Chapter 11

The Dark Side of Artificial Intelligence in Retail Innovation

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Abstract

Many academic scholars argue that the goal of using artificial intelligence (hereafter, AI) in business has been to serve humans in performing their jobs. Nevertheless, some scholars refute such arguments and warn against potential threats of AI to humankind in the future. AI or machine intelligence comprises three main aspects, i.e., learning, reasoning and self-correction, which aggregate to conjure up the artificial mind. In retailing, the employment of AI is progressively becoming a major theme of innovation and retailers are rapidly increasing the use of machine intelligence to efficiently simulate human intelligence and become more competitive through cutting costs and improving customer journeys. However, such benefits can be catastrophic in the long run. As a result of this, this chapter represents an attempt to produce a synthesis of current research on the use of AI in retailing and identify the possible benefits or ramifications on the 'human' pillars of the retail process (i.e., the employers, employees and customers). Finally, this chapter aims to reflect on relevant literature to conclude future research and industrial implications.

Learning Outcomes

This chapter attempts to provide answers to the following questions:

- What is artificial intelligence (AI)? Moreover, what is AI-based retail innovation?
- How does AI work?
- What are the applications of AI in retail services innovation?
- What are the ethical aspects, considerations and issues regarding the employment of AI in retail?

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Introduction

> Intelligence is central to what it means to be human. Everything that civilisation has to offer is a product of human intelligence. (Hawking, 2018, pp. Kindle Locations 1925–1926).

It has been broadly observable that AI is increasingly and significantly affecting the way we live and do things. In this regard, many recent reports, surveys and estimations provide indications that describe the outbreak of AI as an integral part of the future. The global AI technology market is expected to experience massive growth in the coming years, with sales rising from about USD 9.5 billion in 2018 to an estimated USD 118.6 billion by 2025, according to market research firm Tractica. The AI industry as a whole covers a wide range of applications like those of natural language processing (NLP), automation of robotic processes and deep learning, amongst others (Tractica, 2019). Many giants in the tech industry have made significant investments in AI acquisitions as well as AI research and development. Corporations like Microsoft, IBM, Google and Samsung have filed thousands of AI patent applications since 1999, while AI-related companies are raking up investment funds that are worth billions of US dollars reaching 7.41 billion US dollars in the second quarter of 2019 alone (Statista & CB Insights, 2019). Fig. 11.1 shows the number of AI-related patent applications by technology company from 1999 to 2017. Microsoft tops the list of these firms with 4,167 applications for AI-related patents while NEC comes last amongst the tech titans with 930 apps (Statista, 2018).

Knowing the fact that customers are reporting higher levels of acceptance of AI-powered technologies, e.g., digital assistants (Martin, 2019), the rise of AI has posed opportunities and challenges for businesses across the different sectors, including retail, and pushed them to embrace the change or step aside in favour of the AI-vested entrants. Platforms like Amazon have not only created new business but have also replaced brick and mortar retail sales. Consequently, a significant part of AI's disruption will contribute to a change in productivity between competitors (Kreutzer & Sirrenberg, 2020). Furthermore, without AI, a marketer would find it too difficult to collect and process vast amounts of data from a variety of sources such as websites, mobile app interactions, purchases and customer reviews. Those who are reluctant to accept AI will be competitively disadvantaged, since they will not be able to predict their customers on time, precisely and profitably (Sutton, 2018). Thus, we define **AI-based retail innovation** as using new AI-powered technologies to profitably and sustainably improve individual customers' shopping experiences across retail's different channels.

