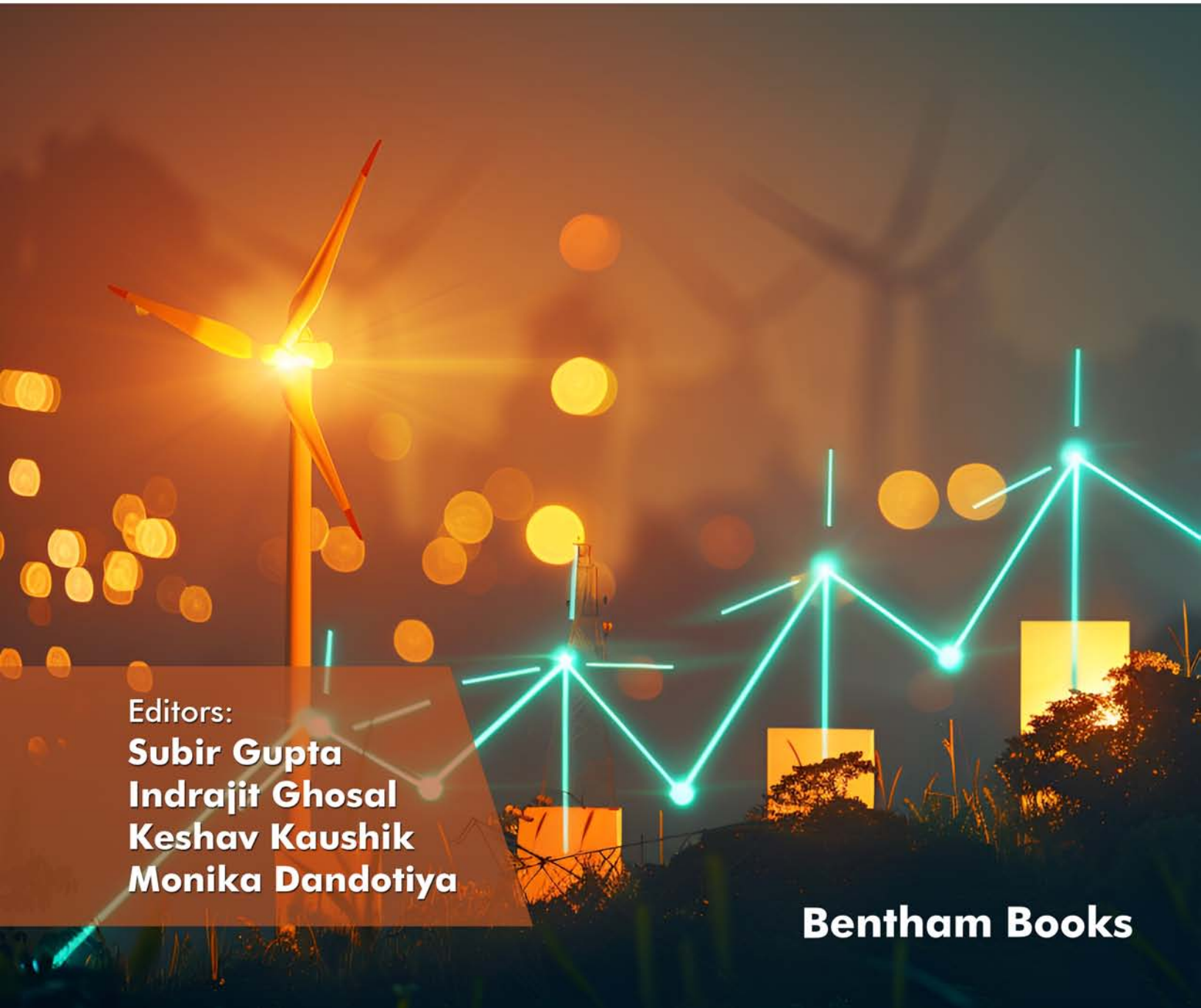
AI-DRIVEN COMPUTATIONAL ENGINEERING FOR SUSTAINABLE DEVELOPMENT



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PREFACE

The dawn of Industry 5.0 marks a pivotal moment in the ongoing evolution of human-machine collaboration, offering unprecedented opportunities for sustainable development. As technology advances at an accelerated pace, the integration of Artificial Intelligence (AI) and Natural Language Processing (NLP) in computational engineering is emerging as a cornerstone of this new industrial paradigm. This book, AI-Driven Computational Engineering for Sustainable Development, is a comprehensive exploration of the role AI and NLP play in shaping the future of Industry 5.0, where the synergy between humans and machines drives innovation and progress. The concept of Industry 5.0 extends beyond the mere technological advancements that characterized its predecessor, Industry 4.0. It envisions a world where machines not only work alongside humans but collaborate with them in a harmonious partnership, enhancing productivity while fostering sustainable development. This book delves into the multifaceted aspects of this collaboration, examining how AI and NLP can be harnessed to address the complex challenges of modern computational engineering.

The theoretical and practical insights presented in these pages offer a rich resource for AI professionals, NLP researchers, database experts, and scholars in computational engineering. By exploring the opportunities, challenges, and applications of AI and NLP, this book equips readers with the knowledge needed to navigate and contribute to the rapidly evolving landscape of Industry 5.0.

One of the key objectives of this book is to identify and analyze emerging themes and research trends within the context of Industry 5.0. The scientific community's growing interest in this paradigm shift underscores the importance of understanding the implications of AI and NLP in fostering sustainable development. Through a detailed examination of the current state of research, this book also highlights critical gaps, offering a roadmap for future investigations and innovations. The book provides valuable insights into the economic and productivity implications of Industry 5.0. By focusing on the collaborative potential between humans and machines, it offers a fresh perspective on how this new industrial era can contribute to a more sustainable and efficient manufacturing industry, ultimately benefiting the broader economy.

AI-Driven Computational Engineering for Sustainable Development is designed to serve as a foundational text for both specialists and beginners in the field of computational engineering. Whether you are a seasoned researcher or new to the world of AI and NLP, this book will guide you through the complexities of Industry 5.0, offering the technical knowledge and conceptual frameworks necessary to contribute meaningfully to this transformative era.

As you embark on this journey through the pages of this book, we hope it inspires you to explore the limitless possibilities that AI and NLP offer for sustainable development in computational engineering. The future of Industry 5.0 is not just about advancing technology; it is about creating a world where humans and machines work together to build a better, more sustainable future.

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I, Dr. Subir Gupta, as one of the editors of the book "AI-Driven Computational Engineering for Sustainable Development", extend my heartfelt thanks to my fellow editors, Keshav Kaushik, Monika Dandotiya, and Dr. Indrajit Ghosal, for their collaboration and insight. I am also grateful to the publishing team at Bentham Science, UAE, for their expertise and support throughout the publication process. Lastly, I would like to acknowledge the invaluable contributions of all the authors who have shared their knowledge across various chapters, enhancing the scope and depth of this work. Their expertise has been crucial in making this publication a comprehensive resource in sustainable development through computational engineering.

Dr. Subir Gupta

My heartfelt gratitude and love to all my family members, especially my wonderful wife, Arpita, and my children, Amitrajit and Adhrit, for their love, wishes, and motivation. I would like to thank Dr. Saileswar Ghosh (HOD, Management Dept.), Dr. Anant Kumar Srivastava (Dean Academics), and all the faculties and colleagues at Brainware University, Kolkata (India). I wish to thank all the editors who have been associated with this project, especially Prof. Keshav Kaushik, who has supported me from the beginning to the end. I would also like to show my gratitude and thanks to my mentor cum philosopher Dr. Sudhir Rana, Dr. Sudin Bag, Dr. Pranay Kumar Roy Barman, and all my loving students, Research colleagues for their continuous support, and motivation to complete this project successfully.

Dr. Indrajit Ghosal

This book is dedicated to my beloved Parents- Sh. Vijay Kaushik, Smt. Saroj Kaushik,

wife- Priyanka, daughter Kashvi, and son Harshiv.

May God always bless us. Har Har Mahadev!

