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*Semiparametric Theory and Missing Data*  
 MIT Press  
 Comparative effectiveness research (CER) is the generation and synthesis of evidence that compares the benefits and harms of alternative methods to prevent, diagnose, treat, and monitor a clinical condition or to improve the delivery of care (IOM 2009). CER is conducted to develop evidence that will aid patients, clinicians, purchasers, and health policy makers in making informed decisions at both the individual and population levels. CER encompasses a very broad range of types of studies—experimental, observational, prospective, retrospective,

and research synthesis. This volume covers the main areas of quantitative methodology for the design and analysis of CER studies. The volume has four major sections—causal inference; clinical trials; research synthesis; and specialized topics. The audience includes CER methodologists, quantitative-trained researchers interested in CER, and graduate students in statistics, epidemiology, and health services and outcomes research. The book assumes a masters-level course in regression analysis and familiarity with clinical research.  
**Actual Causality** Yale University Press  
 Explores actual causality, and such related notions as degree of responsibility, degree of blame, and causal explanation. The goal is to arrive at a definition of causality that matches our natural language usage and is helpful, for example, to a jury deciding a

legal case, a programmer looking for the line of code that cause some software to fail, or an economist trying to determine whether austerity caused a subsequent depression.

Dataset Shift in Machine Learning  
 Routledge

Functionals on stochastic processes;  
 Uniform convergence of empirical measures;  
 Convergence in distribution in euclidean spaces;  
 Convergence in distribution in metric spaces;  
 The uniform metric on space of cadlag functions;  
 The skorohod metric on  $D[0, \infty)$ ;  
 Central limit teorems;  
 Martingales.

**Contributions to a General Asymptotic Statistical Theory** Lulu.com  
 This book is about making machine learning models and their decisions interpretable. After exploring the concepts of interpretability, you will learn about

simple, interpretable models such as decision trees, decision rules and linear regression. Later chapters focus on general model-agnostic methods for interpreting black box models like feature importance and accumulated local effects and explaining individual predictions with Shapley values and LIME. All interpretation methods are explained in depth and discussed critically. How do they work under the hood? What are their strengths and weaknesses? How can their outputs be interpreted? This book will enable you to select and correctly apply the interpretation method that is most suitable for your machine learning project.

*Methods in Comparative Effectiveness Research* Createspace Independent Publishing Platform

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.

**Data Analysis Using Regression and Multilevel/Hierarchical Models** CRC Press

Extensive code examples in R, Stata, and Python Chapters on overlooked topics in econometrics classes: 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

*Methods Matter* Cambridge University Press

An accessible, contemporary introduction to the methods for determining cause and effect in the Social Sciences “Causation versus correlation has been the basis of arguments—economic and otherwise—since the beginning of time. Causal Inference: The Mixtape uses legit real-world examples that I found genuinely thought-provoking. It’s rare that a book prompts readers to expand their outlook; this one did for me.”—Marvin Young (Young MC) Causal inference encompasses the tools that allow social scientists to determine what causes what. In a messy world, causal inference is what helps establish the causes and effects of the actions being studied—for example, the impact (or lack thereof) of increases in the minimum wage on employment, the effects of early childhood education on incarceration later in life, or the influence on economic growth of introducing malaria nets in developing regions. Scott Cunningham introduces students and practitioners to the methods necessary to arrive at meaningful answers to the questions of causation, using a range of modeling techniques and coding instructions for both the R and the Stata programming languages.

*The Book of Why* Springer

This fresh edition, substantially revised and augmented, provides a unified, in-depth, readable introduction to the multipredictor regression methods most widely used in biostatistics. The examples used, analyzed using Stata, can be applied to other areas.

*Statistics and Causality* Princeton University Press

It is common wisdom that gathering a variety of views and inputs improves the process of decision making, and, indeed, underpins a democratic society. Dubbed “ensemble learning” by researchers in computational intelligence and machine learning, it is known to improve a decision system’s robustness and accuracy. Now, fresh developments are allowing researchers to unleash the power of ensemble learning in an increasing range of real-world applications. Ensemble learning algorithms such as “boosting” and “random forest” facilitate solutions to key computational issues such as face recognition and are now being applied in areas as diverse as object tracking and bioinformatics. Responding to a shortage

of literature dedicated to the topic, this volume offers comprehensive coverage of state-of-the-art ensemble learning techniques, including the random forest skeleton tracking algorithm in the Xbox Kinect sensor, which bypasses the need for game controllers. At once a solid theoretical study and a practical guide, the volume is a windfall for researchers and practitioners alike.