While many authors advocate AI for its benefits like offering companies the opportunity to increase their sales, lower bounce rates and attract customers with

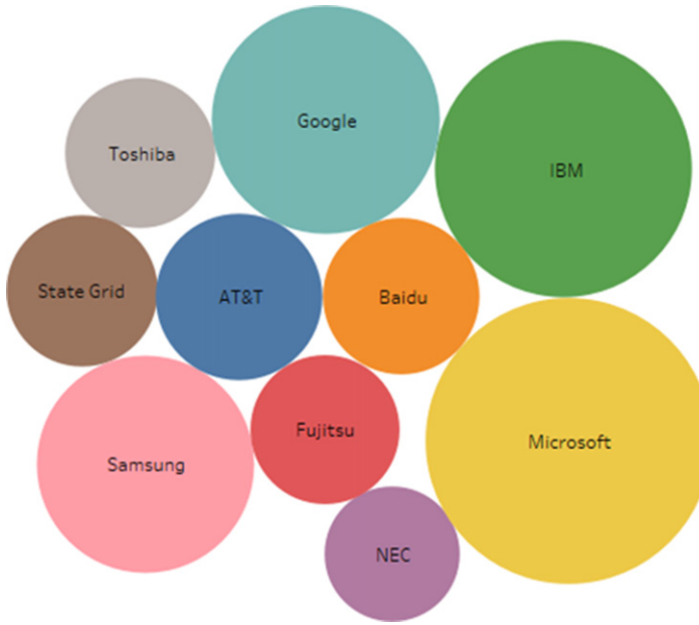

Fig. 11.1. AI Patent Applications of Leading Technology Companies from 1999 to 2017. *Source:* Produced by the authors using Tableau software and based on Statista's (2018) data.

hearing, motor and visual impairment through the use of NLP and deep learning (e.g., Dudharejia, 2019) many others point at it as a massive future threat to humankind. Since computers keep up with Moore's law, doubling speed and storage capacity every 18 months, the implications will be that machines will likely surpass humans on the intelligence scale in the next century (Hawking, 2018). The later viewpoint, by Stephen Hawking, concurs with recent surveys showing that 46% of Britons think that in the future, AI could develop a will of its own, in conflict with humans' (YouGov, 2018), while 47% of 3,000 global business executives, managers and analysts believe that AI will enforce businesses to reduce their workforces (MIT Sloan Management Review & BCG, 2017). Thus, this chapter serves as a scholarly endeavour towards identifying AI and its applications in retail, investigating the ethicality behind the way AI is revolutionising retail, and finally discussing the future of AI in retail drawing on current research in this area.

Artificial Intelligence and How It Works

AI refers predominantly to computational technology driven by ways in which people use their brains' neurons and nervous systems to reason and make

conclusions and decisions, although they usually work very differently (Mehta & Hamke, 2019). Hassabis, Kumaran, Summerfield, and Botvinick (2017) pinpoint that although cognitive science findings naturally guide AI research, yet, it also more frequently provides insights for psychology to understand the brain activity mechanisms better. Thus, before we attempt to define the AI and its surrounding terms, it is worth mentioning and describing what a 'nonartificial', i.e., human, intelligence is.

According to Sternberg (2017), human intelligence represents the ability to learn from experience, to adapt to new situations, to understand and manage abstract concepts and to use knowledge to manipulate our environment. Human intelligence encompasses a vast array of approaches, which demonstrate logical, spatial and emotional cognition. Whether we are degreed engineers or persuasive marketers, we should use cognitive abilities to learn and excel in everyday environments. Working memory sustained attention, creation of categories and pattern recognition are examples of such mental capabilities. Computers surpass humans in computational tasks of great magnitude, yet the machines' abilities are claimed to be restricted, and the potential of computers in other areas lags behind human intelligence (Yao, Zhou, & Jia, 2018). Thus, we conclude that AI can be described as computer or software intelligence where the computer is the machine and software is a set of commands that directs 'electronic signals' regarding how to act inside a machine (Chace, 2015).

AI-powered tech meets us most of the time in a way that does not first make us think of AI (Kreutzer & Sirrenberg, 2020). Although it brings intricacy to our life, it offers new and more efficient ways to do our daily things. We start noticing that it is becoming easier to do something than before (Modern Diplomacy, 2019). Only think of virtual personal assistants such as Alexa, Google Home, Cortana and Siri that play favourite music from Spotify through voice triggers, create shopping and wish lists or even make purchases and schedule appointments. We are referring to virtual personal assistants as they are not physically tangible assistants anymore (Kreutzer & Sirrenberg, 2020). For example, Fig. 11.2 shows how Microsoft's Cortana is tracking a user's emails and suggesting tasks based on their sent messages. At the same time, Fig. 11.3 exhibits Gmail as being functioned by Google's AI in order to label received emails as 'Primary', 'Social' or 'Promotions'.

