Artificial Intelligence for Business Optimization

Research and Applications

Bhuvan Unhelkar
Tad Gonsalves

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Blending business and academics, Artificial Intelligence for Business Optimization: Research and Applications *fills the need for authoritative information in an emerging market. The book is a valuable contribution on the academic, business and ICT services. The authors have a reputation of thought leadership, with academic and business credibility.*

Keith Sherringham (BSc. Hons, FACS)
Senior Vice President at Citi
Greater Sydney Area, Australia

This book makes a unique contribution in the field of Artificial Intelligence (AI) by focusing on optimizing business processes. The business context in the discussions herein is excellent. The material presented here has practical applications in health, education, sustainability and many other such areas that are important for the quality of life on Earth.

Andy Lyman
Chairman of the Board for All Point POS
Florida, USA

The authors have done an excellent job in discussing the application of AI to business. Crucial topics such as leadership and business strategies in optimization are very well presented. Dynamicity in learning will open up many new areas of research.

Dr. Anurag Agarwal
Professor, Department of Information Systems &
Operations Management
Florida Gulf Coast University
Florida, USA

I am a believer in the power of Artificial Intelligence for business optimization from a strategic standpoint. This book is a journey from data to decisions. The unique business perspective shown by the authors is invaluable in understanding Artificial Intelligence in practical application in business organizations. Adopting data-driven culture and the value of leadership and change management in the context of AI make this book unique.

Jean Kabongo, PhD
Campus Dean and Professor, Muma College of Business,
Sarasota-Manatee
University of South Florida
Florida, USA

At USF, especially in my college, the focus is squarely on application of technology to business. This book by Drs. Unhelkar and Gonsalves, does a fine job of demonstrating the application of Artificial Intelligence to the challenges of Business Optimization. AI and ML have already transcended Automation and need to be increasingly applied in business process optimization - as discussed and demonstrated in this book. This book makes a valuable contribution for both practitioners and researchers.

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FAMILY

[BU]: Thanks to my family for their support and good wishes: Asha (wife), Sonki (daughter), Keshav (son), and Chinar (sister-in-law); and our dog Benji. This book is dedicated to my extended family!

[TG]: This book is dedicated to the new generation in our family: Savio, Glenda, Samson, Johnson, Qutandy, Janice, Lester, and Pearl. Thank you for your constant support and wishes.

DEDICATION

Trivikrama (TV), Jayalakshmi, and Shankar [BU]

Isabel and Paulo [TG]

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Foreword by Andy Lyman

The book in your hand makes a unique contribution in the field of Artificial Intelligence (AI). The mention of the word AI is almost synonymous with imagery of data centers, complex analytics, neural networks, and automation. The age-old stories of robots taking over humans and computers beating chess masters add to the spice. I am fortunate to be witnessing the growth of AI as a technology as it coincides with my own growth from that of technology expertise to managing and growing a business. Businesses, for most part, are not interested in the dramatic presentations of AI including its replication of human interaction.

How can AI help my business be more profitable? This is the crucial question and, perhaps, the only question that business is interested in. Having implemented AI projects and run successful businesses in the past and, currently, as Chairman of the Board for *All Point POS*, I can tell you with complete certainty that business is extremely keen to know how AI will help solve problems, create profit, support critical thinking, and enable the business to provide customer value. Business is also very keen to remain lean and agile – important business characteristics that are developed with AI.

Way back in 1993, I was a member of a four-person team that implemented the first real-time Neural Network fraud detection system for the Credit Card industry at Household Credit Services. Even this early AI implementation gained traction in large returns on investment which lead to increases to the bottom line for companies. Is the bottom line all that counts? Or does customer value what matters most? Are they so intertwined that you cannot separate them?

Customer value is precisely where this book is unique. While the authors have also provided details on various types of machine learnings and statistical techniques, the focus of their work here is on the application of those technologies and techniques to enable businesses to provide and enhance customer value.