*Targeted Learning* Springer Science & Business Media

One of the primary motivations for clinical trials and observational studies of humans is to infer cause and effect. Disentangling causation from confounding is of utmost importance. Fundamentals of Causal Inference explains and relates different methods of confounding adjustment in terms of potential outcomes and graphical models, including standardization, difference-in-differences estimation, the front-door method, instrumental variables estimation, and propensity score methods. It also covers effect-measure modification, precision variables, mediation analyses, and time-dependent confounding. Several real data examples, simulation studies, and analyses using R motivate the methods throughout. The book assumes familiarity with basic statistics and probability, regression, and R and is suitable for seniors or graduate students in statistics, biostatistics, and data science as well as PhD students in a wide variety of other disciplines, including epidemiology, pharmacy, the health sciences, education, and the social, economic, and behavioral sciences. Beginning with a brief history and a review of essential elements of probability and statistics, a unique feature of the book is its focus on real and simulated datasets with all binary variables to reduce complex methods down to their fundamentals. Calculus is not required, but a willingness to tackle mathematical notation, difficult concepts, and intricate logical arguments is essential. While many real data examples are included, the book also features the Double What-If Study, based on simulated data with known causal mechanisms, in the belief that the methods are best understood in circumstances where they are known to either succeed or fail. Datasets, R code, and solutions to odd-numbered exercises are available at [www.routledge.com](http://www.routledge.com).

**Causal Inference in Statistics** Harvard University Press

Causality offers the first comprehensive coverage of causal analysis in many sciences, including recent advances using graphical methods. Pearl presents a unified account of the probabilistic,

manipulative, counterfactual and structural approaches to causation, and devises simple mathematical tools for analyzing the relationships between causal connections, statistical associations, actions and observations. The book will open the way for including causal analysis in the standard curriculum of statistics, artificial intelligence ...

#### Convergence of Stochastic Processes

Academic Press

This book, first published in 2007, is for the applied researcher performing data analysis using linear and nonlinear regression and multilevel models.

#### **Handbook of Big Data** Springer Science & Business Media

This book deals with estimation in situations in which there is believed to be enough information to model parametrically some, but not all of the features of a data set. Such models have arisen in a wide context in recent years, and involve new nonlinear estimation procedures. Statistical models of this type are directly applicable to fields such as economics, epidemiology, and astronomy.

#### *Targeted Learning* Springer

This book is a full-scale exposition of Charles Manski's new methodology for analyzing empirical questions in the social sciences. He recommends that researchers first ask what can be learned from data alone, and then ask what can be learned when data are combined with credible weak assumptions. Inferences predicated on weak assumptions, he argues, can achieve wide consensus, while ones that require strong assumptions almost inevitably are subject to sharp disagreements. Building on the foundation laid in the author's *Identification Problems in the Social Sciences* (Harvard, 1995), the book's fifteen chapters are organized in three parts. Part I studies prediction with missing or otherwise incomplete data. Part II concerns the analysis of treatment response, which aims to predict outcomes when alternative treatment rules are applied to a population. Part III studies prediction of choice behavior. Each chapter juxtaposes developments of methodology with empirical or numerical illustrations. The book employs a simple notation and mathematical apparatus, using only basic elements of probability theory.

#### **Multiple Testing Procedures with Applications to Genomics** Springer

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.

#### An Introduction to Causal Inference MIT Press

"Princeton University Press published Imai's textbook, *Quantitative Social Science: An Introduction*, an introduction to quantitative methods and data science for upper level undergrads and graduates in professional programs, in February 2017. What is distinct about the book is how it leads students through a series of applied examples of statistical methods, drawing on real examples from social science research. The original book was prepared with the statistical software R, which is freely available online and has gained in popularity in recent years. But many existing courses in statistics and data sciences, particularly in some subject areas like sociology and law, use STATA, another general purpose package that has been the market leader since the 1980s. We've had several requests for STATA versions of the text as many programs use it by default. This is a "translation" of the original text, keeping all the current pedagogical text but inserting the necessary code and outputs from STATA in their place"--

#### *Impact Evaluation* Springer Science & Business Media

This book summarizes current knowledge regarding the theory of estimation for semiparametric models with missing data,

in an organized and comprehensive manner. It starts with the study of semiparametric methods when there are no missing data. The description of the theory of estimation for semiparametric models is both rigorous and intuitive, relying on geometric ideas to reinforce the intuition and understanding of the theory. These methods are then applied to problems with missing, censored, and coarsened data with the goal of deriving estimators that are as robust and efficient as possible.

#### **Discovering Causal Structure**

Cambridge University Press

*Handbook of Big Data* provides a state-of-the-art overview of the analysis of large-scale datasets. Featuring contributions from well-known experts in statistics and computer science, this handbook presents a carefully curated collection of techniques from both industry and academia. Thus, the text instills a working understanding of key statistical

#### **Causal Learning** Springer

A Turing Award-winning computer scientist and statistician shows how understanding causality has revolutionized science and will revolutionize artificial intelligence "Correlation is not causation." This mantra, chanted by scientists for more than a century, has led to a virtual prohibition on causal talk. Today, that taboo is dead. The causal revolution, instigated by Judea Pearl and his colleagues, has cut through a century of confusion and established causality -- the study of cause and effect -- on a firm scientific basis. His work explains how we can know easy things, like whether it was rain or a sprinkler that made a sidewalk wet; and how to answer hard questions, like whether a drug cured an illness. Pearl's work enables us to know not just whether one thing causes another: it lets us explore the world that is and the worlds that could have been. It shows us the essence of human thought and key to artificial intelligence. Anyone who wants to understand either needs *The Book of Why*. *Targeted Learning in Data Science* Oxford University Press

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.

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