Keshav Kaushik

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Dr. Monika Dandotiya

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CHAPTER 1

AI-Driven Churn Management Portal for Managing Churn and Retention

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Abstract: Client retention is now just as important as client acquisition in today's fiercely competitive business climate. Since it is frequently more expensive to acquire new clients than to retain current ones, churn management is an essential corporate priority. Artificial Intelligence (AI) has become an increasingly powerful tool as companies seek more efficient methods to reduce client attrition. Traditional approaches cannot match the capacity to anticipate, evaluate, and react to customer behaviour that AI-driven churn management solutions provide. By foreseeing churn threats and offering useful insights, advanced analytics and machine learning algorithms play a crucial part in this process. Telecom firms take a multifaceted strategy to churn management. To build client loyalty, this includes: 1) personalised offerings, which entail developing service plans and incentives based on unique consumer demands and usage patterns; 2) customer engagement, which includes establishing enduring relationships with customers by being proactive in communication, giving excellent customer service, and responding to issues right away; 3) predictive analytics, which involves using predictive models to pinpoint potential customers who might leave and putting retention plans in place; 4) network quality, which entails ensuring a dependable and high-quality network to reduce reasons for churn connected to services; 5) competitive pricing, which includes drawing and keeping clients that are price sensitive, offering competitive pricing structures while preserving profitability; 6) data security, which inludes protecting consumer information and privacy that is important for maintaining trust and reducing turnover and lastly, 7) value-added services, which includes enhancing the client experience with cutting-edge features and services. The topic of telecom churn management is one thatis continually evolving due to the changing technologies and evolving customer expectations. Successful churn management can have a long-lasting positive impact on a telecom company's bottom line by not only preserving revenue but also fostering customer loyalty and advocacy. This study emphasises the significance of telecom churn management in a highly competitive market and the continual innovation and adaptation required to suit customers' shifting needs. This study implements a paradigm for managing telecom churn, which will assist telecom companies in maintaining low churn rates. To achieve this, the framework forecasts churners with a likelihood percentage, predicts their churn behaviors and causes,

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recommends consumers who exhibit similar behaviors, and suggests retention strategies for customers based on their behaviors. The administrator of the telecom company can efficiently manage telecom clients through this framework's user-friendly interface. This framework includes: 1) a comprehensive list of all customers, 2) a predictive list of potential churners along with their reasons for leaving, identified using the Random Forest algorithm, 3) detailed customer profiles that highlight individual service usage patterns, and 4) most importantly, an AI-powered retention solution that suggests targeted actions for customers likely to churn, based on behavior predictions generated by the TCCMR framework. The entire system is implemented using the Python programming language. This framework also suggests that similar consumers assist telecom firms in offering the same retention solutions to similar customers. The model performed exceptionally well in predicting churners, achieving outcomes with up to 100% accuracy.

Keywords: Churn management, Churn prediction, Machine learning, Recommendation system, Retention solutions, Telecommunications.

INTRODUCTION

One of the most pressing problems service providers face in the fast-paced and fiercely competitive telecommunications sector is customer churn. Customers are the primary source of income for all industries, making them a valuable resource for any business [1].

Customer churn, also known as “churn,” occurs when subscribers stop using a certain telecom service provider's products or switch to another one. Churn can be expensive for telecom firms because it typically incurs significant costs to acquire and retain new subscribers. Long-term client loss can also have a significant negative effect on sales and profitability.

Rapid technological advancements, evolving customer preferences, and intense competition characterize the telecommunications sector. These factors make it imperative for telecom companies to adopt proactive churn management strategies to stay competitive and sustainable in the marketplace.

A wide range of activities, such as data analysis, customer segmentation, predictive modeling, and targeted retention initiatives, are included in effective telecom churn management. Churn management seeks to reduce churn by implementing various retention techniques, such as offering new products or services, to keep customers from cancelling subscriptions. For retention strategies to be effective, businesses must gain insights into their customers' traits and behaviors to identify those most likely to leave [2]. It entails understanding the causes of customer turnover, identifying at-risk clients, and implementing

strategies to reduce churn rates. The following are some of the main causes of telecom churn:

1.1. Customers are frequently sensitive to price fluctuations and may switch to suppliers that offer more affordable options.

1.2. Quality of Service: Customer satisfaction and retention are greatly impacted by network dependability, call quality, and data speed.

1.3. Consumer service: Whether a consumer decides to stay or depart depends on how well they are taken care of and how quickly they respond to problems.

1.4. Competitive Environment: The telecom industry is highly competitive, with competitors' better deals frequently drawing in customers

1.5. Technology advancements: As consumers seek the latest features and capabilities, new technologies and services can influence their purchasing decisions.

1.6. Contract Conditions: Contract conditions, early termination fees, and adaptable plans all affect client retention.

1.7. Customer Experience: Churn rates can be impacted by the general experience, including billing procedures and the simplicity of account management.

1.8. Market Saturation: In developed countries, there is a single solution that works for all cases of managing telecom churn. It necessitates a data-driven, customer-focused approach that can adapt to the demands of the market and the needs of the client. Companies that succeed in understanding their consumers, anticipating churn, and implementing successful retention strategies are better positioned to thrive in the telecom sector in this constantly changing environment. This study delves further into the tactics, techniques, and technologies that telecom firms use to lower churn rates, boost customer satisfaction, and ultimately achieve sustainable development in this fast-paced and fiercely competitive industry. The telecom admin user can view all current customers, potential churners, and related customers, as well as retention strategies for potential churners, categorized by their potential cause for leaving.

Businesses seek sustainable techniques that complement their entire retention goals to maintain client loyalty over the long run. This approach aims to foster long-term client loyalty, rather than merely reactive strategies. That is precisely what AI-powered churn management portals offer. They enable them to create data-driven plans. These personalized engagement plans foster client satisfaction and promote long-term retention.

CHAPTER 2

Legal and Ethical Implications of AI for Human Resource Management: Handling Bias, Data Privacy, and Transparency for Sustainability

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Abstract: Artificial Intelligence (AI) is increasingly being incorporated into Human Resource Management (HRM), which brings complex ethical and governing issues. This research paper addresses moral and legal problems by methodically investigating Artificial Intelligence's legal and ethical implications in HRM for an effective business. The study addresses the ethical aspects, including bias, justice, accountability, transparency, and the confidentiality and security of worker information. The legal roots are examined, covering information fortification strategies such as the General Data Protection Regulation and anti-discrimination regulations. The Personal Data Protection Bill and the Equal Remuneration Act are two Indian laws discussed in the paper, and their implications for AI in HRM are explored. The major aspects considered in the paper are lawful strategies that signify discrimination in AI-driven HR. The study employed a methodical approach, examining current legal systems and literature.

The main findings include the necessity of model interpretability, the use of fair machine learning algorithms, open communication with employees, and informed consent for sensitive employee data. The study emphasizes the importance of using AI responsibly to uphold human rights that are fair, open, and respectful of individual liberty. The results inform the conversation about AI ethics and legal compliance, directing the responsible application of AI in HR.

Keywords: AI in human resource management, Artificial intelligence and HRM, Compliance, Ethics, GDPR, Handling bias, Information privacy and transparency, Law, Sustainability.

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INTRODUCTION

Artificial Intelligence (AI) has significantly influenced Human Resource Management (HRM) [1], offering efficiency and data-driven decision-making capabilities in organizations. AI-driven HRM pervades multifarious areas of HRM such as recruitment and selection, employee performance evaluation, employee engagement, training and development, compensation management, employee retention, *etc*. [2, 3].

However, this innovative and cautious approach also raises a combination of legal and ethical issues that demand careful investigation. The concept behind the use of AI in HR is that these systems can seamlessly screen job candidates and personnel, gathering organizational information in an unbiased and objective manner. Nevertheless, beneath the surface of impartiality, problems are deeply rooted in the algorithms, which are based on past information and prone to prejudices that could reinforce existing biases [4]. AI in HRM raises a paradox: Does AI eliminate or computerize human preconception? Natural Language Processing and Machine Learning can investigate massive datasets speedily and accurately [5]. According to Boudreau and Cascio [6], these capabilities hold the prospect of Ring's high-potential employees and mitigating employee turnover. However, investigating the likelihood of prejudice and injustice in these systems is increasingly important as AI-driven selections progressively affect individuals' professional trajectories, posing a perilous risk. It is pertinent to align AI use in HR with the ethical principles of fairness, transparency, and accountability, as these principles can significantly impact the ethical foundation of AI-driven decision-making, thereby affecting employees' financial and mental well-being. Because of this, the research paper aims to simplify the moral insinuations of AI in Human Resources by revealing the subtleties of algorithmic prejudice and opacity. Doing this simplifies companies' moral accountabilities when applying AI in Human Resource procedures and the subsequent effects on the employees.

This study examines the moral implications of AI in human resources, focusing on algorithmic bias and opacity, as well as the moral responsibilities that arise from adopting AI-driven human resource practices, which in turn impact their staff and livelihoods. This, in turn, will help endorse sustainable HR practices.

