

01 - Course Overview

ml4econ, HUJI 2023

Itamar Caspi

March 19, 2023 (updated: 2023-03-20)

An aside: about the structure of these slides

- The course's slide decks are created using the **xaringan** (/ʃæ:'rɪŋ.gæn/) R package and **Rmarkdown**.
- Some slides include hidden comments. To view them, press **p** on your keyboard

About this presentation

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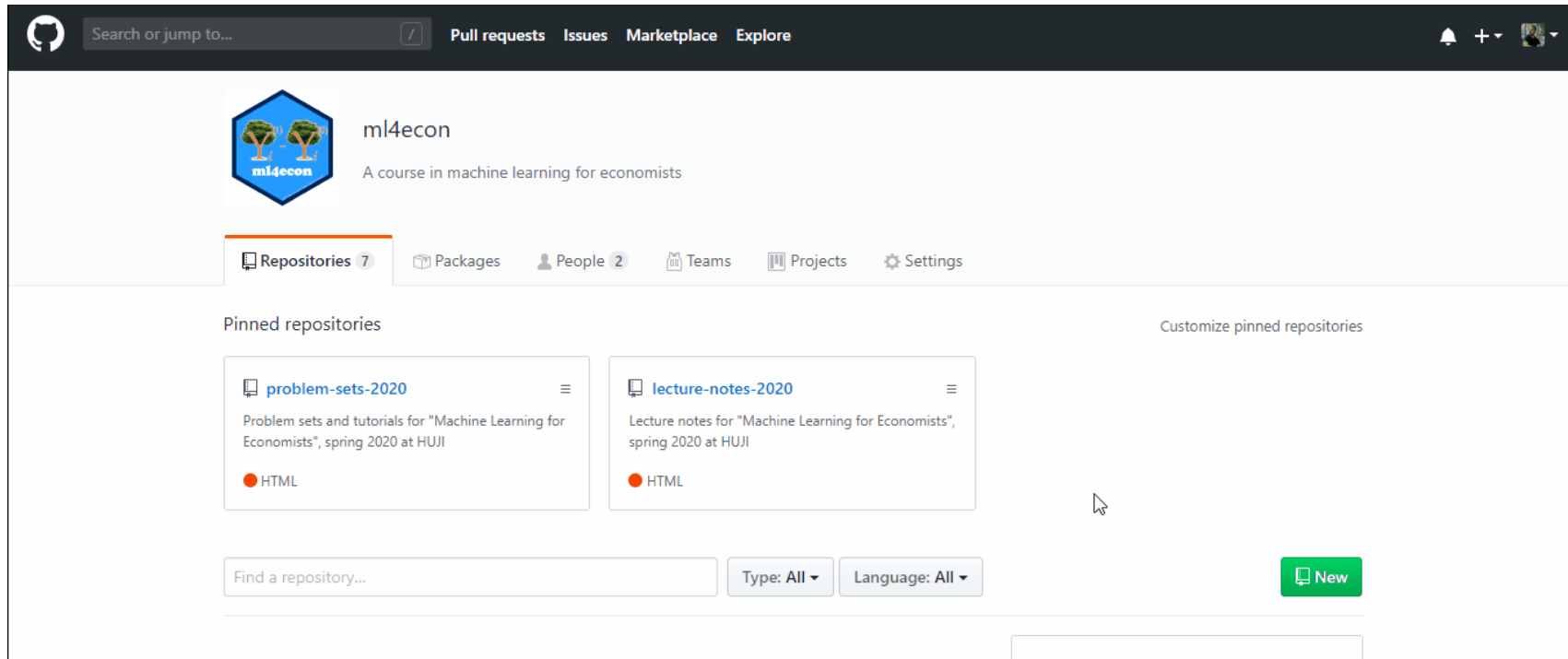
Outline

1. Logistics
2. About the Course
3. To Do List

Logistics

ml4econ GitHub repository

The class's GitHub repository: <https://github.com/ml4econ>



Posit Cloud workspace

Posit Cloud is a hosted version of RStudio in the cloud that will make it easy for R and Python novices to learn data science and machine learning using R and Python.



