

JUDITH S. HURWITZ ■ JOHN K. THOMPSON

CAUSAL ARTIFICIAL INTELLIGENCE



THE NEXT STEP IN
EFFECTIVE BUSINESS AI

WILEY

Praise for *Causal AI*

I am delighted to welcome this exceptional book on causal AI, written by Judith Hurwitz and John Thompson, which bridges the gap between conventional methods of business analytics and modern techniques of causal analysis and machine learning. Business leaders and data scientists who are trained in prescriptive statistics, simulation, and optimization techniques will be happy to discover how critical problems in their field, commonly left to intuition or contentious judgment, can now be systematically conceptualized, articulated, and solved using simple techniques of causal artificial intelligence. These include predicting the effects of potential interventions, finding explanations for unexpected outcomes, testing the validity of one's assumptions, and combining data from several sources. The lucid exposition of this book and the variety of practical examples provided promise to make business analytics the new beneficiary of the causal revolution.

—Judea Pearl

UCLA chancellor professor emeritus in computer science,
recipient of the A.M. Turing Award

As the authors describe in detail, the vast majority of AI today is based on statistical association rather than causality. Under many circumstances those results aren't sufficiently clear-cut to drive action. The world will eventually move toward causal AI, and this book will provide a head start.

—Thomas H. Davenport

distinguished professor at Babson College;
author of *All In on AI*, *Working with AI*, and
The AI Advantage

Causality is no longer a purely academic sport. From Amazon to Spotify and Netflix, companies worldwide are investing in building causal systems to capture value where traditional machine learning and statistics fall short. Judith and John take a unique perspective on causality, focusing on the business side of things and shedding light on practical aspects of causality, which are no less than essential to any modern decision-maker.

—Aleksander Molak

author of *Causal Inference and Discovery in Python*,
community leader at CausalPython.IO

Judith's and John's book turns over all the proverbial stones revealing deep truths about causal AI and AI more generally. While they explore relevant topics like avoiding bias in AI, the realities of data federation, and many more, I was captivated by the care taken to relate the human and AI intersection. In this exploration, the authors illustrate how experts are important for AI developments to move past the "science fair stage" to tooling that reliably produces trustable outcomes with easy-to-understand utility.

—Michael Hay

digital infrastructure portfolio leader at Hitachi Vantara

The causal AI revolution is starting to have a huge impact on digital transformation. Being able to determine why events happened and how best to leverage or mitigate them has the potential to help management make better decisions and grow revenue. The vast amount of available technical knowledge and open-source tools means that the commercialization of causal AI is becoming a reality. This book provides an invaluable resource for business teams to gain insights into the way causal AI can transform business.

—Stuart Frost

CEO at Geminus Software

Causal Artificial Intelligence

Causal Artificial Intelligence

**The Next Step in
Effective Business AI**

**Judith S. Hurwitz
John K. Thompson**

WILEY

Copyright © 2024 by John Wiley & Sons, Inc. All rights reserved.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada and the United Kingdom.

ISBNs: 9781394184132 (paperback), 9781394184149 (epdf), 9781394184156 (epub)

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 750-4470, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at www.wiley.com/go/permission.

Trademarks: WILEY and the Wiley logo are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates, in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc. is not associated with any product or vendor mentioned in this book.

Limit of Liability/Disclaimer of Warranty: While the publisher and authors have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

If you believe you've found a mistake in this book, please bring it to our attention by emailing our reader support team at wileysupport@wiley.com with the subject line "Possible Book Errata Submission."

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic formats. For more information about Wiley products, visit our web site at www.wiley.com.

Library of Congress Control Number: 2023942854

Cover image: © Arfandri Ilham/Getty Images
Cover design: Wiley

I dedicate this book to Warren, my partner in life.

—*Judith S. Hurwitz*

For my readers in the analytics community.

