Artificial Intelligence and Machine Learning in Business Management

Concepts, Challenges, and Case Studies

EDITED BY
Sandeep Kumar Panda
Vaibhav Mishra
R. Balamurali
Ahmed A. Elngar

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Dedicated to my sisters, Sushri Susmita, Sujata, Bhaina Sukanta, nephew Surya Datta, wife Itishree (Leena), son, Jay Jagdish, and late father, Jaya Gopal Panda, and late mother, Pranati Panda.

Sandeep Kumar Panda

Dedicated to my father, Ravindra Kumar Mishra, my mother, Shakuntala Mishra, and other members of my family and friends.

Vaibhav Mishra

Dedicated to the Almighty Lord (God Father Shiva) and all Divine Brothers and Sisters of Brahma Kumaris World Spiritual University, Mt. Abu, Raj.

R. Balamurali

Dedicated to my parents, to my love, Eman - your smile brings happiness to my life, and also to my kids, Farida, Seif, and Malek.

Ahmed A. Elngar

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Preface

The focus of this book is to introduce Artificial Intelligence (AI) and Machine Learning (ML) technologies in the context of Business Management. The advent of AI & ML technologies has the potential to deeply impact the traditional ways of managing businesses. The book consists of the introduction of Artificial Intelligence and its relationship with other technologies. The reader will also get to know the impact and challenges associated with this. The remaining few chapters will cover the impacts of AI and ML in various fields of business and management like operations management, marketing management, human resource management, finance and strategy. The chapters of the book will give insights into the implementation and impact of AI & ML to business leaders, managers and technology developers and implementers.

With the maturing use of Artificial Intelligence or Machine Learning in the field of business intelligence, this book examines a number of projects with innovative uses of AI beyond data organization and access. It follows the Predictive Modelling Toolkit for providing new insight on how to use improved AI tools in the field of business. It explores cultural heritage values and risk assessments for mitigation and conservation and discusses on-shore and off-shore technological capabilities and spatial tools for addressing marketing strategy change and change in retail, insurance and healthcare system etc. Taking a multidisciplinary approach for using AI, this book provides a single comprehensive resource for undergraduate, graduate, business professionals and related disciplines.

Nowadays, AI improves a lot in the area of supply chain to track the product, to provide intelligence in insurance field, to finance field etc. In this regard, the traditional approach of teaching and learning is not meeting the requirement in the policies of Industry 4.0 revolution. Hence, we edited this book to minimize the gap between academia and Industry.

The book is organized into 15 chapters:

Chapter 1, *Artificial Intelligence in Marketing*, discusses how AI help to the marketing people to better understand the speech (recognition) by applying techniques like text mining, with latest advancement in programming it has made modelling of direct marketing responses and predicting churn using classification trees and training machines to better understand customer needs etc.

Chapter 2, *Consumer Insights through Retail Analytics*, describes an in depth understanding on how Indian retail companies such as 'Shoppers Stop' and 'Future Group' are exclusively using customers' purchases and other transaction data to predict their future purchase behaviour and design product placement strategies.

Chapter 3, *Multi-Agent Paradigm for B2C E-Commerce*, discusses the business applications of KBS, CBR, ANN, GA and MAS along with negotiation, customer relationship management and customer orientation. From computational point of view, agent characteristics, multi-agent system paradigm and its communication protocol also been discussed. Lastly, the chapter describes the Belief-Desire-Intention (BDI) architecture for mental state and other cognitive parameters such as

preference, commitment, and capability required for computation of trust in any AI based e-business system to formalize the internal architecture of complex agents.

Chapter 4, *Artificial Intelligence and Machine Learning: Discovering New Way of Doing Banking Business*, illustrates the impact of AI and ML application on finance with the principal focus on Banking sector, how AI affects customers, maintains the customer relationship, influences business performance and finally how AI will change future of Banking sector. Artificial Intelligence (AI) is one of the front digital transformation strategies that can spread in the area of finance today.