AI-related Terminologies

Machine intelligence has been mishandled in pop culture to refer to nearly any kind of computerised or automated processing. To deter confusion, AI scholars and practitioners have a preference to employ the term Artificial General Intelligence (AGI) to describe systems with human-level or higher intelligence, sufficiently adroit in deriving concepts from narrow experience and transferring knowledge between disciplines. AGI is also known as 'Strong AI' to distinguish from 'Weak AI' or 'Narrow AI', which relates to machines or software intended for handling a specific task that cannot be by far transferable to other systems (Yao et al., 2018). In other words, the dissimilarities between human-like general intelligence and the artificial narrow intelligence are that we can make useful

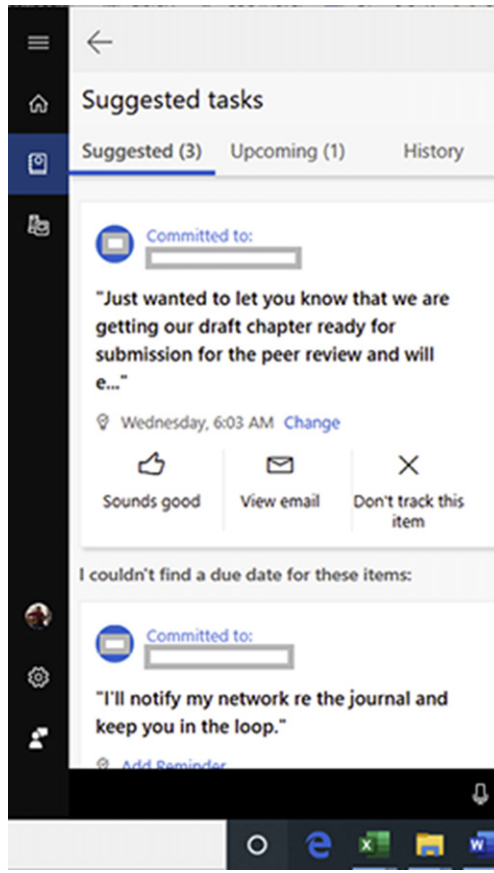

Fig. 11.2. Cortona: Microsoft's Personal Assistant. *Source:* Authors' own material.

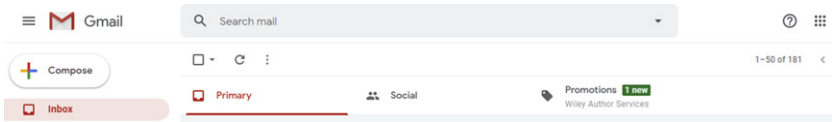

Fig. 11.3. Google Gmail's AI-Powered Filter. *Source:* Authors' own material.

conclusions from one activity and relate them to another. Also, unlike AGI, narrow AI lacks volition and does what we *order* it to, while a general AI will be capable of reflecting on its goals and determining whether to change them (Chace, 2015). The exponential growth of AI is thought to bring much more massive

changes to humankind through which AI will be the next phase of human evolution on which the tech expert Peter H. Diamandis comments by saying: 'We are going from Darwinism evolution by natural selection to evolution by human direction' (Ashley, 2019). That is not far away from what OpenAI, a US-based AI research lab, revealed in 2018 when it announced that it developed a robotic hand that had taught itself how to play with and solve the Rubik's cube using a 'reinforcement-learning' algorithm, a technique that patterns the way animals learn (Hao, 2019).