—*John K. Thompson*

Contents

<i>Foreword</i>	<i>xix</i>
<i>Preface</i>	<i>xxiii</i>
<i>Introduction</i>	<i>xxix</i>
Chapter 1	
Setting the Stage for Causal AI	1
Why Causality Is a Game Changer	2
Causal AI in Perspective with Analytics	7
Analytical Sophistication Model	8
Analytics Enablers	10
Analytics	10
Advanced Analytics	11
Scope of Services to Support Causal AI	11
The Value of the Hybrid Team	13
The Promise of AI	14
Understanding the Core Concepts of	
Causal AI	15
Explainability and Bias Detection	15
Explainability	17
Detecting Bias in a Model	17
Directed Acyclic Graphs	18
Structural Causal Model	19

	Observed and Unobserved Variables	20
	Counterfactuals	21
	Confounders	21
	Colliders	22
	Front-Door and Backdoor Paths	23
	Correlation	24
	Causal Libraries and Tools	25
	Propensity Score	25
	Augmented Intelligence and Causal AI	26
	Summary	27
	Note	27
Chapter 2	Understanding the Value of Causal AI	29
	Defining Causal AI	30
	The Origins of Causal AI	33
	Why Causality?	34
	Expressing Relationships	37
	The Ladder of Causation	38
	Rung 1: Association, or Passive Observation	40
	Rung 2: Intervention, or Taking Action	40
	Rung 3: Counterfactuals, or Imagining What If	42
	Why Causal AI Is the Next Generation of AI	43
	Deep Learning and Neural Networks	43
	Neural Networks	44
	Establishing Ground Truth	45
	The Business Imperative of a Causal Model	46
	The Importance of Augmented Intelligence	51
	The Importance of Data, Visualization, and Frameworks	52
	Getting the Appropriate Data	52
	Applying Data and Model Visualization	55

	Applying Frameworks After Creating a Model	56
	Getting Started with Causal AI	57
	Summary	58
	Notes	59
Chapter 3	Elements of Causal AI	61
	Conceptual Models	62
	Correlation vs. Causal Models	63
	Correlation-Based AI	63
	Causal AI	63
	Understanding the Relationship Between Correlation and Causality	64
	Process Models	66
	Correlation-Based AI Process Model	67
	Causal-Based AI Process Model	69
	Collaboration Between Business and Analytics Professionals	72
	The Fundamental Building Blocks of Causal AI Models	75
	The Relations Between DAGs and SCMs	76
	Explaining DAGs	76
	Causal Notation: The Language of DAGs	78
	Operationalizing a DAG with an SCM	79
	The Elements of Visual Modeling	81
	Nodes	83
	Variables	83
	Endogenous and Exogenous Variables	83
	Observed and Unobserved Variables	84
	Paths/Relationships	84
	Weights	86
	Summary	88
	Notes	89

Chapter 4	Creating Practical Causal AI Models and Systems	91
	Understanding Complex Models	92
	Causal Modeling Process: Part 1	94
	Step 1: What Are the Intended Outcomes?	95
	Step 2: What Are the Proposed Interventions?	97
	Step 3: What Are the Confounding Factors?	99
	Step 4: What Are the Factors Creating the Effects and Changes?	102
	Common/Universal Effects in a Causal Model	102
	Refined Effects in a Causal Model	103
	Step 5: Creating a Directed Acyclic Graph	105
	Step 6: Paths and Relationships	105
	Types of Paths	106
	Path Connecting an Unobserved Variable	107
	Front-Door Paths	108
	Backdoor Paths	108
	Modeling for Simplicity to Understand Complexity	109
	Step 7: Data Acquisition	110
	Causal-Based Approach: Part 2	112
	Step 8: Data Integration	113
	Step 9: Model Modification	114
	Step 10: Data Transformation	115
	Step 11: Preparing for Deployment in Business	118
	Summary	121
	Notes	122