Chapter 5, *Analysis and Comparison of Credit Card Fraud Detection Using Machine Learning*, discusses fraud detection technique to protect or prevent the cardholder from huge losses. To determine the fraud transaction various deep learning architecture like Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), Convolutional Neural Network (CNN), and Multilayer Perceptron (MLP) have been used.

Chapter 6, *Artificial Intelligence for All: Machine Learning and Healthcare: Challenges and Perspectives in India*, deliberates on the healthcare sector as its main thrust area to study the application of Machine Learning. The role of ML is to help the common people to access healthcare facilities without any constraints.

Chapter 7, *Demystifying the Capabilities of Machine Learning and Artificial Intelligence for Personalized Care*, discusses Machine Learning enabled Artificial Intelligence, which detects the abnormality at an early stage, where physician, as well as patient, can be alarmed earlier about a future disease or health conditions, enabling early intervention to provide early treatment along with personalized recommendation and how physicians, as well as patients, look at these technologies along with small case studies.

Chapter 8, *Artificial Intelligence and the 4th Industrial Revolution*, focuses on briefly understanding the threats of governance over data privacy, net ethics and cybersecurity issues and underscores the need for broader cyber laws and policymaking in the future. The transformative impact of Artificial Intelligence, Machine Learning and embedded technology will shape the new economy and market space. How will the economies, markets, ecosystems and organizations react and respond in this ever-expanding yet interconnected world remains to be seen.

Chapter 9, *AI-Based Evaluation to Assist Students Studying through Online Systems*, focuses on the AI techniques used to grade the performance of students in an Online Learning Environment and provides a feedback to improve the Learning Process. A simple implementation based on Markov Decision Process is present to understand this approach.

Chapter 10, *Investigating Artificial Intelligence Usage for Revolution in E-Learning during COVID-19*, examines the portrayal of AI in E-learning during COVID-19 and apart from discovering the role of AI during this pandemic. The study has also investigated the future of AI in E-learning post COVID-19.

Chapter 11, *Employee Churn Management Using AI*, describes an AI model which can help the Human Resource Management to anticipate which representative can leave the association in not-so-distant future by investigating the past informational index of the association in a significant manner.

Chapter 12, *Machine Learning: Beginning of New Era in the Dominance of Statistical Methods of Forecasting*, briefly covers the popular empirical studies covering statistical and ML (AI) methods used for the purpose of forecasting and their outcomes and suggestions for the future scope of study.

Chapter 13, *Recurrent Neural Network-Based Long Short-Term Memory Deep Neural Network Model for Forex Prediction*, provides the historical data of different countries on a daily basis that are compared separately using Back-propagation Neural Network (BPNN), Functional Link Artificial Neural Network (FLANN) and LSTMs. Comparing daily exchange rate prediction of these three models, LSTMs model outperformed with maximum accuracy with faster convergence.

Chapter 14, *Ethical Issues Surrounding AI Applications*, highlights ethical issues and approaches that are currently being undertaken to address in the different domain.

Chapter 15, *Semantic Data Extraction Using Video Analysis: An AI Analytical Perspective*, deliberates on extracting vehicle numbers off of vehicles from a CCTV captured video through four steps, including conversion of video to a continuous image sequence, image segmentation, character segmentation and character recognition, with preprocessing at every stage to improve the quality of input data available for the next step. In the era of the growing complexity of problems along with the increasing functionalities offered by video analytics, this can be the most basic and generic solution supporting many applications.

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First and foremost, we would like to thank the Almighty Lord. In the process of putting this book together we realized how gifted we are. You have given us the power to believe in our passion and pursue our dreams. We could never have done this without the faith we have in you, the Almighty.

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We are very much grateful and thankful to CRC Press, Taylor & Francis for providing the opportunity to edit the book *Artificial Intelligence and Machine Learning in Business Management: Concepts, Challenges, and Case Studies*. In this regard special thanks go to Keith Povey Editorial Services Ltd for much improvement of the English language and syntax. We strongly believe that the book will have a positive impact on the readers.