The legal framework governing AI in Human Resource Management remains complex and fragmented. Today's digital realm varies considerably from the landmark era in which previous anti-discrimination laws, such as Title VII of the Civil Rights Act in the U.S., were established by Pager [7]. One needs to reflect whether existing laws adequately address and regulate the complexities of AI, or if their scope needs to be re-evaluated. In addition, in AI-driven Human Resource

structures, Europe's General Data Protection Regulation raises significant concerns about information confidentiality and protection [8]. It is indispensable to cautiously examine the legal framework to determine whether it is sufficient to guard individual rights and allow Human Resources to employ AI responsibly.

This investigation employs a multidisciplinary approach to navigate the complex intersection of law and morals in AI-driven HRM, integrating knowledge from HRM, lawful obedience, and AI ethics. This study aims to investigate AI's ethical and legal consequences in HRM. Additionally, it aims to cultivate best practices and references that companies may use to ensure their A.I-driven HR practices result in moral and lawful compliance.

By exploring the moral and legal implications of AI assimilation into Human Resources, this research paper navigates the complex landscape of AI integration into Human Resources.

The researchers discover the multifaceted features of AI in Human Resource Management, assessing the moral quandaries elevated by algorithmic decision-making as well as the supervisory necessities that companies must meet. We aim to provide insight into the track of AI use in HRM by navigating this complex landscape and demonstrating how technology can support fair, open, and accountable HR processes.

LITERATURE REVIEW

A.I. in H.R.M: An Overview

A.I. has gradually become predominant in HRM in recent years, shifting several facets of human resource procedures. Performance appraisals, talent management, and recruitment are just a few areas where this groundbreaking trend has affected operations. AI stresses its transformative consequences on organizational processes through various functions, including HR. With technological progressions, establishments progressively embrace AI to streamline procedures and increase efficacy. Renowned organizations have widely acknowledged the multifarious benefits of AI and have leveraged it across various functional areas of business, such as HR, marketing, finance, *etc.* Reports suggest that AI will significantly influence the global economy, with an approximate prediction of considerable development in economic value by 2030. AI incorporation into HR functions is perceived as vital for improving workforce effectiveness and talent acquisition.

HR professionals use AI to foster innovation, simplify courses, and enhance decision-making, eventually refining the whole worker experience.

CHAPTER 3

AI-Based Voice-Assisted Email System

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Abstract: In today's technologically advanced era, the integration of communication technologies with the internet has made communication very simple. Email, in particular, is the most reliable and widely used mode of digital communication for both personal and commercial purposes. As of 2021, around 4.1 billion people used email globally. By 2024, this figure is expected to increase. By 2024, this figure is expected to increase. By 2024, this figure is expected to increase. By 2024, this figure is expected to increase to over 4.48 billion. This indicates the continued importance of email as a communication tool in our increasingly digital world. However, the visually impaired and blind people face several difficulties in using this important service, and there are currently around 2.2 billion people who have vision impairment globally, as per a report by the WHO. To address this issue, we propose an effective aid in the form of a voice command-based email system that will help individuals with special needs manage their email accounts through voice commands, making it easier for them to use the service. The proposed system will also benefit others by reducing their time consumption. Python, text-to-speech and speech-to-text conversion, Interactive Voice Response (IVR) technology, and other tools were used in the development of the email system. Through the use of their voice, visually impaired and blind persons will be able to effectively utilize email services and complete tasks without depending on a visual interface.

Keywords: Email system, IVR, Speech recognition, STT, TTS, Voice assistance.

INTRODUCTION

In recent years, Artificial Intelligence (AI) has significantly transformed digital interactions, enhancing efficiency, accessibility, and intelligence in various

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applications. A noteworthy example is voice-assisted email systems—tools that enable users to dictate, organize, and manage emails using voice commands. These systems fall under the broader category of voice-enabled digital assistants, which include popular technologies like Google Assistant, Amazon Alexa, Apple's Siri, and Microsoft's Cortana.

Voice-assisted email systems are becoming integral across multiple sectors, providing hands-free operation that benefits professionals in fast-paced or hands-occupied environments, and greatly improving accessibility for those with physical disabilities. By eliminating the need for typing and manual inbox management, these systems streamline communication, allowing users to interact with emails in a natural, conversational way.

Core AI Technologies in Voice-Assisted Email Systems

Several key AI technologies enable voice-assisted systems to interpret, process, and respond to spoken commands effectively:

1. Automatic Speech Recognition (ASR): ASR technology translates spoken language into text. Trained on extensive datasets, ASR models learn to accurately transcribe spoken words, handling a variety of accents and background noise.
2. Natural Language Processing (NLP): NLP enables the system to comprehend the intent behind spoken words. It allows the assistant to distinguish between commands like "Send an email to [Contact]" *versus* "Read my last email," ensuring that the correct action is taken.
3. Machine Learning (ML) and Deep Learning: These algorithms, particularly deep learning approaches such as neural networks, are crucial for enhancing accuracy and precision. They enable the system to adapt based on user interactions, enhancing voice recognition, intent understanding, and predictive capabilities from prior interactions.
4. Natural Language Generation (NLG): NLG enables systems to generate automatic replies, summaries, or draft content, providing contextually relevant and naturally worded responses.

When integrated, these AI-driven methods enable voice-assisted email systems to address communication challenges effectively, making them especially useful in professional domains like healthcare, law, and corporate environments, where time savings and hands-free functionality are essential.

In today's digital world, email is an essential tool for communication. It makes long-distance communication quick, simple, and affordable. It is especially useful

for businesses, as it allows them to communicate with customers, partners, and suppliers in different parts of the world simultaneously. Its importance will continue to grow as technology evolves and its capabilities expand. As of 2021, there are approximately 4.3 billion email users worldwide, and this number is projected to grow to over 4.9 billion by 2024.

Additionally, the number of daily emails sent and received is also increasing, with an estimated 347 billion emails sent and received each day in 2022. As technology continues to evolve and more people gain access to the internet, . However, a section of people still cannot access this service as efficiently as others, particularly the visually challenged. They encounter several difficulties when using email, such as composing and reading emails, navigating the interface, and performing other tasks. The World Health Organization (WHO) estimates that globally, there are approximately 253 million people who experience visual impairment, with 36 million of them being blind. From these numbers, we can infer that many people are unable to utilize the email service effectively. Many technologies have been developed, including screen readers and voice assistants like Alexa and Siri. However, there is no full-fledged solution that allows the visually impaired to use basic communication facilities like email comfortably.

We have proposed a voice-based system to address this issue, enabling users to access mailing features exclusively through voice commands. These systems can be particularly useful for individuals with vision disabilities or those who find typing difficult or time-consuming. Additionally, a voice-based email system can also be integrated with smart devices, such as smart speakers or smartphones, making it more accessible and convenient for users. This kind of system can be a crucial tool for people with visual impairments or blindness. It allows them to access their email independently without relying on others. It promotes independence, enabling individuals to participate in the workforce and society as a whole. Voice-assisted email systems have revolutionized communication by both accessibility and productivity. These systems utilize advanced AI technologies, including Automatic Speech Recognition (ASR), Natural Language Processing (NLP), and Machine Learning (ML), to provide seamless and user-friendly experiences. The following case studies demonstrate the practical impact of these systems in real-world scenarios, with a focus on the AI methods that enable their effectiveness.

This paper is divided into nine sections: Section 1 introduces the background and purpose of the project. Section 2 provides a brief overview of the literature reviewed. Section 3 details the project development methodology, including the proposed system, flowcharts, and algorithms. Section 4 presents the system's

CHAPTER 4

Navigating the AI Era: Applications, Opportunities, Threats, and Challenges in Practice

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Abstract: Artificial Intelligence (AI) is driving transformative paradigm shifts across industries, offering innovative solutions to pressing societal challenges, including sustainability. By automating repetitive tasks and augmenting human capabilities, AI technologies have catalyzed productivity enhancements in sectors such as manufacturing, services, and education over the past two decades. The rapid evolution of expert systems, underpinned by advancements in AI research, has demonstrated significant potential in addressing complex problems across interdisciplinary domains, including healthcare, engineering, meteorology, and business analytics. This chapter provides a comprehensive examination of AI's conceptual foundations, applications, and innovations, with a focused analysis of its implementation in educational contexts. Through empirical case studies and critical analysis, it explores AI's role in optimizing operational efficiency, fostering quality improvements, and shaping future technological trajectories. The discussion concludes with an evaluation of emerging trends and ethical considerations, positioning AI as a pivotal force in advancing both industrial and societal progress.

