1 DESCRIPTION

FEM11213-23 introduces students to the use of Machine Learning (ML) in economic analysis with a specific focus on its application to HR problems. ML focus will be on how and when to apply ML methods to

- estimate treatment effects
- make policy-relevant predictions and classifications
- while using big data.

Will tackle HR problems using econometrics, ML, and the economic way of thinking.

2 TOPICS

1. Introduction
2. Uncertainty
3. Regression
4. Regularization
5. Classification
6. Controls
7. HR Application

3 READINGS

Ones in bold face are required readings.

1. **Business Data Science: Combining Machine Learning and Economics to Optimize, Automate, and Accelerate Business Decisions, by M. Taddy. New York: McGraw-Hill Education, 2019.**
    - Can find an ebook version at the university library website.
    - Otherwise can purchase online.
    - We will draw HEAVILY on this book and the code that can be found at https://github.com/TaddyLab/MBAcourse.
2. **CEO Behavior and Firm Performance, by O. Bandiera, A. Prat, S. Hansen, et al. In: Journal of Political Economy 128.4, pp. 1325-1369, 2020.**

3. **Hiring as Exploration, by D. Li, L. Raymond, P. Bergman. Working Paper, 2021.** https://danielle-li.github.io/assets/docs/HiringAsExploration.pdf

4. **Discretion in Hiring, by M. Hoffman, L. Kahn, D. Li. Quarterly Journal of Economics, Volume 133, Issue 2, Pages 765–800, May 2018.**

5. The impact of machine learning on economics, by S. Athey. In The Economics of Artificial Intelligence: An Agenda. University of Chicago Press, 2018.

    - Also published in NBER working paper series.

6. Machine learning: an applied econometric approach, by S. Mullainathan and J. Speiss. Journal of Economic Perspectives, 31(2), 87-106, 2017.

7. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing, by Y. Benjamini and Y. Hochberg. In: Journal of the Royal Statistical Society. Series B (Methodological) 57.1, pp. 289-300, 1995.

8. What can machine learning do? Workforce implications, by E. Brynjolfsson and T. Mitchell. In: Science 358.6370, pp. 1530-1534, 2017.

9. Notes for Predictive Modeling, by E. García-Portugués. Version 5.9.12. ISBN 978-84-09-29679-8. 2023. URL: https://bookdown.org/egarpor/PM-UC3M/.

4 PREREQUISITES

1. Applied econometrics (FEM11090) or equivalent.

2. Experience with a programming language (Stata or Python or R e.g.).

5 PROGRAMMING

We will use Rstudio and Github in this course. Part of the objective here will be learn Rstudio and Github. You should do the following as soon as possible:

1. Download and install Git.

2. Download and install R and RStudio.

3. Create an account on GitHub

4. Download and install GitHub Desktop.

Posit Cloud lets you use RStudio in the cloud. It is meant to be easier for R and Python novices to learn data science and machine learning using R and Python. Posit has some primers that you familiarize yourself with the language: Posit Primers.

Another useful source is Introduction to Econometrics with R (Hanck, Arnold, Gerber, and Schmelzer).

You can use ChatGPT or equivalent in this course. In fact, I encourage it.

6 MATERIALS

Github. Critical materials can be found at a GitHub repository:

https://github.com/SachaKapoor/FEM11213

Canvas. Supplementary materials will be posted to Canvas: syllabus, larger datasets, videos, replication groups. Please keep on top of the materials and announcements therein.

7 EVALUATION

3 parts:

1. **Github Repository is 20%.** Done individually.
   - Set up folders for each week of the course.
   - Each folder should contain evidence that you have been practicing the material.
   - Each folder should have a README file that outlines what you did. For example,
     - Made an Rmarkdown file with prof Kapoor's code
     - Altered code in such in such a way
   - Learned that this function or modifier does X.
   - These are easy points.
2. **Replication is 30%**. Done in groups.
   - 4 to 5 students per group. You pick your group. After picking your group, register it on Canvas (go to **People/Replication Groups**).
   - You will replicate the ML exercise in a paper I give you.
   - Will give you the code they used. You can use ChatGPT to convert it to R.
   - You will make one meaningful extension
   - You will describe everything in a 7 page report (excluding tables).
   - You will present your extension on the last day of class (Presentation times will depend on class size).

- You will hand the report thereafter.
- Presentation grade is 5

3. **Final Exam: 50**%

8 SCHEDULE AND IMPORTANT DATES

- Wed Nov 1 - Intro + Methods Lecture
- Wed Nov 8 - Methods Lecture
- Wed Nov 15 - Methods Lecture
- Wed Nov 22 - Methods Lecture
- Wed Nov 29 - Methods Lecture + HR Application
- Wed Dec 6 - Guest Lecture (Edi Terlaak, Scientific Collaborator at Dutch Inspectorate of Education)
- Wed Dec 13 - Assignment Presentations + Exam Review
- Fri Dec 15 - Hand in Assignment
- Fri Dec 22 - Final Exam

9 FEEDBACK

Course is new. Also first time for me. Please feel free to give honest and direct feedback. I would like to improve this course. You can email comments to me, tell me directly, or wait for the course evaluations. Either way, I appreciate concrete examples where improvement can be had.