People

- **Itamar Caspi**

- Head of Monetary Analysis Unit, Research Department, Bank of Israel.
- email: caspi.itamar@gmail.com
- homepage: itamarcaspi.rbind.io

- **Ariel Karlinsky**

- Ariel Karlinsky is a PHD student in economics at Hebrew University who researches various economic fields and maintains the World Mortality Dataset.
- email: karlinsky@gmail.com

- Meeting hours: after class/zoom, on demand.

Feedback

This is the fourth time we run this course \Rightarrow your continuous feedback is important!

Please feel free to contact us by

- email
 - in person
 - or open an issue in our discussion forum
-

About the Course

Prerequisites

- Advanced course in econometrics.
- Some early experience with R (or another programming language) are a plus.

This course is

About

How and when to apply ML methods in economics

- estimate treatment effects.
- prediction policy.
- work with new types of data (e.g., text).

To do that we will need to understand

- what is ML?
- how it relates to stuff you already know?
- how it differs?

Not about

- Cutting-edge ML techniques (e.g., generative AI)
- Computational aspects (e.g., gradient descent)
- Data wrangling (a.k.a. "feature engineering")
- Distributed file systems (e.g., Hadoop, Spark)

Tentative schedule

Week	Topic
1	Course Overview & ML Basics
2	Reproducibility and ML Workflow
3	Regression and Regularization
4	Classification
5	Non-parametrics
6	Unsupervised Learning
7	Text analysis
8	Causal Inference
9	Lasso and Average Treatment Effects
10	Trees and Heterogeneous Treatment Effects
11	Prediction Policy Problems
12	The Economics of AI

NOTE: This schedule can (and probably will) go through changes!

Readings on ML for economists

All materials and lecture notes will be available on the [class website](#).

Please read the following excellent surveys:

- **The impact of machine learning on economics** Athey (2018)
In The Economics of Artificial Intelligence: An Agenda.
University of Chicago Press.
- **Machine learning: an applied econometric approach** Mullainathan and Spiess (2017)
Journal of Economic Perspectives, 31(2), 87-106.



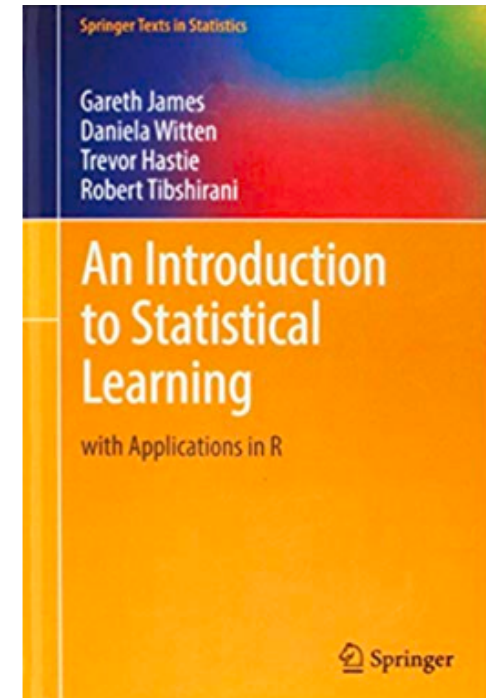
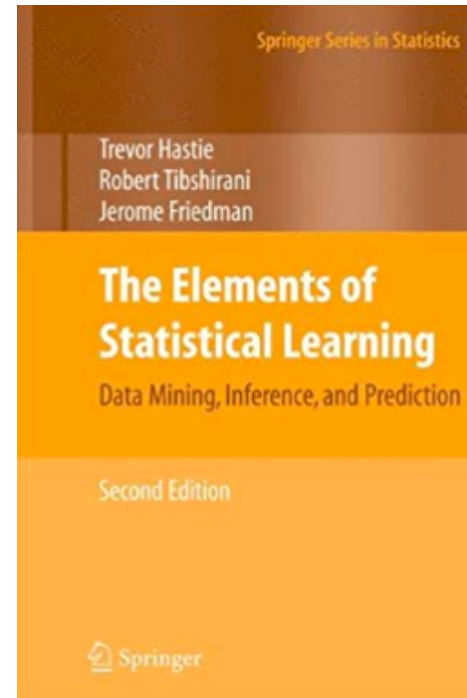
Readings on ML

All materials and lecture notes will be available on the [course repo](#).

There are **no** required textbooks.