The anatomy of AI reveals a set of concepts that we need to have abreast of. Samuel (1959) provides the classic definition of **machine learning** by referring to it as the branch of science that enables the machines, i.e., the computers, to learn without being overtly programmed. **Neural networks**, or sometimes called artificial neural networks to differentiate them from the neural network that is in one's brain, are used for simulating processes occurring in biological neural networks in a brain (Flasiński, 2016). **Deep learning** is a unique layout of neural networks and a subset of machine learning where the 'deep' describes the enormous number of layers of the neural network (Kreutzer & Sirrenberg, 2020). Presently, the terms neural networks and deep learning are practically similar. They consist of simple interconnected modules, which process data simultaneously (Flasiński, 2016). Thus, neural network or deep learning represents the masterwork of AI (Kreutzer & Sirrenberg, 2020). Finally, given the recent Google's claims of achieving quantum supremacy (Lichfield, 2019), it is worth mentioning that when AI is enhanced by quantum computing and algorithms, a new much more robust pattern of AI, i.e., Quantum Artificial Intelligence will emerge.

AI's Effects

Most of us likely have, already, come across some reads about the value potential that AI produces on different fronts. An estimated 13 trillion US dollars' worth of wealth will be generated annually by the year 2030, according to a report by the *McKinsey Global Institute* (Bughin, Seong, Manyika, Chui, & Joshi, 2018). While AI already generates enormous value for the computer software industry, much of the value that will be generated in the future is expected to go beyond the boundaries of the software business. In all areas of the economy, like retail, leisure, transport, automobiles, supplies, manufacturing, one should find it difficult to think of an industry in which they do not believe AI is going to have a significant effect in the coming years (Ng, 2018). Since this chapter covers the prevalence of AI in the retail industry, the following section is entirely devoted to addressing AI's effects on retail.

AI Applications in Retail

Bertacchini, Bilotta, and Pantano (2017) mention several ways through which retail can benefit from the robotic system. For instance, according to them, (1) the attractiveness of robotic technology will encourage customers to engage more in

shopping activities, and this will help the retailers boost their sales; (2) customers will benefit from faster and intelligent guidance during shopping and thus make more effective and efficient purchase decisions; (3) robotic technology will support retailers' endeavours towards minimising the personnel costs and enhancing the staff well-being.

The following points expand on the current scholarly and business debates about the AI uses in retail.

The Inevitable Is Happening

Retail is a fast-moving industry, and market success is about keeping up with technology. One of the technologies is AI, and evidence shows that it is an integral part of the retail future. Thus, the use of AI in retail has become inescapable. Moreover, this is not limited to online stores. Offline retailers are also using AI to redress the balance as most customers have become more inclined to take a multichannel approach to shopping. AI redefines the retail industry in a variety of ways, like helping customers find the products through visual search and personalising their entertainment experience via chatbots. By 2020, Jain and Laney (2016) expect smart personalisation engines that understand the intent of customers to allow digital businesses to achieve 15% of increases in profits. Retail data continue to grow with business data doubling every 1.2 years (Shankar, 2018). Retail data include data on purchases, online browsing data, social media data, data on mobile usage and data on customer satisfaction. Walmart, for example, collects data around 1 million transactions per hour, leading to 2.5 terabytes of data. AI systems have been trained on big datasets and retailing is considered as a fertile ground for using and growing the AI systems. Retailers invest in several AI applications to exploit these burgeoning results.

Furthermore, it is expected that retailers' expenditure on AI will reach an amount of $6 billion in the year 2022 (Shankar, 2018). According to a report by the *McKinsey Global Institute* (Bughin et al., 2018), the highest potential value impact from using AI is in marketing and sales (as top-line-oriented business functions) as well as in supply chain management and manufacturing (as bottom-line-oriented operational functions). Furthermore, by the year 2021, 85% of retail companies are preparing for implementing intelligent supply chain automation which is expected to result in 10% of annual growth (IBM, 2019).

A New Level of Understanding and Predicting Consumer Behaviour

AI technologies have been integrated into retail and marketing by using big data analytics to develop customer-specific profiles and their anticipated buying habits (Dwivedi et al., 2019). Knowing and forecasting consumer's demand across interconnected supply chains is more important than ever, and AI technology is expected as an essential component (Dwivedi et al., 2019). Retailers use real-time cloud technology to assess several factors for forecasting an outcome. Such a practice will provide stores with the power to predict behaviour and then

customise the shopping experience of a customer. Most online retailers use machine learning to make customised product recommendations and experience a tremendous increase in their product's sales. For example, Amazon has generated 35% of its revenue by using a recommendation engine. The practical algorithms analyse past behaviour of a customer (viewed items, frequency of orders, history of searches) and other behaviours of similar shoppers.

