/

Organizer: **Petra Thiemann**, Lund University, petra.thiemann@nek.lu.se, Phone: +46-76-0710379.
If you have any questions, don't hesitate to contact me.

## 2  LOCATION AND TIMES

### 2.1  LOCATION

Lund University School of Economics and Management, Holger Craaford Centre, Tycho Brahes väg 1, 22363 Lund, Sweden.

**Room EC3:108** – Karlssonsalen. This room is on the ground floor of the EC3 building.

You can find travel directions and a campus map at https://www.lusem.lu.se/about-lund-university-school-economics-and-management-lusem/our-campus-visit-us

### 2.2  TIMES

- Morning session: 10:15 -12:00
- Afternoon session: 13:15-15:00

Lectures and computer exercises will be interspersed throughout each course day/session.

**You must bring your own laptop on all course days to follow the computer exercises. Sockets to charge your laptop are available for all seats in the lecture hall. You do not need to install R on your laptop because the exercises will be run on a server.**

### 2.3  LUNCH BREAKS

Lunch breaks will be each day from 12:00-13:15. Lunch will NOT be provided as part of the course, but several affordable lunch options are available close to campus.

On each course day, we will reserve some tables at Inspira, where you can join us for lunch (SEK 110 per person—no need to sign up in advance).

### 2.4  SOCIAL GATHERING

There will be a course dinner on one of the course days, generously sponsored by the Arne Ryde Foundation. A separate invite for the dinner will follow closer to the course.

# 3  PREREQUISITES

Basic knowledge of statistics and econometrics, such as hypothesis tests, linear regression, and inverse probability weighting.

The computer exercises are designed so that most of the content can be understood with little prior knowledge of R. We work with standard packages and do not start programming algorithms ourselves.

# 4  SCHEDULE

- Day 1: Intro, Regularised Regression (Lasso & Ridge)
- Day 2: Trees and Random Forests
- Day 3: Causal ML: Confounding (Double Selection Procedure, Double Machine Learning)
- Day 4: Causal ML: Heterogeneity (Causal Forest, Policy Learning)

# 5  LITERATURE TO GET STARTED

## 5.1  INTRODUCTION

Mullainathan and Spiess (2017): "Machine Learning: An Applied Econometric Approach", Journal of Economic Perspectives, 31 (2), pp. 87-106,
https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.31.2.87

Athey (2017): "Beyond Prediction: Using Big Data for Policy Problems", Science, 355 (6324), pp. 483-485, https://science.sciencemag.org/content/355/6324/483/tab-pdf

## 5.2  BASIC MACHINE LEARNING

Chapters 6.2, 8.1 and 8.2 of James, Witten, Hastie, Tibshirani (2023): "An Introduction to Statistical Learning with Applications to R", online version: https://hastie.su.domains/ISLR2/ISLRv2_corrected_June_2023.pdf.download.html

## 5.3  CAUSAL ML

Chapter 5 of Huber (2023): "Causal Analysis: Impact Evaluation and Causal Machine Learning with Applications to R", online version https://mitpress.ublish.com/ebook/causal-analysis-impact-evaluation-and-causal-machine-learning-with-applications-in-r-preview/12759/iv

# 6  INFORMATION ON INSTALLING AND USING R

Please find attached an installation guide for R. It is not necessary to install R to follow the course, as we will be accessing R through a server during the course. However, it would still be good if you had R installed for your own research.

This video is good for getting a quick overview of R:

https://www.youtube.com/watch?v=4wS3n54Kon0

# 7  LECTURE SLIDES AND COURSE MATERIALS

The lecture slides and additional course materials will be available on a GitHub server before the course starts.

# 8  PARTICIPANT LIST

1.  Abdullah-Al-Baki, Chowdhury, Linkoping University
2.  Åkerlund, Ruben, Lund University
3.  Almgren, Pelle, Lund University
4.  Bakay, Barnabas Fabian, Copenhagen Business School
5.  Becker, Ralf, University of Manchester
6.  Bengtsson, Elias, Lund University
7.  Berggreen, Steve, Lund University
8.  Bretschneider, Tilman, Lund University
9.  Chakraborty, Adrij, University of Luxembourg
10. Christie, Nick, Lund University
11. Deniz, Sinan, Lund University
12. Eifler, Nadja, University of Copenhagen
13. Ek, Andreas, Lund University
14. Ellegård, Lina Maria, Lund University
15. Falk, Johanne, Technical University of Denmark
16. Fogel Henneberg, Christian, University of Copenhagen
17. Gokmen, Gunes, Lund University
18. Hajimirza, Najmeh, Lund University
19. Hamadi, Hassan, Lund University
20. Hjorth, Laurits, Copenhagen Business School
21. Izquierdo Nofuentes, Àlex, University of Barcelona
22. Kaddoura, Yousef, Lund University
23. Karakaya, Rojan, Institute for Futures Studies
24. la Cour, Lisbeth, Copenhagen Business School
25. Lark, Olga, Lund University
26. Lindahl, Robert, Linkoping University
27. Mann, Katja, Copenhagen Business School
28. Martinez Correa, Jimmy, Copenhagen Business School
29. Maschmann, Christina, Lund University
30. Maschmann, Lukas, Lund University
31. Mealy, Dominic, Lund University
32. Meffe, Nico, Lund University
33. Merouani, Youssouf, Lund University
34. Montañez-Medina, Kimberly, Lund University
35. Morgado Azevedo, Hugo, Lund University
36. Muraro da Silva, Vinicius, Lund University
37. Nicklas, Nordfors, Stockholm University
38. Nordström, Marcus, Lund University
39. Østdal, Jacob, University of Copenhagen
40. Peredo Siles, Daniel, Hanken School of Economics

41. Polis, Maxime, Lund University
42. Pozzoli, Dario, Copenhagen Business School
43. Reese, Simon, Lund University
44. Rigos, Alexandros, Institute for Futures Studies
45. Rosengren, Oliver, Linnaeus University Växjö
46. Saha, Sanjib, Lund University
47. Samandari, Naeim, University of Copenhagen
48. Simonsen, Emil, University of Copenhagen and The ROCKWOOL Foundation
49. Singhal, Karan, University of Luxembourg
50. Sola, Jose, Universitat de Barcelona
51. Sørensen, Anders, Copenhagen Business School
52. Theobald, Emelie, Lund University
53. Vigild, Daniel, University of Copenhagen
54. Westerheide, David, Lund University
55. Yunyi, Jin, Lund University
56. Zhao, Liang, Lund University
57. Zhao, Yuqing, Lund University
58. Zhu, Nanbo, Karolinska Institutet