Keywords: Artificial intelligence, AI applications, Expert systems, Intelligent technology.

INTRODUCTION

Research in operational research, management sciences, and educational technology is becoming more integrated, with educational technology also incorporating artificial intelligence.

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Artificial Intelligence (AI) is a branch of computational science focused on developing computing equipment and systems that mimic human cognitive and behavioral processes. The ability to gather information and apply it to solve challenging problems is a common definition of intelligence. In many fields, intelligent machines will soon surpass human capabilities. Artificial Intelligence refers to the study of software and machines capable of reasoning, learning, knowledge acquisition, and manipulation. It involves systems that can perceive their environment and take appropriate actions. Computing plays a vital role in enabling these systems to sense and respond effectively. Artificial Intelligence differs from computer science in that it emphasizes perception, thinking, and action more than psychology does, as it places a greater emphasis on computation. It enhances machines' intelligence and usefulness. Perceiving and acting on reason is made possible by the study of computation. Artificial Intelligence differs from computer science and psychology in that it places focus on computing and an increased emphasis on observation, thinking, and action. It increases machine intelligence and utility. It operates with the aid of scientific theorems, which are if-then statements and logics, and Artificial Neural Networks (ANNs). The state of AI technology has progressed to the point where many of its applications are now producing real, practical benefits. Some of the primary areas of artificial intelligence include computer vision and scene identification, robotics and sensory systems, speech recognition, natural language processing, intelligent computer-aided instruction, expert systems, and neural computing. This expert system is the source of a rapidly developing technology that is significantly influencing various aspects of existence. Neural networks, fuzzy logic, evolutionary computing, computer-aided instruction, and hybrid artificial intelligence are some of the methods used in artificial intelligence.

Artificial Intelligence's Significance

Artificial Intelligence is the result of combining the terms I”artificial” and “intelligence.” Artificial Intelligence is something that is “not real” or “natural,” whereas intelligence is defined as ” the ability to think, to generate fresh concepts, to observe, and to learn.” The field of computer science known as artificial intelligence is largely concerned with building intelligent machines that have human-like behavior and thought processes. It is a combination of multiple tasks, including artificial intelligence design for computers, speech recognition, learning, and problem solving. A system that adapts to its environment is considered intelligent. The efficient utilization of scarce resources is the definition of artificial intelligence. Making computer programs that solve complicated problems in the same way that humans solve them is the definition of AI. It is therefore divided into two halves: the first focuses on machine-based complex issue solving, and the second is used to solve problems for people. The phrase

“artificial intelligence” can also refer to a feature of programs or machines: the intelligence exhibited by the system. Combining science and engineering, artificial intelligence aims to create robots that exhibit intelligent behavior. It combines a number of disciplines, including computer science, psychology, and philosophy.

The ability of a software or machine to carry out tasks that typically require human intelligence is known as Artificial Intelligence (AI). At the vanguard of artificial intelligence research and engineering are the domains of speech recognition, visual perception, language translation, and decision-making. Artificial Intelligence (AI) is the computer, or more precisely, the computer system's imitation of human intellectual processes. Learning, thinking, planning, self-correction, and problem-solving are all necessary for this. The topic of Artificial Intelligence (AI) is controversial and often presented in a negative light. Although some believe that technology poses a threat to humanity's survival since it can subjugate and control people, in reality, AI has had a direct or indirect impact on our way of life and is influencing tomorrow's trends. Despite the indispensable applications of digital assistants on smartphones, driver assistance systems, chatbots, text and speech translators, and systems that help with personalized learning and product and service recommendations, Artificial Intelligence (AI) has already permeated every aspect of our daily lives and profoundly altered our way of life.

AI Types

One way to categorize artificial intelligence is through its features and capacities.

Based on capabilities, artificial intelligence can be divided into three categories:

Three types of AI:

- Narrow AI
- General AI
- Super AI

There are four categories of artificial intelligence under functionalities:

- Machines that React
- Self-awareness
- Theory of Mind
- Limited Theory

CHAPTER 5

The Influence of AI-driven Digital Service Channels on Consumer Satisfaction

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Abstract: Consumer satisfaction and purchasing decisions made by consumers have always been a concern of marketers, taking into account these two aspects can encourage businesses to develop. The purpose of this study is to examine the relationship between AI-driven digital service channels and customer satisfaction, with a focus on the moderating effect of demographic variables. A survey of 189 consumers from Delhi NCR revealed that digital service channels—characterized by ease of use, convenience, and personalization—have a positive impact on customer satisfaction. Age, gender, and education have a moderating effect on the relationship. The existing literature has largely overlooked the role of demographic factors and lacks sufficient emphasis on digital service channels. The findings of this study can be used by businesses and the government to build more consumer/citizen-centric strategies.

Keywords: Customer satisfaction, Digital service channels, Demographics, Digital channels.

INTRODUCTION

The evolution of technology has provided businesses with new digital channels to communicate with consumers and influence their behavior [1]. 'Digital channels' are defined as digital shopping formats that are used by businesses to offer online

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shopping opportunities to consumers [2]. It helps companies make shopping an emotional experience for consumers [3, 4]. Companies from a wide range of industries, sectors, and sizes are implementing innovative digital strategies to attract more customers and enhance their experience [5 - 7]. Top companies such as Amazon, Apple, Facebook, Microsoft, Tesla, Uber, Spotify, Adobe, and Slack utilize a range of digital channels, including email, social messaging, social media platforms, live chats and chatbots, virtual and augmented reality (VR/AR), voice agents, and mobile applications [8]. McKinsey revealed that in every country and region, the willingness to consider digital channels is more than 70% [9]. Thus, in today's interconnected world, the use of digital service channels is not a choice but a necessity for companies to enhance consumer experience and satisfaction.

One such digital transformation has been in the form of Artificial Intelligence (AI). AI has become an essential component for improving digital service channels. AI refers to the creation of computer systems capable of executing activities that would normally need human intelligence, including interpreting natural language, identifying patterns, and making judgments [10]. In the context of digital service channels, AI enables organizations to provide personalized suggestions, automate responses through chatbots, and effectively analyze consumer behavior [11]. The incorporation of AI-powered solutions improves the simplicity and efficiency of digital services, ultimately increasing customer satisfaction [12]. With advances in machine learning and data analytics, AI continues to play an important role in redefining how businesses interact with customers, creating a seamless experience.

Customer satisfaction is the attitude of the consumer that affects the purchase, which directly influences the repurchase intention of the person [13]. Faced with rapid technological innovations and increased regulatory constraints, companies must focus on customer satisfaction to build service loyalty relationships and improve service quality [14]. It also helps businesses increase their profitability while building consumer trust. However, over the years, the concept of consumer satisfaction has changed. Initially, good quality consumer service by salespersons was regarded as the means of satisfying consumers, but now the demands of consumers are more customized which are according to their lifestyles, needs, and tastes [15, 16]. The evolution of technology has enabled the provision of more customized services to customers, with Netflix and FedEx being primary examples [17].

One such digital transformation has been in form of Artificial Intelligence (AI). The AI technology enables more intelligent recognition and matching of consumers' preferences; consequently, consumers are more attracted to companies that utilize AI techniques [18]. To meet this need, companies utilize

digital services like chatbots, which simulate human intelligence by responding to customer inquiries. The use of bots enables organizations to enhance digital service effectiveness and provide more satisfaction to consumers [19]. Thus, in digital service channels, AI integration is a powerful tool for increasing growth, improving efficiency, and driving loyalty [20].

In the literature, it was found that most studies connected either digital channels or demographic variables to customer satisfaction. However, given that the preferences of the consumers are affected by their needs, desires and lifestyles, demographics form a key component of the extent to which digital channels affect customer satisfaction. Moreover, there is extant literature examining "predetermined" factors such as customer loyalty [21] and brand image [22]. To bridge this gap, the study examines the effect of digital service channels on consumer satisfaction with the inclusion of demographical characteristics as moderators.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Relevance of AI-driven Digital Service Channels

The COVID-19 pandemic boosted the growth of internet-based businesses as a large number of consumers are now relying on the use of digital technologies. With this, organizations are compelled to explore digital technologies for value creation and consumer interaction [20, 23]. Nowadays, digital channels are used by companies for activities like rationalization, reaching target groups, automated document handling, process supervision, and delivery of services [24]. The usage of digital channels creates the ability to interact with customers, providing opportunities to reach new consumer segments, and increasing access to insights and data [24].

