Machine Learning & Causal Inference
A Practical Approach using Python

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Requirements:

- Undergraduate Statistics & Econometrics.

- Python-capable machine.

- Ideally, agent-based IDE for coding (e.g., Cursor, Claude Code).

Recommended Readings:

- Intro to Causal Inference w/ examples in Python: *Causal Inference for The Brave and True.* Matheus Facure

- Causal Inference Theory: *Causal Inference: A Statistical Learning Approach.* Stefan Wager

- Machine Learning Theory: *The Elements of Statistical Learning.* Hastie, Tibshirani, Friedman

- Some resources on Prompt Engineering:

  - Prompt Engineering Guide by Google
  - Context Engineering for AI Agents by Anthropic

Content:

Lecture 1: 18-Feb. Basic Elements of Coding

1. Python. Virtual environments. Basic libraries. Data loading.

2. Basic programming logic: "for", "while" loops. "if" conditions.

3. User-defined functions. Classes.

4. Scripts vs notebooks.

5. Version control: Github.

6. AI Agents. Prompts. Good practices.

Lecture 2: 20-Feb. Treatment Effects

1. Fundamental Problem of Causal Inference.

2. Data simulations. Seeds for reproducibility. Visualizations.

3. RCTs. Difference in means estimator.

4. Variance reduction. Lin (2013) adjustment.