Chapter 5	Creating a Model with a Hybrid Team	125
	The Hybrid Team	126
	Why a Hybrid Team?	127
	The Benefits of a Hybrid Team	128
	Establishing the Hybrid Team as a Center of Excellence	129
	How Teams Collaborate	131
	But Why?	132
	Defining Roles	134
	Leaders and Business Strategists	137
	Subject-Matter Experts	138
	Data Experts	140
	Software Developers	142
	Business Process Analysts	143
	Information Technology Expertise	143
	Project Manager(s)	144
	The Basics Steps for a Hybrid Team Project	145
	An Overview of Model Creation	146
	It Depends on Your Destination	150
	Understanding the Root Cause of a Problem	151
	Understanding What Happened and Why	153
	The Importance of the Iterative Process	154
	Summary	155
 Chapter 6	 Explainability, Bias Detection, and AI	
	Responsibility in Causal AI	157
	Explainability	158
	The Ramifications of the Lack of Explainability	159
	What Is Explainable AI in Causal AI Models?	161

Black Boxes	162
Internal Workings of Black-Box Models	162
Deep Learning at the Heart of	
Black Boxes	163
Is Code Understandable?	163
The Value of White-Box Models	166
Understanding Causal AI Code	167
Techniques for Achieving Explainability	169
Challenges of Complex Causal Models	169
Methods for Understanding and	
Explaining Complex Causal AI Models	171
The Importance of the SHAP	
Explainability Method	172
Detecting Bias and Ensuring Responsible AI	175
Bias in Causal AI Systems	176
Responsible AI: Trust and Fairness	178
How Causal AI Addresses Bias Detection	180
Tools for Assessing Fairness and Bias	182
The Human Factor in Bias Detection and	
Responsible AI	183
Summary	184
Note	184

Chapter 7	Tools, Practices, and Techniques to Enable	
	Causal AI	185
	The Causal AI Pipeline	187
	Define Business Objectives	190
	Model Development	193
	Data Identification and Collection	195
	Data Privacy, Governance, and Security	197
	Synthetic Data	198
	Model Validation	199
	Deployment/Production	201
	Monitor and Evaluate	203
	Update and Iterate	205

Continuous Learning	208
The Importance of Synthetic Data	210
Why Create Synthetic Data?	210
Overcoming Data Limitations	211
Enhancing Data Privacy and Security	211
Model Validation and Testing	211
Expanding the Range of Possible Scenarios	212
Reducing the Cost of Data Collection	212
Improving Data Imbalance	213
Encouraging Collaboration and Openness	213
Streamlining Data Preprocessing	213
Supporting Counterfactual Analysis	213
Fostering Innovation and Experimentation	214
Creating Synthetic Data	214
Generative Models	214
Agent-Based Modeling	215
Data Augmentation	215
Data Synthesis Tools and Platforms	215
Conditional Synthetic Data Generation	216
Synthetic Data from Text	216
The Limitations of Synthetic Data	217
Current State of Tools and Software in Causal AI	218
The Role of Open Source in Causal AI	218
Commercial Causal AI Software	221
CausaLens	221
Geminis Software	223
Summary	223
Chapter 8 Causal AI in Action	225
Enterprise Marketing in a Business-to-Consumer Scenario	226

DDCo Marketing Causal Model: Annual	
Pricing Review and Update Cycle	228
Incorporating Internal and External	
Factors in the Model and DAG	230
Easily Enabling Iterating	231
End-User-Driven Exploration	232
Bench Testing	234
DDCo Marketing Causal Model:	
Semiannual Product Planning Cycle	236
Always Consider Model Reuse	237
Give and Take in Building a New Model	239
Typical Model and Process Operation:	
Iterating	239
Keeping the Process/Model Scope	
Manageable and Understandable	240
Moving from Strategy to Building and	
Implementing Causal AI Solutions	241
Agriculture: Enhancing Crop Yield	242
Key Causal Variables	244
Creating the DAG	246
Moving from the DAG to Implementing	
the Causal AI Model	247
Commercial Real Estate: Valuing	
Warehouse Space	250
Key Causal Variables	251
Implementing the Causal AI Model	253
Video Streaming: Enhancing Content	
Recommendations	254
Key Causal Variables	255
Implementing the Causal AI Model	256
Healthcare: Reducing Infant Mortality	258
Key Causal Variables	259
Implementing the Causal AI Model	261

