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Heidelberg University
Winter Term 2021/22

Topics in Data Science and Machine Learning

Comments

The seminar takes place on January 14-15, 2022, in room 00.028 or virtually.
A maximum of 15 students can participate in the seminar.

Description

Data science, machine learning and artificial intelligence are leading new technologies which will have a profound impact on our economy and society. In this seminar, we will shed light on different aspects of these technologies and show why social scientists should be aware of them.

Students may either

- participate in a forecasting challenge
  (programming experience recommended in either Python or R)

or work on a theoretical or applied topic such as

- Quantifying uncertainty
- Hyperparameter tuning
- Interpretable machine learning
- Adversarial Machine Learning
- Reinforcement Learning
- Essential skills in data science
- Artificial Intelligence and productivity growth

Students who chose a theoretical or applied topic will submit a seminar paper.
Those who participate in the programming challenge need to hand in the source code as well as a (shorter) documentation including problem description descriptives, model selection and training results.
A presentation is obligatory in both cases.

Certificates

Your grade will be based on the following: seminar paper (60%), seminar presentation (30%) and active participation (10%) in the seminar discussion. For the students who participate in the programming challenge, the grading looks as follows: coding (30%), documentation (30%), seminar presentation (30%) and active participation (10%).

Registration

Please register for the seminar via email to arne.warnke@gmail.com .

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Literature (among others)

Acemoglu, Daron. “Harms of AI”. In the Oxford Handbook of AI Governance. 2021. https://economics.mit.edu/files/21848

Athey, Susan. "The impact of machine learning on economics." In *The Economics of Artificial Intelligence: An Agenda*. University of Chicago Press, 2018. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/atheyimpactmlecon.pdf

Athey, Susan, and Guido Imbens. *Lectures on Machine Learning*. NBER Summer Institute Econometric Lectures, 2015. https://www.nber.org/econometrics_minicourse_2015/

Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. *Deep Learning*. MIT Press (2016). Available at https://www.deeplearningbook.org/

Breiman, Leo. "Statistical modeling: The two cultures." *Statistical science* 16, no. 3 (2001): 199-231. Available via http://www2.math.uu.se/~thulin/mm/breiman.pdf

Brynjolfsson, Erik, Daniel Rock, and Chad Syverson. "Artificial Intelligence and the Modern Productivity Paradox." *The Economics of Artificial Intelligence: An Agenda* (2019): 23. https://www.nber.org/papers/w24001.pdf

Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. *The elements of statistical learning*. Vol. 1, no. 10. New York, NY, USA:: Springer series in statistics, 2001. Available at https://web.stanford.edu/~hastie/ElemStatLearn/download.html

Gentzkow, Matthew, Bryan Kelly, and Matt Taddy. "Text as data." *Journal of Economic Literature* 57, no. 3 (2019): 535-74. https://web.stanford.edu/~gentzkow/research/text-as-data.pdf

Koopmans, Tjalling C. "Measurement without theory." *The Review of Economics and Statistics* 29, no. 3 (1947): 161-172.

James, Gareth, Daniela Witten, Trevor Hastie, and Robert Tibshirani. *An introduction to statistical learning*. Vol. 112. New York: Springer, 2013. http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Seventh%20Printing.pdf

Mullainathan, Sendhil, and Jann Spiess. "Machine learning: an applied econometric approach." *Journal of Economic Perspectives* 31, no. 2 (2017): 87-106. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.31.2.87