Machine Learning for econometrics

Causal perspective

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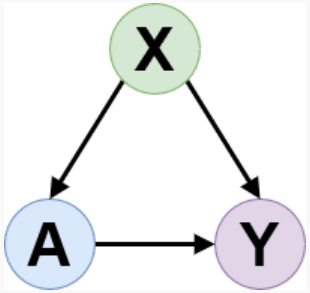
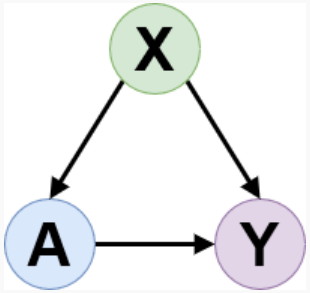
Introduction

Causal inference: subfield of statistics dealing with “why questions”.



At the center of epidemiology, econometrics, social sciences…

Causal inference: subfield of statistics dealing with “why questions”.



At the center of epidemiology, econometrics, social sciences…

Now, bridging with Machine Learning (Kaddour, Lynch, Liu, Kusner, & Silva, 2022)

How to ask a sound causal question

What is a why question ?

- Economics: How does supply and demand (causally) depend on price?
- Policy: Are job training programmes actually effective?
- Epidemiology: How does this threatment affect the patient's health?
- Public health : Is this prevention campaign effective?
- Psychology: What is the effect of family structure on children's outcome?
- Sociology: What is the effect of social media on political opinions?

This is different from a predictive question

- What will be the weather tomorrow?
- What will be the outcome of the next election?
- How many people will get infected by flue next season?
- What is the cardio-vacular risk of this patient?
- How much will the price of a stock be tomorrow?

Why is prediction different from causation?

- Prediction (most part of Machine Learning) focus on understanding what usually happens in a given situation.

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It assumes iid between train and test data.

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- Prediction (most part of Machine Learning) focus on understanding what usually happens in a given situation.

- Causal inference (most part of economists) focus on what would happen if we changed the system ie. under intervention.

It models the covariate shift between treated and control units.

How to ask a sound causal question: The PICO framework

Identify the target trial

What would be the ideal **randomized experiment** to answer the question?

(Hernán & Robins, 2016)

PICO framework

- Population : Who are we interested in?
- Intervention : What treatment/intervention do we study?
- Comparison : What are we comparing it to?
- Outcome : What are we interested in?

Causal graphs

The three steps of causal inference: identification, estimation, inference

Identification: what can we learn from the data?

Identification: what can we learn from the data?

Causal graphs

Potential outcomes

Related concepts

Structural equations.

Hello world

Resources

- https://web.stanford.edu/~swager/stats361.pdf
- https://www.mixtapesessions.io/
- https://alejandroschuler.github.io/mci/

Bibliography

Hernán, M. A., & Robins, J. M. (2016). Using big data to emulate a target trial when a randomized trial is not available. American Journal of Epidemiology, 183(8), 758–764.

Kaddour, J., Lynch, A., Liu, Q., Kusner, M. J., & Silva, R. (2022). Causal machine learning: A survey and open problems. Arxiv Preprint Arxiv:2206.15475.