Last, but not least, we would like to thank all the prospective readers of the book. It has been written with you in the mind. We welcome suggestions, tips for improvements, criticisms and appreciation. Your invaluable inputs are very much required for our future endeavours.

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1 Artificial Intelligence in Marketing

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1.1 INTRODUCTION

During the early days of AI in the 1950s, scientists were asking questions like "Can machines think?" and were looking into deep, complex issues of mechanizing emotional intelligence. However, in today's world of Amazon's Alexa, Apple's Siri, Google Assistant etc. machines have become far more capable, yet AI still has a long way to go. In simple terms, AI can be explained as human intelligence exhibited by machines and can be broadly classified into Artificial Narrow Intelligence (e.g., smart speaker, self-driving car, AI in farming and factories) and Artificial General Intelligence (machines can do anything a human can do). The benchmark for AI is to be as good as human intelligence, and to possess ability to reason, see and communicate like humans do. Though capability of AI has improved by leaps and bounds over the years, it is still far off from that benchmark in comparison to human intelligence. Nevertheless, recent advancements in the field of AI reflect a very promising future.

AI is Machine Learning (ML) driven. ML deals with training a computer to perform specific tasks and functions automatically. Usually, these tasks are exhaustive, repetitive and often too complex for humans to do efficiently. Machines can learn

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through supervised, unsupervised and reinforced learning. In supervised learning, several input and output sets are provided to the machine. Through this approach, data is fed to an algorithm and the machine tries to recognize the relationship between the input and the output. When the machine has stopped learning – in other words, has learned optimally – the learned model can predict the value or the class of new data points. For example, a system can be trained to differentiate between a kangaroo and a koala. By feeding the system with dozens of images of both animals, the system will learn about the features which distinguish each and so improve its prediction. In unsupervised learning, data is analyzed without trying to make any predictions. It is focused on learning and understanding the underlying structural properties and associations in between the observed data. This kind of learning can be used in detecting outliers, classifying and segmenting customers and the market. In reinforcement ML, the system does not have historical data to draw conclusions upon; instead, the algorithm learns by taking different actions and evaluating their successes and failures. Reinforcement learning is used by Facebook in advertising on its platform. The system tests the advertisements on full spectrum when it is flighted for the first time. With time, and when sales rise, Facebook's algorithms analyze the data available, and it then shows the advertisements to certain sets of customers, in certain geographical locations, at certain times of the day and using certain on-screen placements.

1.2 AI, ML AND DATA SCIENCE

We often see AI, ML and data science in use together, and they are considered to be lucrative career options today. Data science can be defined as a broad field of study which pertains to data systems and processes which are aimed at maintaining datasets and deriving meaning from them. With the advent of technology and the Internet, today almost all organizations generate a large volume of data through their daily transactions, and it becomes problematic for these organizations to monitor, store, organize and extract important information from this data. Data scientists use a combination of tools, algorithms, applications and principles to extract useful information from various random data clusters, and then use this information to guide business processes to reach organization goals. The information extracted can be used to study ongoing data trends in any field of business and is helpful in presenting business forecasts and setting courses of action based on insights found and inferences made. The best example of ML is Netflix suggesting movies to the customers based on their movie-viewing behaviour and Amazon recommending books based on the past purchases of customers on the website. With the help of ML, marketers can provide customers with customized content as well as suggest other products that they may wish to purchase.

ML is a field of study that gives computers an ability to learn without being explicitly programmed, whereas data science deals with extracting knowledge from data. Deep learning is a big artificial neural network which mimics the network of neurons in a human brain. It is a subset of ML and is called "deep learning" because it uses deep neural networks for learning. The machine uses different layers to learn from the data and the depth of the model is represented by the number of layers in the