AI Is the New Personal Salesperson

Retailers can use AI to discover new sources of revenue to improve performance, as well as to identify and execute strategies for successful customer relationship management (CRM). AI automates the repetitive sales activities, acts as a virtual assistant, segments customers dynamically and supports customised offerings. Pepper robot is a perfect example of such an AI device capable of improving store traffic, customer interactions and even revenue of sales. Sales assistant AI technology such as Coversica engages in direct conversation with customers and boosts their interactions with the retailer. For example, the New England–based car dealer, Boch Automotive, claims to have improved Toyota car sales at its dealership by using such technology (Shankar, 2018).

Customers' Prospecting and Retention

AI software has been deemed to be able to do everything from discovering leads to managing customers shopping experiences. All in all, the role of AI in sales involves the detection of opportunities in sales and the finding of which customers are ready to buy (Flaiz, 2019). Uniqlo clothing store, for example, is exploring the use of technology and AI to create a different experience in the shop. Selected stores have UMood kiosks powered by AI that display a variety of products to customers and measure their style and colour reaction through neurotransmitters.

Customer Service and Payment Management

AI can be handy for customer service. Even big retailers such as Starbucks and Lowe's are using AI to boost customer experience. In this regard, most retailers are looking for voice- and text-based AI that can analyse customers' attitude towards buying a particular product and service. AI has made significant progress in the area of payments as well. AI not only makes transactions faster but also dissuades fraud. To proactively identify and avoid payment fraud, PayPal's AI uses a deep learning system based on years of digital transactions (Shankar, 2018). The implementation of AI in automated self-checkout systems has been considered as the most innovative improvement to existing processes for self-checkout. A notable example is Amazon, with its model of the Amazon Go store. Robots used for sales support in Amazon Robotics, Cisco, Ocado, and Softbank are more compatible with current store models (Weber & Schütte, 2019).

Media Optimisation

AI is changing how retailers are managing their interaction with digital media. An Australian online gift store named RedBalloon uses an AI-powered platform called Albert to offer personal experiences. Albert is engaging markets, mixing and matching creative resources, purchasing advertising and running campaigns across both paid and free media channels, including YouTube, Facebook and Google. RedBalloon reported an increase in Facebook conversion rates of around 750 percent and a return on its marketing investment of around 1,500 percent (Shankar, 2018).

Inventory Optimisation

AI is also used to determine how many products of each commodity should be stored in various warehouses depending on the local warehouse, season, area and major cities (Weber & Schütte, 2019). Then accordingly, AI adjusts the quantities of optimal stock. The start-up company 'Tally' built a retail trade robot with AI that manages shelves entirely automatically. The machine continuously scans for empty spaces and items that are wrongly placed and travels automatically through the shops (Vanian, 2018). Likewise, H&M is using AI to keep stock of popular items. The brand uses AI to analyse receipts from the sale and returns to determine each store's transactions. The algorithm lets the store know which products are required in certain places to promote and sell more. The data might find that floral skirts in urban stores sell well and change inventory to match what customers want (Morgan, 2019). Walmart announced the Intelligent Retail Lab as its store of the future. Instead of utilising the smart technology to track sales and products, Walmart's program monitors inventory rates to warn employees when shelves need to be restocked or when fresh goods need to be pulled or sat too long (Bayern, 2019). Likewise, Mediamarkt and Ikea have introduced the informative touch-screen displays in large shopping centres and departmental stores to identify as well as search for items in the stores across all of their sales points in Europe (Pantano, Priporas, & Dennis, 2018).