	Retail: Providing Executives Actionable Information	263
	Key Causal Variables	264
	Implementing the Causal Model	265
	Summary	267
Chapter 9	The Future of Causal AI	271
	Where We Stand Today	271
	Foundations of Causal AI	273
	The Causal AI Journey	274
	Causal AI Today	274
	What's Next for Causal AI	276
	Integrating Causal AI and Traditional AI	278
	The Imperative for Managing Data	279
	Ensembles of Data	279
	Generative AI Is Emerging as a Game Changer for Causal AI	281
	The Future of Causal Discovery	282
	The Emergence of Causal AI Reinforcement Learning Will Accelerate Model Training	284
	Causal AI as a Common Language Between Business Leaders and Data Scientists	284
	The Emergence of Probabilistic Programming Languages	286
	The Predictable Model Evolution Cycle	286
	The Emergence of the Digital Twin	287
	Improving the Ability to Understand Ground Truth	289
	The Development of More Sophisticated DAGs	289
	Visualizing Complex Relationships in the DAGs	290
	The Merging of Causal and Traditional AI Models	291

The Future of Explainability	291
The Evolution of Responsible AI	292
Advances in Data Security and Privacy	293
Integration Will Be Between Models and Business Applications	294
Summary	295
<i>Glossary</i>	299
<i>Appendix</i>	313
<i>Selected Resources</i>	329
<i>Acknowledgments</i>	331
<i>About the authors</i>	335
<i>About the contributor</i>	339
<i>Index</i>	341

Foreword

Dear Reader,

It is with great pleasure and enthusiasm that I introduce you to this exceptional book on causal AI, written by the brilliant Judith Hurwitz and John Thompson. As I embarked on my journey through its pages, I found myself intrigued by the depth of knowledge, clarity of explanations, and practical insights it offers. “Causal Artificial Intelligence: The Next Step in Effective Business AI” is a true gem for those seeking to comprehend the intricate world of causal artificial intelligence.

In today’s rapidly evolving technological landscape, the concept of causal AI has emerged as a source of radical innovation and a catalyst for transformation. It holds the key to unlocking the true potential of artificial intelligence, empowering us not only to predict and classify but also to understand the causal mechanisms that underlie complex systems. Through the lens of directed acyclic graphs (DAGs) and structural causal models (SCMs), pioneered by the eminent Prof. Judea Pearl, this book guides us on a remarkable journey of discovery.

One of the book’s greatest strengths is its accessibility, making it a perfect companion for those who are eager to grasp the essence of causal AI but lack a formal background in the field. Whether you are a seasoned professional in the realm of business

analytics or someone just stepping into this fascinating domain, Judith Hurwitz and John Thompson expertly demystify the core concepts, rendering them comprehensible to a wide audience. Their ability to translate complex theories into practical applications is commendable, making “Causal Artificial Intelligence” an invaluable resource for both novices and experts alike.

As you delve into the pages that follow, you will encounter crucial topics that lie at the heart of causal AI. Exploring the realms of explainability, you will discover how causal models offer an unparalleled understanding of why certain decisions are made by AI systems. In a world increasingly driven by algorithms, the book masterfully examines the biases that can be inadvertently embedded within these systems and provides valuable insights into mitigating such biases, ensuring fairness and equity in algorithmic decision-making.

Another significant facet the book illuminates is the vital aspect of robustness in AI systems. Through a meticulous exploration of DAGs and SCMs, you will gain a deep understanding of how to construct models that are not only accurate but also resilient to unforeseen perturbations and uncertainties. This robustness is crucial in building trustworthy and reliable AI systems that can be confidently deployed in real-world scenarios.

The book strikes a perfect balance between theory and practice. While it delves into the fundamental principles and theories that underpin causal AI, it never loses sight of the practical applications and real-world implications. The numerous case studies and examples provided throughout the book reinforce its relevance and enable you to connect the dots between theory and its practical implementation.

I have no doubt that this exceptional work will become an indispensable resource for professionals in business analytics roles. The knowledge imparted within these pages has the potential to revolutionize the way we approach artificial intelligence,

enabling us to harness its power responsibly and ethically. Whether you are a data scientist, a decision-maker, or simply an enthusiast seeking to expand your understanding, this book will serve as an invaluable guide on your journey to master the intricacies of causal AI.

