Introduction to Causal Inference

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October 6, 2022

Motivation

- Our starting point is the difference between an observation and an intervention (or action).
- We can answer many questions from passive observation alone.
- For example: do 16 year-old drivers have a higher incidence rate of traffic accidents than 18 year-old drivers?
- The answer corresponds to a difference of conditional probabilities.
- Let random variables I, A correspond to traffic incident rate and driver's age correspondingly:

$$P(I|A = 16) - P(I|A = 18) > 0?$$

- Both conditional probabilities can be estimated from a large enough sample drawn from the distribution.
- The answer to the question we asked is solidly in the realm of observational statistics.
- However, important questions often are not observational in nature.

[1] These slides are mainly based on Chapter 9 of [Hardt and Recht, 2021].

Hardt, M. and Recht, B. (2021).
Patterns, predictions, and actions: A story about machine learning.
arXiv preprint arXiv:2102.05242.