Logistics, Transportation and Delivery Management

AI has already changed the way the retail industry is doing logistics and transportation. Some of AI's exciting new developments include self-driving vehicles, robot deliveries, intelligent route planning and drones. Dominos, for instance, works with robots to distribute food and drinks while retaining these products at the proper temperature. Amazon has operated drones and is reviewing drone laws around the world in order to make drone shipments routine soon (Shankar, 2018). AI systems can track and improve all logistics operations interactively along with the product attributes (shape, size and weight); plus order demand variables can be considered during the formulation of logistics strategy (Lam, Choy, Ho, Cheng, & Lee, 2015). AI is used to handle

last-minute changes for delivery and shipping. It involves choosing the best option port if the initially planned port is blocked, calculating arrival time and assessing a carrier's likelihood of cancelling a contract (Armstrong, 2017; Weber & Schütte, 2019).

Store Cleaning and Layout Management

AI-driven robots can clean physical retail spaces more effectively. These cleaning robots remove a person's need to stay to clean the space after business hours. Such opportunities can lead to increased customer satisfaction, retention as well as overall experience in addition to cost savings, all of which are essential in retailing. AI can help improve the design and layout of retail stores. AI is also used to customise the layout of the retail stores to maximise the satisfaction of customers and boost sales. The robots are Walmart's newest janitors. The autonomous robots are scrubbing the floors of all Walmart stores in the United States. The employees of Walmart can map out the cleaning routes of AI-supported robot scrubbers and can send them on unmanned missions of cleaning by pressing a single button (Huddleston, 2018).

Janus-faced AI in Retail

The rise of AI in retail can be looked at as a double-edged sword. While the benefits of the extensive application of AI in retail are undeniable, they impose unprecedented threats to the key pillars of the retail process as highlighted below.

Employers

Retailers use AI technologies to become more efficient in creating a unified experience for their customers. The challenge is to be able to create and support a customer experience that combines the best parts of both the physical and the digital store. Personal interaction with the sales associate, ability to touch and feel merchandise via sensory experiences need to be efficiently coupled with the unique and personalised shopping experience that are standard in the digital world (CRM Magazine, 2017). While AI technologies are now affording retailers the use of such integrated systems to reconstruct the best features of in-person and digital shopping experiences, the influx of such systems puts increased pressure on the retailers to find and train a workforce with skills that can complement the skills necessary for the operation of new tasks and technologies. Decreased labour share due to increased automation and removal of low-skilled tedious tasks will lead to displacement effect, which in turn can be counterbalanced by the creation of new tasks (Acemoglu & Restrepo, 2018). However, the skills required for the new tasks and the training availability are primarily lacking and likely to continue to lag behind the much faster pace of the development of new technologies.

Employees

The physical, online and virtual worlds can all successfully intersect to create a beneficial consumer and employee experience. AI technologies enhance employee engagement via better systems capabilities to provide more accurate information and to automate otherwise menial tasks. Automation of retail white-collar jobs, however, is the inevitable consequence of the increasing adoptions of AI. With fewer employees available to assist customers due to displacement effects, despite increased empowerment of in-store employees to value-add activities, there will be increasing pressures on remaining workers to not only perform but to learn the ever more complicated technologies, while at the same time remain customer friendly and approachable.

While it is not uncommon for retailers engaged with AI to downplay the downsizing impact of AI, the actual impact on the number of retail jobs is not easily predictable. The enhancing and empowering element of AI-supported jobs shifts the nature of the job to developing complementary skill sets which are conductive of technology proficiency in combination with ever more critical people skills. H&M group, for example, which uses AI to support supply chain decisions, indicates that AI technology enhances and empowers their human buyers and planners, but in no way replaces them (Scheiber, 2018) at least in the near future.

Customers

Customers are undeniable winners in the competitive race of retail stores to leverage AI as an enabler of enhanced customers' experiences through a variety of interactive technologies that allow retailers to engage and interact with customers in a mutually beneficial dialogue (Byrum, 2018). Customers, however, are subjected to increasing need to share their private information and become easily mistrustful of AI and privacy issues that such technology carries with it (Mahmoud et al., 2019). Will customers embrace AI in retail stores and get along with it in the future? While customers are more understanding and accepting of the need to divulge information to a retailer in order to guarantee the desired product availability, trust is harder to maintain (Johnston, 2018). Most customers do not enjoy having their purchase or browsing histories, for example, following them around on their browser, leading to a build-up of mistrust towards excessive information gathering and potential for misuse.