Digital channels allow organizations to communicate directly with their customers, resulting in more engaging and responsive partnerships. This direct communication allows firms to gather critical information, analyze consumer preferences, and create personalized experiences. Businesses can easily contact new customer groups that would otherwise be inaccessible by utilizing digital platforms such as social media, email, and chatbots. Furthermore, digital channels provide businesses with a wealth of data and insights into client behavior, allowing them to make better-informed decisions and change their strategies more effectively. This improved access to information increases consumer satisfaction and overall organizational success.

Digital service channels differ from traditional ones by offering real-time, interactive experiences rather than one-way, static communication [25]. Unlike

CHAPTER 6

Effects of News on the Stock Prices Using Machine Learning: A Comparative Study

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Abstract: With the advent of technology, it has become an area of interest to forecast stock prices based on the news. Important "new news" is most likely to affect the stock price. The growth of social media platforms has enabled users to express their views on commonplace issues. Hence, the feedback from the public and customers is important. Sentiment analysis, also known as opinion mining, is a popular pre-planning exercise for conversations that seek to identify the underlying feelings associated with various text types. Moreover, public opinion research can provide us useful information. Sentiment analysis is a powerful tool with numerous applications. It can be used to understand user attitudes on social media sites such as Facebook and Twitter.

This sentiment analysis helps determine the customer's inclination, which in turn affects market trends. These trends often indicate a shift in stock prices in response to major announcements and significant news. With the aid of machine learning algorithms, suitably training and testing the data, this effect has been studied, and significant price movements have been observed. This paper employs sentiment analysis, machine learning, and deep learning techniques to examine the influence of news on market prediction, diverging from traditional stock structured data analysis.

However, the efficacy and accuracy of sentiment analysis are being hampered by issues with Natural Language Processing (NLP). Recent studies have shown that deep learning models offer a promising approach to addressing the challenges in natural language processing.

Keywords: Deep learning, Machine learning, Natural language processing, Neural network, News-based stock price prediction, Sentiment analysis.

INTRODUCTION

Shares, or stocks, deal with fragmented ownership in a company, asset, or security. The stock market provides a venue for investors to buy and sell

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ownership of investable assets or offers [1]. Market participants are individuals who engage in the trading of stocks and assets.

An organization can go public and issue stocks, which are then exchanged in secondary markets, or stock exchanges, as a means of raising capital for debt repayment or corporate expansion. By offering shares rather than taking out a cash loan, the company can reduce the risk of losses, debt, and interest payments. Another reason to issue stock is to generate income and profits for the stockholders. These individuals, also known as shareholders, may profit from businesses whose stocks consistently yield dividends or by selling their shares when the company's stock price exceeds the initial investment [2]. Therefore, individuals engaged in stock trading exhibit a significant interest in predicting the market value of these financial assets.

Stock market prediction is the process of estimating a stock's, market segments, or even the market's future value. Numerous individuals have focused their attention on this topic, including corporations, traders, market stakeholders, data analysts, and computer scientists specializing in Machine Learning (ML) and Artificial Intelligence (AI), among others. Since the value of a company's shares is several. It can fluctuate based on a number of variables, primarily determined by its performance and earnings in the market. Investing in it entails several risks. The value can fluctuate based on various factors such as supply and demand, government regulations, and microeconomic indicators. ML, Deep Learning, Neural Networks, AI, and other techniques are investigated to produce software and algorithms based on these market variations [3].

The advent of Web 2.0 has enabled people to discuss and share their thoughts on any subject through blogs, forums, and online social networks. They might discuss current events, air grievances about a recent purchase, or share their political opinions [4]. This platform offers a medium for individuals to express their viewpoints and opinions, often in a casual and informal manner. The open and easy availability of news and events significantly influences the user’s perception of the market. The user actively or passively absorbs the market's emotion and tends to make decisions accordingly. Sentiment analysis on social media platforms has numerous applications and hasevolved into a powerful tool for gaining insight into user perspectives.

Although news influences the stock market, public sentiment and mood also play an equally important role. It is evident from psychological research that emotions and information together play a pivotal role in human decision-making [5]. Behavioural finance supports the notion that financial decisions are largely driven

by emotion and mood. Thus, it seems valid to believe that attitude and public mood might influence stock market values just as much as news.

Financial economists have been interested in the dissemination of news and events into financial assets in recent years. Numerous studies have examined how different types of information (political, macroeconomic, and earnings announcements, among others) affect the pricing of financial assets, thereby capturing the correct user sentiment, which is often an important aspect that requires study.

However, the difficulties in using Natural Language Processing (NLP) are impeding the effectiveness and accuracy of sentiment analysis. Furthermore, these platforms provide people with access to worldwide news, enabling them to formulate opinions and engage with global news. In this case, we are specifically concerned with the impact of any political news that undoubtedly stimulates. Many applications depend on users utilizing this information to function properly [6].

According to several studies, stock values might fluctuate for several months following significant business events [7]. This implies that to some extent, the drift is caused by an information-related reaction (either over- or under). Previous research has shown that news has a significant impact on market trends [8]. In the era of widespread machine learning applications, utilizing news for stock forecasts is uncommon due to the difficulty in using news as input, which hinders its application in stock predictions. This issue will be resolved with the advancement of technology like Natural Language Processing (NLP) [9].

SENTIMENT CLASSIFICATION METHODOLOGY

Sentiment classification methodologies encompass two primary approaches: the Machine Learning approach and the Lexicon-based approach [6]. The subsequent section will elaborate on these categorizations as given in Fig. (**1**).

Machine Learning Approach

The methodologies employed in sentiment analysis encompass a combination of unsupervised and supervised machine learning techniques. The following section outlines these methodologies:

CHAPTER 7

The Role of Machine Learning in Predicting Mental Health on Social Media Platforms

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Abstract: Online communication on social networking platforms offers new perspectives for identifying various neurological disorder problems. Depression is now considered one of the most prevalent mental disorders. This chapter utilizes various machine learning approaches for text classification that categorize posts as either depressed or non-depressed. In this chapter, six machine learning classifiers, including Support Vector Classifier, Random Forest, Decision Tree, K-Nearest Neighbor, Light Gradient Boosting method, and Catboost, are used to make predictions over the Reddit dataset, which includes various posted contents of an individual over the web. The proposed model performs text preprocessing through stemming and normalization, followed by the application of feature extraction techniques using word embedding models. Feature extraction techniques are applied using word embedding models, which are then fed to a machine learning model. The results demonstrated that the LGBM classifier outperforms other machine learning classifiers with a higher accuracy of 99.9%. However, all chosen ML methods are more adaptive and resilient. LGBM outperforms the others.

Keywords: Depression, Machine learning, Mental disorder, Social media, Text classification.

INTRODUCTION

A mental disorder alters a person's emotions, feelings, or behaviors. Mental diseases continue to be a major global source of disability and poor well-being, extensively utilized public health concerns today [1]. The WHO (2018) defines "mental health" as a state of well-being in which a person can thrive by fulfilling

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their potential, engaging in social interactions, and making meaningful contributions to society. Most studies in this field have been quantitative, demonstrating a link between social media usage and mental wellness. However, they provide little insight into the actual use and perception of social networking among teenagers. This narrative review aims to compile the majority of recent qualitative research on teenagers' opinions regarding the mental wellness and psychological effects of social media.

Social media has emerged as the primary information source due to the recent exponential growth in the number of individuals. The use of social media platforms like Facebook, Reddit, and Twitter to express one's ideas and emotions is growing in popularity, especially among young people. As a result, there has been an increase in the number of studies being done on the identification of mental illness through the analysis of user-generated text in social media posts [2]. Emotions are extensively researched in various fields of study, such as behavioral science and psychology, because they are fundamental to human nature and have the power to influence people's actions and mental states [3]. Research has revealed a connection between psychological well-being, such as grief, and emotions [4].

A affecting the brain, central nervous system, or autonomic nervous system is considered a neurological disorder. Life changes, heredity, and a diet low in nutrients, as well as physical injuries or exposure to environmental factors, are all included. If untreated, it generates nervous system issues and develops psychological health problems like stress, anxiety, and sadness. It may even provoke a suicide attempt, which could result in death.