In conclusion, I would like to express my deepest appreciation to Judith Hurwitz and John Thompson for writing this remarkable book. Their passion for the subject matter is evident, and their ability to distill complex ideas into clear and relatable explanations is truly remarkable. Each chapter takes you on a journey, unraveling the intricacies of causal AI and imparting knowledge that is both insightful and actionable. Prepare to embark on a transformational voyage, unlocking the power of causal AI and embracing a future where we not only predict and observe but truly understand.

Enjoy the journey!

Sincerely,

Paul Hünermund

Assistant Professor of Strategy & Innovation
Copenhagen Business School

Preface

In my view, causal AI is the next stage in the evolution of software because it is focused on being able to understand the causes and effects of events. As we discuss in this book, what has caused a marketing campaign to achieve the revenue objectives? Is the problem the campaign itself, or are there underlying issues that are impacting results? Is the cause of the disappointing marketing campaign because of a sudden competitive threat? Is there a problem with the company's reputation? What would the impact on revenue if the product price was reduced by 10 percent? Would a different type of marketing campaign result in better results? The underlying causal technology needed to address these problems is complex, and the approach is instrumental for business leaders to understand the potential impact. Therefore, unlike some earlier evolutions of AI, the value of a causal AI approach can have a direct and profound effect on business outcomes.

A plethora of books and articles already address causal inference—a field that must recognize Judea Pearl as a pioneer and visionary in causality. So, why write yet another book on the topic? The reason is straightforward—this book is written for technology-focused leaders who are not developers but are responsible for bringing new technology into their companies to

gain a competitive edge. In writing this book, I have spent countless hours speaking with leaders in the field and reading many articles and books. The goal of this book is to provide an understanding of why the field of causal AI is so important. It has the potential to truly transform how we use artificial intelligence to digitally transform business.

My journey through the complex world of software started more than 35 years ago. My experience in technology began when I joined a financial services company and was tasked with introducing emerging technology to various business units. The goal was to evaluate how the technology could help transform the competitiveness of the business. From that beginning, I went on to spend many years as a developer, strategy IT consultant, industry analyst, thought leader, and writer. Most recently, I joined Geminis Software, a causal AI company, as their chief evangelist. I credit my ability to begin to understand this amazing and complex technology to the insights and wisdom of the Geminis team.

While I have spent years delving into some of the most complex technologies, I have always put solutions in perspective by focusing on the needs of the business organization. No matter what position I have been in, I always asked some variation of the same questions: What is the purpose of a software platform, and how does it help the business flourish? Why is the technology important?

Since I have always focused on those key issues, it is not surprising that I have paid particular attention to some of the most complex emerging technologies. During my pursuit of learning and understanding the value of new offerings, I have coauthored 10 books and dozens of customized e-books all focused on explaining complex technologies to both business and technical audiences. My goal has long been to bridge the gap of how business

and technology leaders must collaborate to be able to succeed. I have always believed that customers will not buy technology that they do not understand. Topics of the books I have coauthored include service-oriented architecture, big data, machine learning, and cloud computing. My two most recent books focused on cognitive computing and augmented intelligence. Both books have informed my journey to an exploration of causal AI.

As with any emerging technology, causal AI will evolve over the coming decade. The goal of this book is to provide guidance and an understanding for a business audience of the foundation of this important technology. As a participant in the world of emerging technologies, I felt it was the right time to put causal AI in perspective.

—Judith Hurwitz
May 2023

While writing this book on causal AI, generative AI burst onto the market with great excitement, fanfare, and disruption. I was asked by more than a few people who knew that I was involved in writing a book on causal AI if I should put this book on hold and focus my current efforts on generative AI. As with all reasonable suggestions and questions, I considered the change in direction. My conclusion was that while generative AI is transformative in relation to how people are employed, how work will be executed, the impact on productivity, and more, generative AI is not a new field of AI. Generative AI is an extension of, and a new way of combining, neural networks, unsupervised learning, supervised learning, reinforcement learning, and much larger models than we have seen before, but it is not a new field of AI, not the way causal AI is. Hence, my conclusion was that while my day job is dominated by determining how to design, leverage, govern, deploy, and use generative AI in an enterprise environment, this

book on causal AI was still needed to raise the awareness of the power, value, and transformative nature of causal AI.

