



Elements of Causal Inference: Foundations and Learning Algorithms

Jonas Peters , Dominik Janzing , Bernhard Scholkopf

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A concise and self-contained introduction to causal inference, increasingly important in data science and machine learning.

The mathematization of causality is a relatively recent development, and has become increasingly important in data science and machine learning. This book offers a self-contained and concise introduction to causal models and how to learn them from data.

After explaining the need for causal models and discussing some of the principles underlying causal inference, the book teaches readers how to use causal models: how to compute intervention distributions, how to infer causal models from observational and interventional data, and how causal ideas could be exploited for classical machine learning problems. All of these topics are discussed first in terms of two variables and then in the more general multivariate case. The bivariate case turns out to be a particularly hard problem for causal learning because there are no conditional independences as used by classical methods for solving multivariate cases. The authors consider analyzing statistical asymmetries between cause and effect to be highly instructive, and they report on their decade of intensive research into this problem.

The book is accessible to readers with a background in machine learning or statistics, and can be used in graduate courses or as a reference for researchers. The text includes code snippets that can be copied and pasted, exercises, and an appendix with a summary of the most important technical concepts.

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Michiel says

After reading "The Book of Why", I was looking for a more technical introduction to causality. Since by background in machine learning using kernel methods, this book co-authored by Bernhard Schölkopf seemed a good start.

Though I skimmed through the latter chapters, the beginning gives a good introduction to the different types of causality and which assumptions that have to be made. I especially liked the chapters drawing links between causality and topics like transfer learning and domain adaptation!

Hyokun Yun says

This book provides a nice introduction into today's causal inference research. For a person like me who is vaguely interested in the topic, but 1) find classical writings like Pearl's to be difficult to understand because they are not written in the language of modern statistics & machine learning, and 2) want to get an overview of today's rapid & diverse research on the topic, this book is a perfect fit. Authors explain key ideas of causal inference in modern terminologies of machine learning, and I found it much more readable than others. They also cover a wide spectrum of ongoing approaches and issues in the field, and make insightful connections between them. Since the book covers so many topics, however, most topics are only sketchily touched, and technical proofs are mostly left out. Moreover, authors concentrate mostly on theoretical issues (ex: identifiability) and applications to real-world problems are only occasionally discussed. This book only serves as a starting point, and you need to follow references to really understand any topic; I expected deeper and gentler dive, at least for key concepts. I also found latter half of the book to be not as carefully written as in the beginning; so many parentheses and hyphens, which are quite distracting.