A couple of suggestions:

- [An Introduction to Statistical Learning with Applications in R \(ISLR\), 2 ed.](#)
James, Hastie, Witten et al. (2013)
PDF available online
- [The Elements of Statistical Learning \(ELS\)](#)
Hastie, Tibshirani, and Friedman (2009)
PDF available online



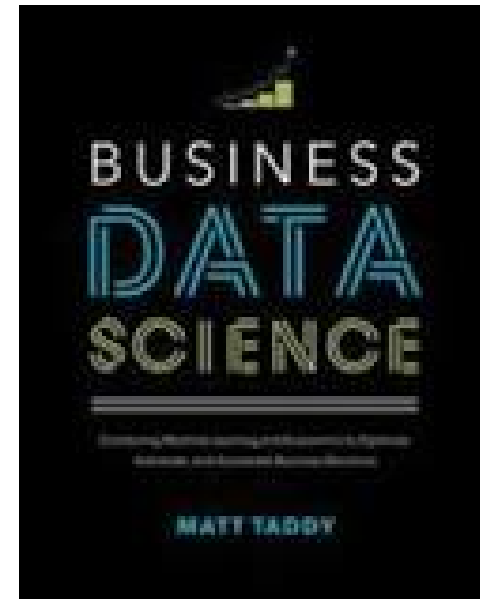
Textbooks (optional)

All materials and lecture notes will be available on the [course repo](#).

There are **no** required textbooks.

A couple of suggestions:

- [Business Data Science](#) by Matt Taddy
No free version available
- [Econometrics](#) by Bruce Hansen, Ch. 29
PDF available online





More resources

Can be found at our GitHub repo:

<https://github.com/ml4econ/lecture-notes-2023/blob/master/resources.md>

Programming

- Two of the most popular open-source programming languages for data science:
 - 
 -  Python
- This course: R.
- Why R? See presentation notes and the [FAQ section](#) of our class website.
- We do encourage you to try out Python. However, we will only be able to provide limited support for Python users.

Catching up with R

Posit Primers

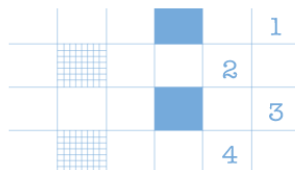
Posit Primers

The Basics



Start here to learn the skills that you will rely on in every analysis (and every primer that follows): how to inspect, visualize, subset, and transform your data, as well as how to run code.

Work with Data



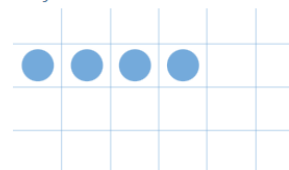
Learn the most important data handling skills in R: how to extract values from a table, subset tables, calculate summary statistics, and derive new variables.

Visualize Data



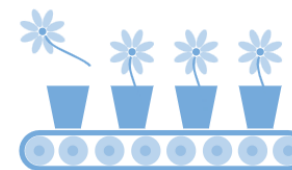
Learn how to use ggplot2 to make any type of plot with your data. Then learn the best ways to visualize patterns within values and relationships between variables.

Tidy Your Data



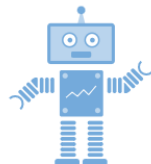
Unlock the tidyverse by learning how to make and use tidy data, the data format designed for R.

Iterate



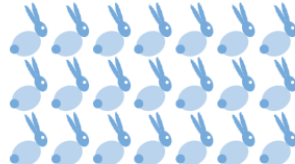
Master a core programming paradigm with the purrr package: for each ____ do ____.

Write Functions



Functions are the key to programming in R. This primer will teach you how to write and use your own reusable functions.

Report Reproducibly



Learn to report, reproduce, and parameterize your work with the best authoring format for Data Science: R Markdown.