Society

There is no doubt that new disruptive technologies carry a tremendous impact on society, on the lives of communities, families and individuals. While most of the changes are healthy and beneficial to society, few of the disruptive forces associated with the AI have the potential to undermine political stability (Bryson & Winfield, 2017). Termed political polarisation, the power of AI to co-create inequality and discrimination hence polarisation, is a prominent concern

regarding the impact of new technologies on economic diversity in society. Technology provides many people with resources they could not dream of accessing. However, there is a concern that the growth of economic inequality may take away the ability for one socioeconomic class to benefit from technology (Simpson, 2018).

Since learning machines can greatly facilitate knowledge gathering via collection, tracking and analysis of information about the consumer, it is possible for those machines to use that information against a consumer (Marr, 2018) and the retail industry is not immune to such misuses. In China, for example, a comprehensive social grading system is going to assign each individual a score based on that individual's behaviour, with an intend to personalise decision-making based on intel gathered for that individual. With the 'big brother' watching over an individual, privacy and potential for social discrimination are huge issues. Much worse might happen when AI-powered retail services experience technical errors. For example, the 18th March, 2018 witnessed the tragic death of Elaine Herzberg. On that day, an Uber's self-driving car – with a backup driver behind the wheel – ran over and killed Ms. Herzberg on a street in Tìmp, Arizona. And that incident was believed to be the first pedestrian death caused by self-driving vehicles. In response to that incident, UBER immediately discontinued testing in Tempe as well as in Cleveland, San Francisco and Toronto (Wakabayashi, 2018). In the same year, a robot sprayed 54 Amazon workers with bear repellent at one of Amazon's warehouses in Arizona. Twenty-four were hospitalised with one of the injured in critical condition, while the remaining workers were treated at the scene (Humphries, 2018). Such incidents would raise serious concerns about potential threats of AI-powered technology to public safety.

Chapter Summary

In summary, AI-based applications are reshaping the way shoppers choose channels, select services, and products, as well as make purchases. AI-based Innovations are set to assist the customers in making the right decisions, feeling less time pressure and increasing confidence as well as satisfaction with their choices. Retailers have no choice but to embrace the emerging innovations in order to defend their competitiveness. AI is not assumed to replace humans.

Nonetheless, recent technology advances, e.g., quantum computing, could accelerate the evolution of AGI. Hence, governments and policymakers are encouraged to observe such developments and legislation should be introduced to limit the growth of the machine's general intelligence and protect humankind from the threats of the 'evolving' robots. Also, retailers should adhere to norms and values that would commit them to be, genuinely, socially responsible businesses whose investments into AI-powered innovation and implementation are not driven only by their interests but also by others' good, i.e., customers, employees and society.

Key Terms and Definitions

(1) *AI-based retail innovation*: The use of new AI-powered technologies to profitably and sustainably improve individual customers' shopping experiences across retail's different channels.
(2) *Machine learning*: The branch of science that enables the machines, i.e., the computers, to learn without being overtly programmed.
(3) *Artificial intelligence*: AI refers predominantly to computational technology driven by ways in which people use their brains' neurons and nervous systems to reason and make conclusions and decisions, although they usually work very differently.
(4) *Artificial narrow intelligence*: ANI relates to machines or software intended for handling a certain task that cannot be by far transferable to other systems.
(5) *Artificial general intelligence*: AGI describes systems with human-level or higher intelligence, sufficiently adroit in deriving concepts from narrow experience and transferring knowledge between disciplines.
(6) *Neural network:* A set of algorithms are used for simulating processes occurring in biological neural networks in a brain. In this regard, deep learning refers to a blueprint of neural networks and a subset of machine learning where the 'deep' describes the enormous number of layers of the neural network.
(7) *Quantum artificial intelligence:* Is an evolved generation of AI as a result of employing quantum computing and algorithms.

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