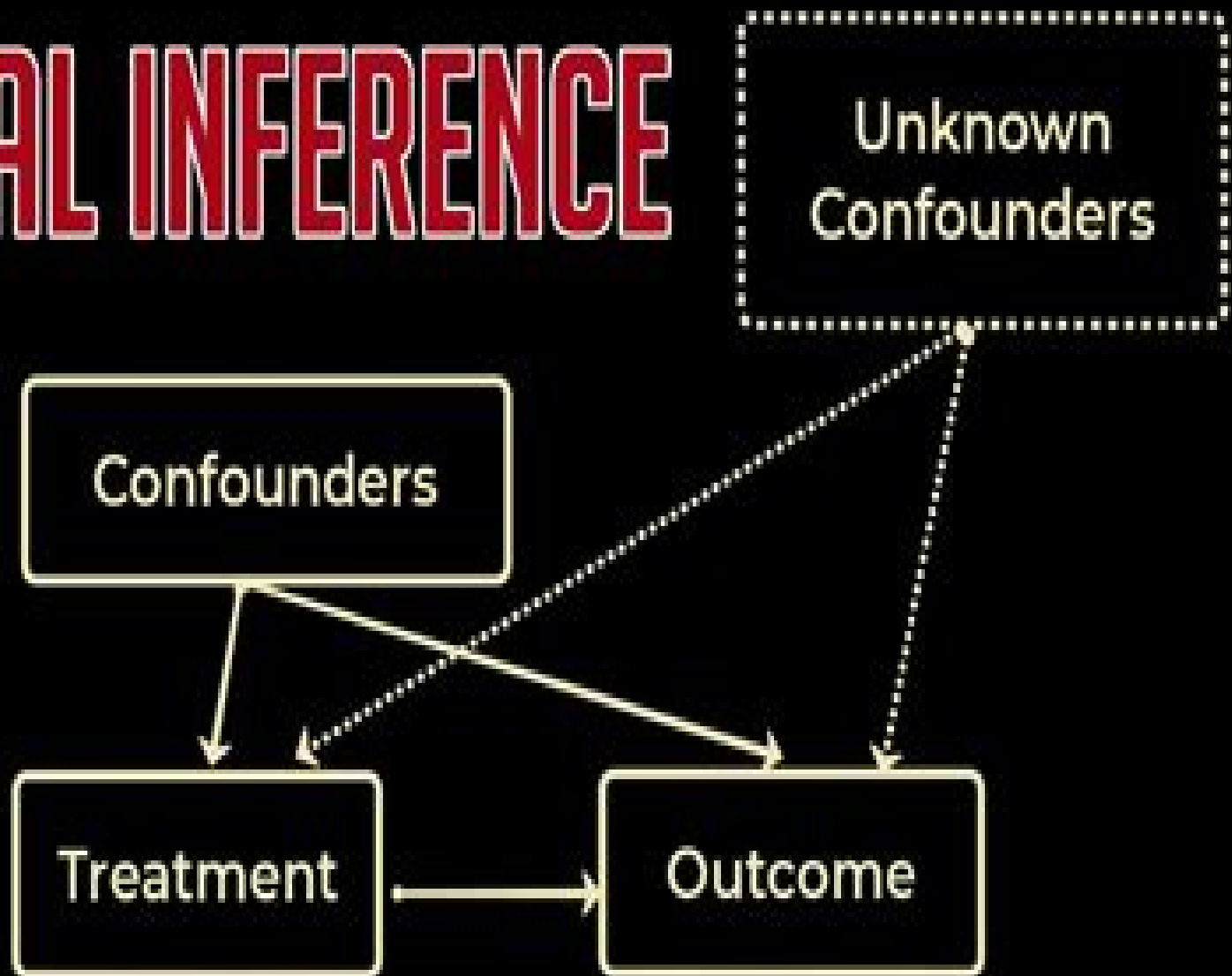


CAUSAL INFERENCE



An Introduction To Causal Inference

Liying Dong



An Introduction To Causal Inference:

