Syllabus of the course:
Machine Learning for Economists

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Aims and objectives

As it has been shown that the standard econometric tools are intrinsically not predictive (Einav, Levin, 2014; McAfee et al., 2012), a new strand of economic literature increasingly uses Machine Learning procedures (Kleinberg et al., 2015; Varian, 2016).

This course aims at making participants familiar with the potential of Machine Learning procedures for social scientists and aims to provide participants the tools for using Machine Learning in their analysis. The teaching will provide the basic knowledge and the way to implement the Machine Learning algorithms mostly used in the recent economic literature: Lasso, Ridge, Elastic Net regressions, Random Forests, Gradient Boosting Machine, and Neural Networks. The training will consist in replicating a few scientific papers using Machine Learning in social science.

After the course, participants are expected to have an improved understanding of the potential to perform Machine Learning, thus becoming able to master Machine Learning tasks both from a data mining and a predictive perspective.

Program

Lesson 1 (two hours) *Fundamentals of Machine Learning*

Lesson 2 (two hours) *An overview of algorithms mostly used in the recent economic literature part 1 (Lasso, Ridge, Elastic Net regressions)*

Lesson 3 (two hours) *An overview of algorithms mostly used in the recent economic literature part 2 (Random Forests, Gradient Boosting Machine, and Neural Networks)*

Lesson 4 (two hours) *Comparing algorithms' performances*

Lesson 5 (two hours) *Replicating scientific papers using R part 1 (prediction tasks)*

Lesson 6 (two hours) *Replicating scientific papers using R part 2 (counterfactual tasks)*

References

1. Antulov-Fantulin, N., Lagravinese, R., & Resce, G. (2021). Predicting bankruptcy of local government: A machine learning approach. *Journal of Economic Behavior & Organization*, 183, 681-699.
2. Einav, L., & Levin, J. (2014). The data revolution and economic analysis. *Innovation Policy and the Economy*, *14*(1), 1-24.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning* (Vol. 112, p. 18). New York: springer.
4. Kleinberg, J., Ludwig, J., Mullainathan, S., & Obermeyer, Z. (2015). Prediction policy problems. *American Economic Review*, *105*(5), 491-95.
5. McAfee, Andrew, et al. "Big data: the management revolution." *Harvard business review* 90.10 (2012): 60-68.
6. Varian, H. R. (2016). Causal inference in economics and marketing. *Proceedings of the National Academy of Sciences*, *113*(27), 7310-7315.

Prerequisites

Knowledge of basic statistics and econometrics, a basic knowledge of R is preferable.

Teaching methods

Lectures/Tutorials