My main motivation for writing this book was to put an original book into the market that takes the dialogue relating to causal AI in a new direction—a direction that begins to draw the business, technical, and analytical communities into the dialogue.

In my research to expand my fundamental understanding of causal AI and the stage of development of this completely new field of AI, before the writing process began, I read nearly 100 pieces of original writing. All of the books, research papers, most of the blogs, and more, on causal AI immediately dove into the details of the calculus and related math underlying causal AI. I refreshed my understanding of calculus that I learned in graduate school. My knowledge of calculus was extended, sharpened, and revived, but I knew that this type of writing was a barrier to broadening and deepening my understanding of causal AI. I also knew that if it was a high barrier for me, then it was a complete showstopper for most people.

I knew that the audiences that I felt needed to know about causal AI were not, for the most part, going to wade through even a 10th of what I had read. I became excited about the opportunity to be among the first people in the field of data, analytics, and AI to develop and carry the message forward that causal AI was being developed, was a powerful new tool, and would be a significant advance in our arsenal of tools in our quest to document, model, and understand our world in a more complete manner.

I wrote *Building Analytics Teams* (BAT) after having built multiple analytics teams over the previous 37 years as a technologist and an AI practitioner. One of my goals, and my primary objective, in writing BAT was to help people from all walks of life who have more than a passing interest in being part of the fields of data, analytics, and AI to understand the real-world environment,

the environment in the majority of enterprise-class organizations, and the real constraints and opportunities that are at play in working in the field of analytics. I wanted to help new college graduates to understand what working in analytics really looked and felt like. I wanted new managers to have a “how to” book on how to design, build, manage, and grow, their analytics teams, and I wanted, most of all, to help analytics professionals to not make the same mistakes that I made. I wanted to make their lives and journeys better. In BAT, I accomplished that goal.

My primary goal in writing this book is to help draw the business, technical, and analytical communities into an exploration of the emerging field of causal AI. I want those practitioners to buy and read this book to understand what is coming next. I want them to engage with the content to fire their imaginations about what they can do with causal AI and how causal AI is an entirely novel and new approach to AI that expands their toolset and puts the power of AI in the hands of the business users. In that respect, putting the power of AI in the hands of business users, causal AI has some similarities to generative AI, but only at a conceptual level.

I recognized that causal AI was a completely new field of AI, and I wanted to be part of the evolution, to be a messenger that raises the awareness of this impressive new area. I knew, and know, that once causal AI moves beyond the research phase into the early adopter phase, there will be a flurry of activity enabling early-mover companies to build and maintain a defensible and significant competitive advantage. This book is a call to action for those early-stage enterprise-class innovators to take notice of causal AI and to begin their process of investigating the potential of this technology and approach.

One of the early epiphanies that I experienced in researching the topic was that the underlying causal approach could be applied to any process. Historically, the causal approach was applied to

agriculture, healthcare, and specialty use cases such as dog breeding. But, as I looked back in time, all the way to ancient Greece, and then forward again to ages like the Renaissance and the Reformation, it was clear that philosophers, mathematicians, and academics of all types were touching on causality and slowly but consistently adding to the global corpus of knowledge related to causality.

This aggregation of knowledge reached an acceleration point in the past century, and causal AI gained a dedicated and devout following that drove the development of casual AI to a new level. Once I realized that the field of causal AI was racing forward, I wanted to write this book.

So, why did I write this book, or atleast my part of the book? I wanted to contribute to the understanding, adoption, and use of this incredible new toolset and technologies that we refer to as causal AI.

I hope that you enjoy reading and learning about causal AI as much as I did.

—John K. Thompson
May 2023