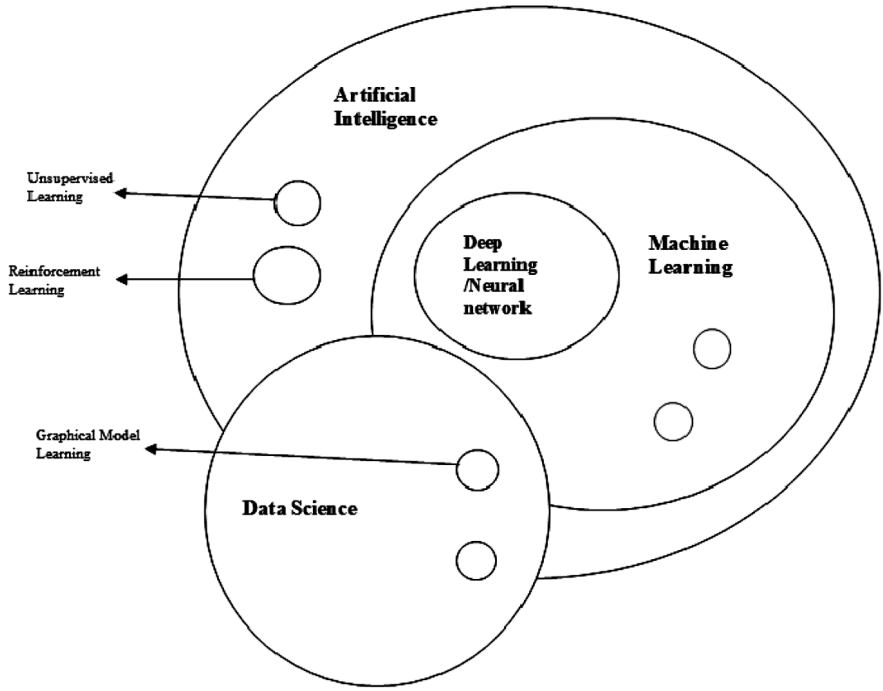

FIGURE 1.1 Relationship between AI, ML and data science.

model. Deep learning is a new term used within the world of AI. Refer to Figure 1.1 Relationship between AI, ML and Deep Learning.

The relationship between AI, ML and data science is given in Figure 1.1.

1.3 AI AND MARKETING

In one century, human civilization has developed by leaps and bounds in terms of technology, healthcare, economy and in every possible materialistic dimension. In the years to come we are likely to witness replacement of human-driven cars to self-driving cars, doctors operating remotely through robotic surgical devices, nanotech self-cleaning clothing, 3D printers facilitating instant delivery of goods, meaning manufacturing time can be brought down, implantable communication devices replacing mobile phones, and many other technical advancements. It would come as little surprise if all advertising and marketing tasks were to be managed wholly by computational systems. Currently, marketers use a lot of technology, but in the coming decades, AI and ML methods will take the marketing game to a new level.

Practitioners and academicians have anticipated that AI will change marketing strategies and customer behaviours. According to a survey conducted by Salesforce, AI will be the technology most adopted by marketers in the coming years. With the help of AI, business processes are being automated and so machines are then able to perform preset tasks with higher accuracy and far less human intervention, such as

transferring data, sending promotional mail to existing as well as potential customers, updating customer files, replacing lost ATM cards, reading documents to extract key points using natural language processing etc. With the help of AI, companies can gain insights from the vast amount of transaction and customer data which will include not only numeric data type, but also text, images, audio recordings of customers conversing with the customer care service provider, facial expressions, and even voice tones. By employing AI in daily functioning, companies can better predict customer choices, deploy appropriate digital marketing strategies or anticipate potential credit fraud.

Marketing bots are one of the most popular forms of automation right now. A bot is basically a piece of software which can be programmed to carry out a specific set of actions on its own. Bots are usually cheap to setup, and easy to program and run. Bot-powered commerce is our modern-day manifested destiny and is the future of marketing. For example, in order to purchase a bulb for your newly bought reading lamp, you need to visit different websites, scroll through a number of pages, fill out forms regarding your shipping address, give payment information and so on. But if there is a bot, you just need to tell it to find a bulb for your reading lamp, and it will guide you through different bulb hues, voltages, etc. and then place the order for you. Behind the screen, the bot leads you through a concatenation of questions in order to better understand your intent, and deliver the right information to you. AI bots can provide both customer as well as sales support services, are available 24/7, have very low error rates, and their deployment can be scaled up or down according to demands.