- ***Depression:*** It appears that depression is a multifaceted disorder that has a substantial negative impact on society and impairs people's functioning in their private, social, professional, and interpersonal domains.
- ***Anxiety:*** An unexpected reaction to depressed feelings, anxiety can cause high nervousness, fear, or panic, and interfere with thinking and problem-solving abilities. Among the psychological and physical symptoms are urinary retention, shaking of fingers and their lips, dry mouth, and insomnia.
- ***Stress:*** Stress is defined as a psychological issue that affects our mental well-being. When an organism cannot adapt to its environmental demands, illnesses related to biology and psychology develop.

Depression is more common today than in the past, and those who suffer from it are more likely than non-depressed people to damage themselves or others violently, commit suicide, or experience other negative outcomes. This has a negative effect on the socioeconomic, familial, and personal development of

individuals. Although these methods have some drawbacks, questionnaires or scales are primarily used for the clinical diagnosis of depression [5].

According to the WHO, stress and depression are to blame for at least 800,000 suicides each year. Over 1.5 million people worldwide commit suicide each year due to stress [6]. Online networking, which can affect a person's mental health, is an important factor associated with the high suicide rate. Using the NLP method, we can determine a person's psychological health from the content they post on networking platforms. Using computer approaches, NLP studies linguistic data, *i.e.*, textual data like blogs, documents, or articles [7]. This technique aids in processing text that is generally unstructured, as it can only be read by people, due to the layout of the text, which is challenging for computers to understand.

According to a global poll of psychiatrists conducted by Doraiswamy *et al.* [8], the majority of respondents agree that Artificial Intelligence (AI) would have an impact on the future of their field. This study will outline the data analytics techniques equipped to transform the depression diagnosis, treatment and therapies, even if AI may never be able to fully replace the individualized, compassionate care that a psychiatrist can offer. Specifically, precision psychotherapy is a new area that makes use of cutting-edge computational methods to provide psychological services based on patients' needs. . These technologies have the ability to identify people with mental health disorders, enabling them to receive the care they require and allowing doctors to customize therapies for specific patients who will most likely benefit from them. Unsupervised learning approaches are also breaking down the specific diagnostic categories now in use and emphasizing the enormous illness variability seen within diagnoses of depression. In addition to allowing a change from current approaches based on group averages, AI also offers the chance to move towards the prescription of treatments based on empirical research [9].

The primary cause is the inability of those suffering from depression symptoms to control their emotions, which lowers emotional complexity. Thus, from a psychological standpoint, knowledge of emotions can help identify mental diseases [10]. In order to determine whether there are any indications that users are depressed, this study will examine Reddit data. The following research concerns were addressed in the work, with the main concern of the research in mind.

1. To highlight the indicators of depressive disorder in the posted tweets or comments.
2. Is it possible to derive these traits from depression-related Reddit comments?
3. To explore various deep learning methods to identify such a disorder on Reddit.

CHAPTER 8

Role of Government Policies and Regulations in Shaping the Landscape of Green Finance in Industry 5.0

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Abstract: The evolution of Industry 5.0 signifies a transformative shift towards a synergistic integration of advanced technology and human creativity, prioritizing sustainability and environmental stewardship. This chapter examines the critical role of government policies and regulations in fostering the growth of green finance within the framework of Industry 5.0. As industries increasingly adopt automation, smart manufacturing, and networked ecosystems, the emphasis on sustainable practices becomes imperative. Government initiatives, through stringent environmental standards and financial incentives, mobilize capital towards green technologies, facilitating the transition to a low-carbon economy. Green finance, encompassing investments and lending aimed at enhancing environmental sustainability, plays a pivotal role in directing financial resources towards eco-friendly projects. Central banks and financial regulators contribute by incorporating sustainability into their frameworks, guiding investments towards green initiatives, and ensuring transparency and accountability in climate finance. The chapter highlights global efforts and policy measures from countries like India, China, Brazil, France, Indonesia, and Germany, showcasing their commitment to sustainable development through green finance. Despite challenges such as substantial upfront investments and regulatory hurdles, the integration of Industry 5.0 and green finance presents opportunities for innovation, enhanced resource efficiency, and reduced environmental impact. The nexus between Industry 5.0, green finance, and sustainability underscores their collective goal of promoting sustainable development. As industries continue to evolve, collaborative efforts among governments, financial institutions, and industries will be crucial in achieving a sustainable industrial ecosystem. This chapter emphasizes the importance of robust policies, financial incentives, and technological advancements in guiding the industrial sector towards a sustainable and environmentally friendly future. Nowadays, sustainability is essential, and reaching the goal of sustainability is the focus of every industry. Industry 5.0 is developing to accomplish this goal. Industry 5.0 is a human-centric strategy that essentially advances the idea of human-robot cooperation for a smart business ecosystem that enhances resource productivity and social well-being. In the framework of Industry 5.0, this chapter explores the dynamic interactions between government initiatives and the emerging field of green financing.

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Keywords: Government regulations, Green finance, Green technology, Industry 5.0, Sustainability.

INTRODUCTION

A new necessity has developed in the dynamic environment of Industry 5.0: the peaceful coexistence of industry and environmental sustainability. Industry 5.0 is defined by the seamless integration of advanced technology and the Industrial Internet of Things (IIoT). The global shift of industries towards a more environmentally conscious model places significant emphasis on the role played by government policies and regulations in influencing the development of green finance. Within the framework of Industry 5.0, this chapter explores the dynamic interactions between government initiatives and the emerging field of green financing. Increasingly, industries are embracing automation, smart manufacturing, and networked ecosystems, which means that incorporating sustainable practices is vital. As a result, governments worldwide are developing laws and rules that not only encourage but require the incorporation of ecologically friendly methods into industrial operations. Promoting green financing encompasses a range of approaches, such as increasing investments in clean and green technologies, providing funding for natural resource-based green economies and climate-smart blue economies, and aligning public financial incentives with environmental goals. It also involves expanding green financing across different sectors, integrating environmental considerations into public sector financing decisions in line with the Sustainable Development Goals, and broadening the utilization of green bonds, among other strategies (UNEP). Green finance is crucial for channeling funds towards environmentally beneficial projects, a necessity amplified in the era of Industry 5.0. As technology becomes deeply integrated into industrial processes, it presents both opportunities and challenges for sustainable development. This chapter explores how laws and policies shape the green finance landscape within Industry 5.0. Governments play a vital role in steering industries towards sustainability by implementing stringent environmental standards and offering incentives for eco-friendly initiatives. In Industry 5.0, the convergence of advanced technologies and industry demands a financial ecosystem that supports sustainable practices. Green finance provides the necessary capital for projects that reduce environmental impact and promote long-term ecological benefits. Government regulations and policies are pivotal in fostering this ecosystem as they set clear guidelines and provide financial incentives, such as tax breaks, subsidies, and grants for green projects. By examining the impact of these laws and policies, this chapter underscores the importance of a supportive regulatory framework in advancing sustainable development. Governments' proactive measures can significantly influence industrial behavior, encouraging investment in renewable energy, clean

technologies, and sustainable manufacturing practices, thereby ensuring a more environmentally friendly industrial future.

Evolution of Industry 5.0

The Industrial Revolution signifies the historic transition from agrarian and artisanal economies to industrialized societies driven by machine manufacturing. This pivotal era heralded a profound transformation in production methods, replacing manual craftsmanship with mechanized processes. It revolutionized the production of goods, fundamentally altering the economic landscape and societal structures. By harnessing the power of machinery, the Industrial Revolution propelled unprecedented levels of productivity and economic growth, laying the groundwork for modern industrialized societies.

The industrial landscape has been in a state of continual transformation since the late 18th century. This journey began with the First Industrial Revolution in the 1780s, a period characterized by the advent of mechanized production. This era harnessed the power of water, steam, and fossil fuels, laying the foundation for modern industry by transitioning from manual labor to machine-driven processes. This shift significantly increased production capacity and efficiency, setting the stage for subsequent industrial advancements.

By the 1870s, the Second Industrial Revolution had emerged, marked by the widespread adoption of electrical energy. This revolution revolutionized mass production, introducing assembly lines and enhancing manufacturing capabilities. Electricity not only powered factories but also facilitated the development of new machinery and equipment, enabling industries to produce goods at an unprecedented scale and speed. The focus during this era was on optimizing production processes and expanding industrial output to meet growing consumer demand.

The 1970s ushered in the third industrial revolution, which introduced the concept of automation through the integration of Information Technology (IT) into manufacturing. This period saw the rise of computers and digital technologies, which transformed production lines by automating repetitive tasks and improving precision and efficiency. The implementation of computer-controlled machinery and robotics marked a significant leap forward, allowing industries to streamline operations and reduce human error. The third revolution laid the groundwork for the interconnected, data-driven manufacturing environments that would follow.