Another important differentiator of this book in your hand is the way it handles the important topic of "optimization". Almost all AI literature focuses on mimicking human brains in order to do what humans do – albeit much faster and with increasing accuracy. This book argues for

optimization, which is in the realm of re-engineering of businesses rather than automating them. As a result, the chapters in this book deal with business strategies, business process modeling, quality assurance, and cybersecurity. Business Optimization, as argued in this book, is detailed examination of all business functions to ensure that they use AI in order to generate customer value. This book discusses these important topics around holistic transformation to a digital business using data and AI.

In handling the important softer aspects of AI application to business, the authors do a great job in dedicating an entire chapter on ethics, morality, and biases in decision making. The importance of Natural Intelligence (NI) in making decisions and understanding their consequences cannot be overemphasized. The role of personalities in decision making and, eventually, business agility is something I emphasize during my guest lectures to the MBA class at the University of South Florida. I am delighted to note these soft topics are duly discussed in this book.

Apart from my work in the industry, I am also a proud Rotarian. As this gets written, Rotary is on the brink of introducing a seventh area of focus dealing with sustainability and the environment. The importance of AI and Machine Learning (ML) in tackling the challenges of sustainability is beyond doubt. I look forward to the application of discussions in this book in practice to sustainability and many other such areas that are important for the quality of life on the Earth.

Andy Lyman
(Sarasota, Florida, USA)

Andy Lyman is a leader in the software domain – specializing in enterprise Retail Solutions using the Teamwork Retail software. Andy serves as Chairman of the Board for All Point POS – a leader in Retail Point of Sale Technology. He has delivered guest lectures in the University of South Florida on the intersection of Agility and Leadership. Currently he serves as Vice Chair of the Muma College of Business Advisory Council. Andy is the District Governor Elect in Rotary District 6960 in Florida, USA.

Preface

Artificial Intelligence for Business Optimization: Research and Applications is a business book discussing the research and associated practical application of artificial intelligence (AI) and machine learning (ML) in business optimization (BO). AI comprises a wide range of technologies, databases, algorithms, and devices. This book aims for a holistic approach to AI by focusing on developing business strategies that will not only automate but also optimize business functions by giving due credence to processes and human aspects. The overbearing focus of this book is on using AI and ML from a business viewpoint with the key purpose of enhancing customer value. The research elements in this book are also described from a practitioner's viewpoint. Crucial issues in BO, associated with governance risks, privacy, and security, are addressed in this book to ensure compliance of AI/ML applications from a business viewpoint. Readers should find the discussions in this book direct and practically applicable in their work environment. Researchers will find many ideas to explore further in the applications of AI to business.

The application of AI in business requires a thorough understanding of technology, business, and people issues. Most contemporary AI literature focuses primarily on technologies and associated analytics. This book gives the business primary importance with AI in balance with business decision-making. This book fills the crucial gap existing in the current literature on AI around holistic and strategic application of AI to BO. The nuances of risks and challenges encountered in the transformation of various business functions and corresponding business processes are neatly outlined. The application of AI to not only automate but also optimize business processes based on actionable insights is discussed in this book. This book prepares the reader to apply AI in BO on an ongoing basis.

This book provides substantial discussions for budding researchers who are exploring the industrial applications of AI. This book is also a potential textbook for higher-degree classes in AI and business. The authors have combined their research expertise with practical experiences and contemplations around key topics such as data analytics, machine learning, Big Data, cybersecurity, and sustainability. This book is replete with practical

examples that make it easy to understand the concepts and apply them in practice.

This book has direct use for leaders strategizing for BO. The challenges in BO are also highlighted based on the practical experiences of the authors in the industry.