Here are a few functions that a bot can perform which can be beneficial to any business:

1. Assist website visitors looking for answers about products.
2. Help in conducting marketing research.
3. Qualify leads.
4. Help in tracking individual team members' work and keep the whole team updated with each other's work.
5. Personalizing advertisements for customers.

With all the descriptions suggested above, AI offers the potential to reduce the costs incurred and increase revenues. Revenues can be increased by making informed and improved marketing decisions (e.g., product recommendations, competitive pricing, personalized promotion, enhancing customer engagement). The costs may decline due to automation of simple marketing tasks and free up human agents to handle more complex marketing tasks.

There is a misconception that AI is replacing humans in their jobs, but firms can use AI to amplify their employees' capabilities. For example, Stitch Fix, a leading clothing and service provider, use AI bots in assisting their employees to provide a better service to their customers. With the help of AI, stylists identify the best clothing styles for their customers by integrating all the data provided by the customers while expressing their preferences, general style trends, handwritten notes, Pinterest boards and preferences of other customers in the same segment. Ginni Rometty (CEO of IBM), in his media interactions has often indicated that AI would not lead to a world of man "versus" machine but rather a world of man "plus" machines [1].

1.4 BENEFITS AND DETRIMENTS OF USING AI IN MARKETING

1.4.1 Benefits

A) Personalization and relevant messages
AI fuelled predictive analytics can help companies by tapping the right customer base and analyzing their browsing history, and then showing appropriate advertisements to the right set of people. This can help companies understand their customer preferences better and then make appropriate recommendations. This is being used widely by Amazon and Netflix, saving billions by keeping customers hooked to their services and avoiding cancellation of services. As a marketer, AI gives you much power in terms of developing certain data points which lets you guide your customers to the right product.

B) Streamlining the marketing efforts
Through deep learning AI can study consumer behaviour patterns and predict which segment of customers are likely to make a certain kind of purchase. This can help businesses in targeting the customer base more accurately without wasting time and money on less probable leads.

C) Cost saving
According to various research surveys conducted worldwide, around 85% of the interactions between brands and customers are going to happen online. As compared to other advertising mediums like prime time tele advertisements, print advertisements, billboards etc. online advertising is cheaper as well as more precise in targeting the right set of customers with the aid of AI.

1.4.2 Detriments

A) **Human control is still required**
AI cannot function without human intervention, as it lacks the creativity, flexibility and imagination which makes humans the epicentre of the marketing world. Humans have various tastes, preferences, experiences etc. which enable them to make better decisions than machines, which are run on algorithms comprising from formulas, statistics, commands etc.

B) **Algorithms can be wrong**
Due to bad data AI can develop biases. For example, automatically preferring and shortlisting CVs of white males over people belonging to other ethnicities, genders, colours etc. because previously most of the successful people in those positions were white males. And this makes AI infer that white males are better suited for those positions over other people.

C) **Automated chat boxes and machine answering calls is not always the solution**
Many people, especially those of older generations, are not comfortable talking with machines instead of human customer care agents. And moreover, we all know how exasperating it can be when we have an urgent matter at hand, and are looking for solutions from a robot. Therefore, chatbots should be installed by businesses only after careful research on their customer segment and product offerings.

1.4.2.1 Amazon Go (Caselet)

Amazon.com, Inc was founded by Jeff Bezos in 1994 under the name Cadabara (1994–95). It started as an online marketplace for books but later ventured into selling furniture, electronics, apparel, food, toys, jewellery, software etc. It is considered one of the Big Four technology companies (alongside Google, Apple and Facebook) and presently focuses on e-commerce, AI, digital streaming and cloud computing. In 2018 Amazon announced its two-day delivery service, Amazon Prime, which today has 10 million subscribers worldwide. Prime Video, Amazon Music, Audible and Twitch are subsidiaries of Amazon through which downloads are distributed, and audiobooks, videos and music are streamed. Amazon distributes various products and services through Amazon Fresh, Amazon Studios, Amazon Wireless, Kindle Store etc. Amazon has acquired around 40 subsidiaries including Zappos, Goodreads, Amazon Robotics, IMDb, Amazon Maritime, Ring, Whole Food Markets etc.