The fourth industrial revolution, often referred to as Industry 4.0, built upon the foundations of its predecessor by aiming for total automation. This revolution has been characterized by significant technological breakthroughs, including the

CHAPTER 9

Understanding Customer Emotion of Private Label Brands of Men's Clothing: Sentiment Analysis Using Natural Language Processing Techniques

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Abstract: The internet has vast amounts of unstructured data. It can be very difficult to analyse these data and be unable to extract meaningful results from them. Due to the abundance of opinionated data on the internet, where people express a wide range of emotions, including happiness, sadness, disappointment, and anger, opinion mining has become increasingly popular. Researchers often use opinion mining and sentiment analysis to understand consumers' attitudes and emotions, which helps evaluate how effectively different brands are performing.

The article employs the Lexicon-based approach to gather, preprocess, and analyze product review data from Amazon using R. The purpose of the study is to determine how customers feel about Amazon's private-label menswear, both positively and negatively. The study considered two brands: Symbol and Inkast. Sentiment scores and emotional variance estimate the outcomes of the Lexicon-based sentiment, which produces a classification of the emotions present in the text. According to the research, consumers are generally confident in their ability to trust Amazon's men's private clothing brands. Compared to Inkast, people prefer buying under the Symbol brand. Sentiment analysis enhances business expansion and customer experience.

Keywords: Amazon, Men's clothing, Natural language processing, Private labels, Sentiment analysis.

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INTRODUCTION

Human language generation and human language understanding are two different branches of Natural Language Processing (NLP). Language understanding is often considered more difficult because natural language is inherently ambiguous and context-dependent. However, language generation presents a different kind of challenge: it produces rational, contextually appropriate, and natural-sounding text despite the same underlying ambiguity in human language. These challenges span multiple NLP applications, including speech-recognition annotation, machine translation, question-answering systems, and automated literature review tools [1]. Emotion recognition and sentiment analysis are the two significant aspects of natural language processing. Recognising an emotion and analysing a sentiment are similar but not the same, and hence cannot be used interchangeably. Sentiment Analysis can evaluate whether the data is positive, negative, or neutral.

On the other hand, Emotion detection can recognize different human emotions, such as anger, happiness, and depression. According to Munezero *et al.*, the terms "emotion detection," "affective computing," "emotion analysis," and "emotion identification" are used interchangeably [2]. Now that internet connections are prevalent, people have started using social media as their preferred outlet for expressing emotions.

Everyone willingly shares their opinions, disagreements, and passions about a wide range of subjects on social media. Further, several customers leave feedback and reviews on various products and services on numerous e-commerce sites. The digital transformation underway in virtually every business and industry generates vast amounts of structured and unstructured data. Making sense out of unstructured data to make it usable and relevant for organizations to solve business problems is indeed an immense task [3]. From a commercial perspective, sellers often advertise on Facebook, Instagram, YouTube, or Twitter and gain valuable consumer response as direct feedback to their products [4]. Real-time user feedback is helpful to consumers who may be looking for additional information before purchasing a product or service. It is something corporate marketers use to monitor customer satisfaction and the competition. Sentiment analysis can use the viewpoints of the customers to adjust the marketers' goods or services accordingly.

In response to the rise of social media, investors can communicate with each other in the stock market much faster and more conveniently [5]. Investor emotions can lead to herd behavior in investment decisions, which can spread and magnify across the network [6], facilitating informational cascades that may exacerbate stock market manipulation. According to Bhardwaj *et al.* (2015), mood and

emotion analysis has altered the way that we conduct business [7]. Concurrently, Twitter and other social media platforms have become primary sources of health information for both citizens and oncology healthcare professionals.

For example, when they used Google Trends data and analyzed the sitelinks of religion-related search results, the authors found that people discussed their opinions on religion during COVID-19 [8]. They were "distressed with the patient's mental health, being separate from their loved ones. Enthusiasm, ability, and zest for what they focus on, along with professional qualifications, augment a teacher's experience. Student feedback: One way a teacher can improve their methods is to receive immediate feedback on students' satisfaction [9]. It's tough to watch all that open-ended text feedback, and even tougher to manually grasp generalizations. Based on sentiment and emotion analyses, teachers or organisations may take remedial action. Students & parents frequently search the web for information on possible schools, courses, and instructors. They talk to other students on the same wavelength, compare colleges on blogs or forums, and more.

Customers' perceptions of a company's goods and services have had a significant impact on businesses in recent years [10]. Businesses are keen to understand customer feedback and respond promptly, particularly in marketing, product quality, and end-to-end delivery. Understanding customer buying patterns through their feedback is a crucial way to improve products, services, and overall customer satisfaction. Consumers express their opinions using a variety of platforms, such as social media, emails, phone surveys, and online text messaging. Their inquiries are taken seriously and directly affect a business's existence and market share. As a result, keeping up with the competition becomes essential amid rapid changes in consumer loyalty and behaviour. As a result, every business pays close attention to its customers' opinions, concerns, and preferences, and makes specific adjustments to its services, products, and marketing plans. But first comes the challenge of screening large amounts of data—sometimes unintelligible, unstructured texts—that illustrate potential reasons for customer turnover that could otherwise go unreported. Moreover, the subjectivity of expectations or satisfaction influenced by variables in the data is the driving force behind complaints, rewards, or reasons for complaint. From a commercial perspective, the goal is to analyze all this data to understand the situation and implement appropriate corrective measures to enhance the customer experience. This study aims to investigate analytical components, such as Natural Language Processing (NLP), to yield valuable insights into customer perception. In this paper, we apply sentiment analysis, also known as opinion mining. This NLP technique analyzes and determines the sentiment expressed in a piece of text, such as customer reviews, social media comments, or survey responses.

CHAPTER 10

AI-Driven Disease Identification: Advances, Challenges, and Future Directions

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Abstract: AI's integration in healthcare has led to significant progress in identifying diseases. Recent innovations, especially in machine learning and deep learning, have fostered the creation of advanced models for prompt and precise disease detection. This paper touches upon AI's role in medical imaging, the analysis of electronic health records, and the use of wearables, emphasizing its transformative effect by improving diagnostic precision and efficiency. We explore specific instances like diagnosing cancer, evaluating cardiovascular risks, and spotting infectious diseases, showcasing the value of AI solutions. Nonetheless, this innovation comes with its set of challenges. Concerns related to ethics and privacy, data quality, availability, and the pressing need for regulatory structures are pivotal challenges confronting AI in disease detection. We delve deep into these challenges, providing possible solutions. As we look to the future, we suggest directions such as improving the clarity and justification behind AI model decisions, widening the spectrum of detectable diseases, and endorsing partnerships between healthcare experts, AI specialists, and regulators to guarantee AI's safe integration into healthcare. This paper aims to give a holistic understanding of where AI stands in disease detection, focusing on its advantages and the hurdles ahead. It's an essential guide for researchers, healthcare professionals, and decision-makers aiming to harness AI for diagnosing diseases and enhancing health outcomes.

Keywords: Artificial intelligence, Disease identification, Healthcare, Machine learning, Predictive modelling.

INTRODUCTION

The fusion of Artificial Intelligence (AI) with healthcare is heralding a new age of disease detection and diagnosis. Leveraging the prowess of machine learning and deep learning, AI-fuelled diagnostic systems are showing incredible potential in

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enhancing the diagnostic accuracy and patient care [1]. This review delves into the latest innovations, current challenges, and prospective paths in the AI-mediated disease detection domain.

AI's ability to swiftly and accurately sift through extensive data has paved the way for pivotal progress in several medical fields. Ranging from the detailed scrutiny of medical images, analysis of Electronic Health Records (EHRs), to real-time insights *via* wearables, AI's influence is fundamentally altering the landscape of disease detection and management. Moreover, its benefits are not just limited to individual care but also have a broader impact on public health strategies and early interventions [2].

Exploring specific scenarios like early cancer detection, gauging cardiovascular threats, and pinpointing infectious diseases showcases AI's transformative potential in the medical diagnosis arena. Such breakthroughs not only refine diagnostic precision but also equip healthcare professionals with the necessary tools for swift and data-driven decisions, leading to enhanced patient care and a more efficient healthcare system [3].

Yet, AI's integration into healthcare is not devoid of challenges. Issues related to the ethics of patient data, ensuring data quality and consistency, and the urgency for comprehensive regulatory guidelines are of paramount importance. These challenges need careful navigation to realize the full potential of AI in disease detection [4].