Bhuvan Unhelkar (USA)
Tad Gonsalves (Japan)

Readers

This book will be of immense value to the following readers:

a. Practitioners (consultants, senior executives, decision-makers) dealing with real-life business problems on a daily basis, who are keen to develop systematic strategies for the application of AI/ML/BD technologies to business automation and optimization
b. Practitioners keen to provide and increasingly enhance customer value
c. Researchers who want to explore the industrial applications of AI, machine learning, and Big Data that will reduce the risks of these applications and provide increasingly more value to business
d. People responsible for making policies and establishing governance-risk-compliance (GRC) within and outside an organization, in the industry, and also globally to ensure sufficient security and privacy of data and corresponding AI applications
e. Workshop presenters and participants – typically from the industry – attending a two-day event in a very practical setting (see the outline of a two-day workshop based on this book, below)
f. Instructors and students of a higher-degree course/subject in a university setting

CHAPTER SUMMARIES

Starting with an understanding of AI, ML, and BI, this book develops the idea of utilizing Big Data (BD) analytics for optimized business decision-making. The reader is updated with crucial concepts of the range of ML approaches that handle BD and how to overcome the risks in implementing these approaches. This book contains innovative and entirely new ideas around dynamic learning that have not been discussed anywhere else in the literature on AI. The following is a statement on each of the 11 chapters in this book:

Chapter 1: Artificial intelligence and machine learning: Opportunities for digital business sets the tone for business optimization. and focuses on the business opportunities and customer value.

Chapter 2: Data to decisions: Evolving interrelationships outlines the framework to *Think Data* and how data evolves into decisions.

Chapter 3: Digital leadership: Strategies for Adoption underscores the importance of leadership and strategies in digitizing business using AI.

Chapter 4: Statistical understanding of machine learning types: AI and ML in the business context deals with the statistical algorithms of ML.

Chapter 5: Dynamicity in learning: Smart selection of learning techniques develops the concept of dynamically changing requirements and solutions in ML.

Chapter 6: Intelligent business processes with embedded analytics focuses on the business process aspect of optimization, including modeling and reengineering of processes.

Chapter 7: data-driven culture: Leadership and change management for business optimization underscores the importance of developing an approach to change, which is inevitable in all functions of a business as it optimizes.

Chapter 8: Quality and risks: Assurance and control BO deals with the important topic of quality in the use of Big Data and AI for optimization.

Chapter 9: Cybersecurity in BO: Significance and challenges for digital business draws attention to the importance of security in the use of AI in optimization.

Chapter 10: Natural intelligence and social aspects of AI-based decisions aims to balance the inexplainability of AI with NI for value generation and risk reduction.

Chapter 11: Investing in the future technology of self-driving vehicles: Case study Shows an example of how AI is used in autonomous vehicles.

MAPPING BOOK TO A WORKSHOP

The material in this book is presentable in varying formats. These include:

- A two-day practical training course or a workshop that can be delivered in public or in-house (customized) format to industrial participants (See Table I.1).
- A one-semester, 15-week, university course
- A distance-learning format wherein the assessments, case studies, etc. are based online. Here is a potential mapping of this book to the workshop

Table 1.1 Mapping of the Chapters in This Book to a Two-Day Workshop.

Day	*Session*	*Presentation and Discussion Workshop Topic*	*Relevant Chapters*	*Comments*
1	8:30–10:00	Introduction to AI, ML, BD, and corresponding business challenges	1	Key concepts and terms are introduced. Significance of business applications is highlighted.
	10:30–12:00	Developing business strategies for optimization	3	Holistic strategy development for AI/ML/BD applications is outlined.
	1:30–3:00	Data to decisions pyramid	2	Evolution of data utilization in decision-making is discussed.
	3:30–5:00	Taxonomy of machine learning and application in business	4	Comprehensive understanding of various ML types, their research-based relevance, and their application in business automation and optimization is discussed.
2	8:30–10:00	Dynamic learning; optimizing business processes	5, 6	Embedding data-driven analytics in business processes and their dynamicity is discussed.
	10:30–12:00	Cultural issues in AI applications; superimposing natural intelligence; quality, security and privacy (GRC)	7–9	"Soft" issues in AI applications to business include quality, security, privacy, natural intelligence, and so on. These are discussed here.
	1:30–3:00	Understanding and working through a case study	3, 4, 5, 11	Participants move to a workshop format and develop a business optimization strategy with AI.
	3:30–5:00	Handling practical challenges and risks associated with BO	All	Participants share and outline their business strategy in optimization; and discuss and present their thoughts, issues, and challenges

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Figures

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