An Introduction to Causal Inference Judea Pearl, 2015 This paper summarizes recent advances in causal inference and underscores the paradigmatic shifts that must be undertaken in moving from traditional statistical analysis to causal analysis of multivariate data Special emphasis is placed on the assumptions that underly all causal inferences the languages used in formulating those assumptions the conditional nature of all causal and counterfactual claims and the methods that have been developed for the assessment of such claims These advances are illustrated using a general theory of causation based on the Structural Causal Model SCM described in Pearl 2000a which subsumes and unifies other approaches to causation and provides a coherent mathematical foundation for the analysis of causes and counterfactuals In particular the paper surveys the development of mathematical tools for inferring from a combination of data and assumptions answers to three types of causal queries 1 queries about the effects of potential interventions also called causal effects or policy evaluation 2 queries about probabilities of counterfactuals including assessment of regret attribution or causes of effects and 3 queries about direct and indirect effects also known as mediation Finally the paper defines the formal and conceptual relationships between the structural and potential outcome frameworks and presents tools for a symbiotic analysis that uses the strong features of both The tools are demonstrated in the analyses of mediation causes of effects and probabilities of causation p 1

An Introduction to Causal Inference ,2009 This paper summarizes recent advances in causal inference and underscores the paradigmatic shifts that must be undertaken in moving from traditional statistical analysis to causal analysis of multivariate data Special emphasis is placed on the assumptions that underly all causal inferences the languages used in formulating those assumptions the conditional nature of all causal and counterfactual claims and the methods that have been developed for the assessment of such claims These advances are illustrated using a general theory of causation based on the Structural Causal Model SCM described in Pearl 2000a which subsumes and unifies other approaches to causation and provides a coherent mathematical foundation for the analysis of causes and counterfactuals In particular the paper surveys the development of mathematical tools for inferring from a combination of data and assumptions answers to three types of causal queries 1 queries about the effects of potential interventions also called causal effects or policy evaluation 2 queries about probabilities of counterfactuals including assessment of regret attribution or causes of effects and 3 queries about direct and indirect effects also known as mediation Finally the paper defines the formal and conceptual relationships between the structural and potential outcome frameworks and presents tools for a symbiotic analysis that uses the strong features of both

Observation and Experiment Paul Rosenbaum, 2017-08-14 In the face of conflicting claims about some treatments behaviors and policies the question arises What is the most scientifically rigorous way to draw conclusions about cause and effect in the study of humans In this introduction to causal inference Paul Rosenbaum explains key concepts and methods through real world examples

Cause, Effect, and Everything in Between Aboozar Hadavand, 2025-08-08

Cause Effect and Everything in Between introduces readers to causal inference the science of cause and effect Using examples and case studies Aboozar Hadavand provides an accessible introduction to the fundamental concepts and methodology of causal inference By the end of the book readers are equipped to interpret and assess causal claims in scientific research and political arguments thus able to make better informed decisions

Elements of Causal Inference Jonas Peters, Dominik Janzing, Bernhard Scholkopf, 2017-12-29 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

Causal Inference for Statistics, Social, and Biomedical Sciences Guido W. Imbens, Donald B. Rubin, 2015-04-06 Most questions in social and biomedical sciences are causal in nature what would happen to individuals or to groups if part of their environment were changed In this groundbreaking text two world renowned experts present statistical methods for studying such questions This book starts with the notion of potential outcomes each corresponding to the outcome that would be realized if a subject were exposed to a particular treatment or regime In this approach causal effects are comparisons of such potential outcomes The fundamental problem of causal inference is that we can only observe one of the potential outcomes for a particular subject The authors discuss how randomized experiments allow us to assess causal effects and then turn to observational studies They lay out the assumptions needed for causal inference and describe the leading analysis methods including matching propensity score methods and instrumental variables Many detailed applications are included with special focus on practical aspects for the empirical researcher