Amazon Go opened its first store in 2018 in Seattle. It is a chain of convenience stores, with 26 sites across the US, and a further ten planned to open across the United Kingdom as of 2020. Amazon Go is not just any other grocery store: it is a store enabled with 'Just Walk Out' technology, where the customers can simply enter the store, grab whatever they need and leave, eliminating checkout lines. In order to get started with the shopping, shoppers need to have an Amazon account, a smartphone and the free Amazon Go app. As the shoppers enter the store, they need to scan a barcode within the app on their smartphone at the entrance turnstiles, keep their phones with them, and then grab whatever they need before leaving the store. Amazon has applied the technology used by self-driving cars (AI, ML, Image recognition, array of fusion sensors, deep learning, computer vision, bigdata on how humans shop etc.) to create the shopping experience in Amazon Go stores. From the moment shoppers enter the store, they are recognized and tracked with the help of sensors and cameras installed all over the store. The technology automatically detects the products taken from or returned to the shelves. It keeps a track of the products in the virtual cart, and once the shopping is complete and the shopper exits the store, Amazon charges them from their Amazon account and emails a receipt to the customer.

1.4.2.2 Technical Working of Amazon Go

Firstly, the data is acquired through several sensors in order to enable awareness of which products have been picked up from the aisle or the shelves. Some examples of the type of sensors are weight measurement, pressure detectors, dimensional measurements of the products. Secondly, several deep learning algorithms are used to understand what product the customer picked up or put back; which products to keep in the virtual cart; which products the customer picked up while making a purchase decision; how much time did the customer take to make a decision; which products are getting sold faster and where to place these products for easy access. And finally, when the customer passes a transition point on exiting the store, a bill is generated for the items present in the virtual cart, which is the result of the automated analysis done by intelligent machines working behind the curtain.

After the success of Amazon Go stores, many retailers had shown interest in this technology which is an amalgam of complex system of sensors, cameras and software that tracks each and every activity and movement of the shoppers inside the store. The Amazon Go tech bundle has been put on sale in the market. 'Just Walk

Out' technology can be installed in the pre-existing retail stores undergoing renovation as well as new stores under construction and requires only few weeks for the entire setup procedure. The brand has gone a step further by creating a new website dedicated to 'Just Walk Out' technology and covers all the technology related aspects like sales offers, most frequently asked questions about their new business line etc. The site does not cover the pricing info, but covers a variety of package related info like hardware required, software solutions etc. Amazon provides 24/7 customer support via phone or mail [2].

1.4.2.3 Issues Related to Amazon Go Technology

Amazon Go uses computer imagery and a sensor fusion tech bundle to record and analyze customer actions, and gives accurate results accordingly. But what if the customer wears a mask? Wearing a mask is a necessity during the prevailing pandemic conditions. Will Amazon Go be able to identify the customer correctly?

The number of products in Amazon Go might increase, and what if the customer does not return the lifted product to the shelf from where it was picked up? Will the customer be charged for the product? What if the customer consumes the product in the store itself (e.g., a juice bottle or candy in a box) and puts back the empty product packaging on the shelf. Can the sensors, cameras and image processing software identify such instances? What if a family with kids enter the store? How will the products picked up by the kids be charged? And it has been observed that if there are more than 20 customers in the store at a time, the software crashes; how will Amazon handle these issues? The technology is still growing and has a long way to go.

Amazon Go Stores: This is What Future Looks like is given in Figure 1.2. Figure 1.3 shows a cashier-less store that lets customers pick up the products and walk out of the store where as Figure 1.4 represent Amazon Go Cashier less convenience store. Figure 1.5 indicates an Employee stocking the shelves in a cashier less store.

FIGURE 1.2 Amazon Go Stores: This is What Future Looks like.