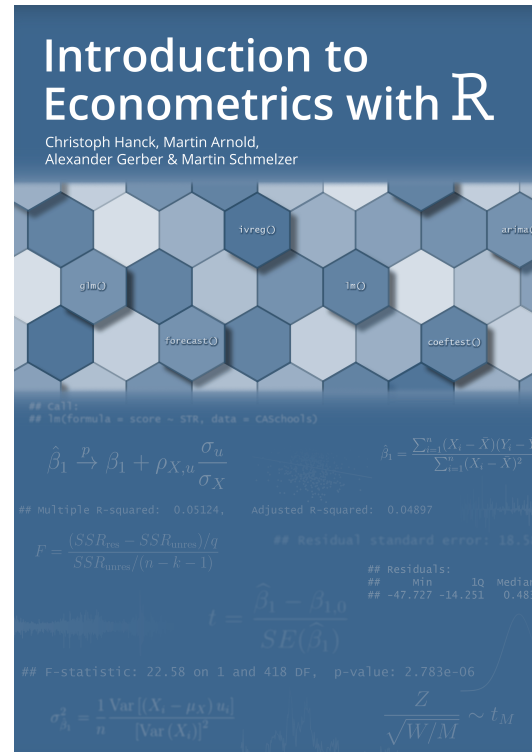
Build Interactive Web Apps



Say hello to Shiny, R's package for building interactive web apps. Learn to turn your analyses into elegant tools to share with others.

Econometrics with R

Introduction to Econometrics with R (Hanck, Arnold, Gerber, and Schmelzer)



Large Language Models (LLMs)

We encourage you to use [ChatGPT](#), [BingAI](#), or any other LLM in this course, as it is an **essential skill to acquire**.

It is important you understand the (current) limitations of LLMs:

- Prompt engineering is necessary for quality outcomes.
- Always assume that it is wrong.
- Acknowledge its use in assignments and explain what prompts were used.

A couple of useful resources:

- Follow [@emollick](#) (Ethan Mollick)
- Read "[Language Models and Cognitive Automation for Economic Research](#)" by Korinek (2023).

Share your discoveries with us and your classmates!

Grading

Assignments:





- Submit 4 out of a total of 6 Problem sets.


Projects:

- Kaggle prediction competition.
- Conduct a replication study based on one of the datasets included in the [experimentdata](#) package, or a paper of your choice.

GRADING: Assignments **20%**, kaggle **40%**, project **40%**.

Kaggle


 Search  Competitions Datasets Kernels Discussion Learn ...  


 InClass Prediction Competition

55750: Machine Learning for Economists @ HUJI 2019

A prediction competition for course participants


[Host](#) [Overview](#) [Data](#) [Kernels](#) [Leaderboard](#) [Rules](#) [Team](#) [My Submissions](#)

 This competition hasn't been launched. Only hosts and Kaggle admins can see it.

Overview 

Description

Evaluation

 Add Page

In this competition, course participants will rely on the "Boston Housing Data" to train and test machine learning models learned in the course. In particular, course participants are required to apply the tools introduced in the course in order to predict Boston area **median house values** based on a set of area specific features.

experimentdatar

We will also make use of the `experimentdatar` data package that contains publicly available datasets that were used in Susan Athey and Guido Imbens' course "[Machine Learning and Econometrics](#)" (AEA continuing Education, 2018).

- You can install the **development** version from [GitHub](#)

```
# install.packages("devtools")  
devtools::install_github("itamarcaspi/experimentdatar")
```

- **EXAMPLE:** Load the `experimentdatar` package and the `social` dataset:

```
library(experimentdatar)  
data(social)
```

- Tips:
 1. Running `?social` provides variable definitions.
 2. Running `dataDetails("social")` will open a link to the paper associated with `social`.

To Do List

Homework*

- ✓ Download and install [Git](#).
- ✓ Download and install [R and RStudio](#).
- ✓ Create an account on [GitHub](#)
- ✓ Download and install [GitHub Desktop](#).

[*] Feel free consult the [Guides](#) section in the course's old website.

```
slides %>% end()
```

 [Source code](#)

References

- [1] S. Athey. "The impact of machine learning on economics". In: *The Economics of Artificial Intelligence: An Agenda*. University of Chicago Press, 2018.
- [2] T. Hastie, R. Tibshirani, and J. Friedman. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition*. Springer, 2009. פבר. ISBN: 9780387848570.
- [3] G. James, T. Hastie, D. Witten, et al. *An Introduction to Statistical Learning: With Applications in R*. Springer Texts in Statistics. Springer London, Limited, 2013. ISBN: 9781461471370.
- [4] A. Korinek. "Language Models and Cognitive Automation for Economic Research". In: *NBER Working Paper 30957* (2023).
- [5] S. Mullainathan and J. Spiess. "Machine learning: an applied econometric approach". In: *Journal of Economic Perspectives* 31.2 (2017), pp. 87-106.