The Effect Nick Huntington-Klein, 2025-07-09 The Effect An Introduction to Research Design and Causality Second edition is an excellent teaching text about research design specifically concerning research that uses observational data to make a causal inference It is separated into two halves each with different approaches to that subject The first half goes through the concepts of causality with very little in the way of

estimation It introduces the concept of identification thoroughly and clearly and discusses it as a process of trying to isolate variation that has a causal interpretation Subjects include heavy emphasis on data generating processes and causal diagrams Concepts are demonstrated with a heavy emphasis on graphical intuition and the question of what we do to data When we add a control variable what does that actually do The target audience is practitioners as well as undergraduate and graduate students studying causal inference in various fields such as statistics econometrics biostatistics the social sciences and data science Key Features Extensive code examples in R Stata and Python Chapters on heterogeneous treatment effects simulation and power analysis new cutting edge methods and uncomfortable ignored assumptions An easy to read conversational tone Up to date coverage of methods with fast moving literatures like difference in differences The second edition features a new chapter on partial identification updated materials methods and writing throughout and additional materials for help navigating the book or in using the book in teaching

Causal Inference for Data Science Aleix Ruiz de Villa Robert, 2025-02-18 When you know the cause of an event you can affect its outcome This accessible introduction to causal inference shows you how to determine causality and estimate effects using statistics and machine learning A/B tests or randomized controlled trials are expensive and often unfeasible in a business environment Causal Inference for Data Science reveals the techniques and methodologies you can use to identify causes from data even when no experiment or test has been performed In Causal Inference for Data Science you will learn how to Model reality using causal graphs Estimate causal effects using statistical and machine learning techniques Determine when to use A/B tests causal inference and machine learning Explain and assess objectives assumptions risks and limitations Determine if you have enough variables for your analysis It's possible to predict events without knowing what causes them Understanding causality allows you both to make data driven predictions and also intervene to affect the outcomes Causal Inference for Data Science shows you how to build data science tools that can identify the root cause of trends and events You'll learn how to interpret historical data understand customer behaviors and empower management to apply optimal decisions About the technology Why did you get a particular result What would have led to a different outcome These are the essential questions of causal inference This powerful methodology improves your decisions by connecting cause and effect even when you can't run experiments A/B tests or expensive controlled trials About the book Causal Inference for Data Science introduces techniques to apply causal reasoning to ordinary business scenarios And with this clearly written practical guide you won't need advanced statistics or high level math to put causal inference into practice By applying a simple approach based on Directed Acyclic Graphs DAGs you'll learn to assess advertising performance pick productive health treatments deliver effective product pricing and more What's inside When to use A/B tests causal inference and ML Assess objectives assumptions risks and limitations Apply causal inference to real business data About the reader For data scientists ML engineers and statisticians About the author Aleix Ruiz de Villa Robert is a data scientist with a PhD in mathematical analysis from the Universitat Autònoma de Barcelona

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Jewell, 2016-01-25 CAUSAL INFERENCE IN STATISTICS A Primer Causality is central to the understanding and use of data Without an understanding of cause effect relationships we cannot use data to answer questions as basic as Does this treatment harm or help patients But though hundreds of introductory texts are available on statistical methods of data analysis until now no beginner level book has been written about the exploding arsenal of methods that can tease causal information from data Causal Inference in Statistics fills that gap Using simple examples and plain language the book lays out how to define causal parameters the assumptions necessary to estimate causal parameters in a variety of situations how to express those assumptions mathematically whether those assumptions have testable implications how to predict the effects of interventions and how to reason counterfactually These are the foundational tools that any student of statistics needs to acquire in order to use statistical methods to answer causal questions of interest This book is accessible to anyone with an interest in interpreting data from undergraduates professors researchers or to the interested layperson Examples are drawn from a wide variety of fields including medicine public policy and law a brief introduction to probability and statistics is provided for the uninitiated and each chapter comes with study questions to reinforce the readers understanding

Causal Inference Paul R. Rosenbaum, 2023-04-04 A nontechnical guide to the basic ideas of modern causal inference with illustrations from health the economy and public policy Which of two antiviral drugs does the most to save people infected with Ebola virus Does a daily glass of wine prolong or shorten life Does winning the lottery make you more or less likely to go bankrupt How do you identify genes that cause disease Do unions raise wages Do some antibiotics have lethal side effects Does the Earned Income Tax Credit help people enter the workforce Causal Inference provides a brief and nontechnical introduction to randomized experiments propensity scores natural experiments instrumental variables sensitivity analysis and quasi experimental devices Ideas are illustrated with examples from medicine epidemiology economics and business the social sciences and public policy

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