This research seeks to provide a rounded perspective on AI's role in disease identification, emphasizing its achievements, the hurdles ahead, and the promising avenues that might further bolster AI's role in healthcare.

Literature Review

Artificial Intelligence (AI) has emerged as a powerful tool in healthcare, particularly in the context of disease identification. This section provides a review of the existing literature on AI-driven disease identification, highlighting key advancements, challenges, and trends in this field.

Advancements in AI for Disease Identification

AI in disease detection has experienced remarkable progress lately. With the adoption of machine learning and deep learning, we have seen the evolution of sophisticated models that excel in disease identification. For example, studies in 2019 showed that machine learning can match the expertise of dermatologists in identifying skin cancers using medical images [2]. Another research in 2017

revealed the effectiveness of deep neural networks in the same field, indicating AI's pivotal role in enhancing diagnostic precision [3].

Additionally, AI's role is not limited to imaging. It has been utilized in parsing Electronic Health Records (EHRs) to forecast disease vulnerabilities and elevate patient care outcomes. A study in 2020 highlighted how AI can sift through EHRs, deploying predictive models to spot individuals prone to specific diseases [1]. Such innovations point towards AI's transformative capacity in proactive disease detection and tailored healthcare.

Challenges in AI-Driven Disease Identification

While AI holds great promise in disease identification, several challenges must be addressed. One of the foremost challenges is the ethical use of patient data. Char *et al.* (2018) emphasized the importance of ethical considerations in implementing machine learning in healthcare and discussed the need for robust data privacy and security measures [4]. The responsible handling of sensitive medical data is crucial to maintaining patient trust and regulatory compliance.

Additionally, data quality and availability pose significant challenges. High-quality, standardized healthcare data are essential for training accurate AI models. Insufficient or biased data can lead to inaccurate diagnoses and treatment recommendations. Addressing these data challenges is imperative to realizing the full potential of AI in healthcare.

Future Directions in AI-Driven Disease Identification

The horizon of AI-powered disease detection is brimming with potential. As Rajkomar *et al.* (2019) pointed out, making AI models more interpretable and explainable is an ongoing area of focus [2]. It is vital for AI-backed diagnostic results to be clear and relatable to medical professionals to foster widespread acceptance and confidence.

The next wave of research aims to broaden the range of medical conditions AI can diagnose. Moving beyond frequently diagnosed diseases like cancer and heart conditions, AI's capabilities could be pivotal in discerning uncommon ailments and new infectious cases. Joint endeavors between medical experts, AI specialists, and regulatory bodies will be crucial in propelling this mission forward.

CHAPTER 11

AI-Based Marketing Management Strategies and Industry 5.0

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Abstract: AI-powered marketing strategies are now crucial to transforming the way businesses interact with their customers. Firstly, it focuses on examining state-of-the-art marketing technologies based on AI with reference to Industry 5.0, which includes social media platforms, big data analytics, augmented reality, virtual reality, with reference to Industry 5.0, which includes social media platforms, big data analytics, augmented reality, virtual reality, and the Internet of Things. Industry 5.0 is a concept with a shift toward machine-human cooperation, which refers to an exchange between mutually beneficial parties related to technological signaling and workers. It highlights the combination of emotional intelligence, problem-solving skills, and artificial intelligence and automation, which is useful in creating more productive industrial environments. This approach facilitates modern industry operations. The analysis of the significance and challenges of integrating new AI-enabled technologies in marketing management is the second main objective of this study. The study focuses on discovering new ways in which Indian companies are utilizing modern technologies to enhance their operations. One of the major goals of the study is to help businesses understand how to effectively utilize AR and VR in their marketing strategies, enabling them to enhance their client experiences. More concerns have been raised about the data privacy associated with the use of AI-enabled products. It provides guidance to marketing managers on how to evaluate the complexities involved in incorporating all new AI-based technologies into their existing workflows. Ultimately, it highlights the importance of companies effectively managing the complexities of technology implementation to maintain their leadership in the modern era of marketing strategies.

Keywords: Augmented reality, Big data analytics, AI, Search engine marketing, Virtual reality, Web of Things or IoT.

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INTRODUCTION

In today's era, Artificial Intelligence (AI) is reshaping marketing and customer interactions, transforming the business environment. These innovative tools enhance customer experiences and encourage long-term growth. Businesses must adopt new technologies as the digital revolution gains momentum to remain competitive and relevant in an ever-changing market. Most businesses are collaborating to create adaptive, flexible, and sustainable production systems that utilize cutting-edge robotics and Artificial Intelligence (AI) technologies, which are highly valued in Industry 5.0 as a new phase in industrial development. Artificial Intelligence (AI)-based marketing strategies are crucial in this situation because they leverage cutting-edge technologies to enhance customer understanding and communication. The integration of data-driven insights with compelling consumer experiences has enabled the application of artificial intelligence in technology, facilitating effective marketing management through data-driven decision-making, adaptive personalization, and real-time interactions. Big data analytics and artificial intelligence play a key role in driving Industry 5.0 by enabling personalized solutions, effective human-machine collaboration and real-time decision-making. Marketing managers can now create targeted campaigns, make informed decisions, and offer unique experiences that connect with specific customers by leveraging AI-powered algorithms to analyze massive amounts of data and identify pertinent patterns and trends. Big data analytics enhances Artificial Intelligence (AI) by uncovering hidden opportunities, forecasting future trends, and deriving meaningful insights from client data. These are all crucial for effective marketing management. Li X. and Karahanna E. investigated consumer perceptions and plans for using AI chatbots in customer service in 2019. The study looked at user experience, perceived utility and trust in AI-based techniques as factors that influence consumers' acceptance of and intentions toward chat-bots [1]. Towards Industry 5.0, the study investigates the possibility of integrating all AI-based marketing strategies that contribute to commercial success, thereby altering the way businesses engage with their target market. Businesses can now concentrate on digital content instead of traditional business models, and in this regard, Artificial Intelligence (AI) offers interactive product demonstrations and virtual showrooms. VR offers the opportunity for consumers to engage with brands in a virtual environment, enabling experiential marketing and brand narrative. Ultimately, these technologies influence consumer decisions and brand loyalty by fostering emotional connections and brand involvement. The study explores the application of connected devices and the Internet of Things (IoT) to marketing management, from real-time data tracking to tailored customer interaction. Today, marketers have more options to distribute tailored and contextually relevant content due to the Internet of Things, which enables the gathering of real-time data from connected devices. Smart campaigns

can be developed with the help of the Internet of Things that adjust to each customer's unique interests and behaviours, fostering engagement and customer satisfaction. And due to that, social media platforms are crucial to contemporary marketing management. This technology enables businesses to create a unique brand, monitor customer sentiment, and share directly with their target audience. The primary focus of this research is to identify the most effective social media marketing strategies currently employed and to examine how different types of social media influencers influence consumer behavior. The integration of AI technology with marketing management has created more opportunities and challenges compared with earlier time periods. By proactively implementing these transformative technologies, businesses can enhance customer experiences and gain a competitive edge. Understanding the characteristics and uses of artificial intelligence, VR, Big Data Analytics, AR, social media platforms, and IoT will enable marketing managers to develop relevant, data-driven customer-centric strategies that resonate with their target audience, thereby opening the door for sustainable growth in the digital era of Industry 5.0.

OBJECTIVE

In this study, we aim to explore the application and results of AI-driven marketing technologies in Industry 5.0 with a particular emphasis on VR, IoT, social media platforms, and Augmented Reality (AR). Another objective is to examine the benefits and drawbacks for Indian businesses. It aims to address data privacy concerns and provide marketing managers with guidance. The study's objective is to demonstrate how these technologies can boost employee productivity and support companies' ability to compete.

Methodology of Research: This current study is based on secondary data and a comprehensive literature review. In this context, 41 research publications pertinent to the topic are reviewed.

Literature Review: The following main new Artificial Intelligence (AI)-based technologies are used in industry 5.0 marketing management (Fig. **1**).

CHAPTER 12

AI-Enabled Green and Sustainable Resource Management in Horticulture

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Abstract: The integration of AI into horticulture offers a revolutionary strategy for environmentally responsible resource allocation. The modern horticultural industry must find a way to increase production while reducing its negative effects on the environment. The advent of AI presents a revolutionary chance to optimize resource management procedures. Precision farming, pest and disease management, and crop yield prediction are at the forefront of AI-enabled green and sustainable resource management in horticulture. The basic concept is to establish a networked horticulture ecosystem in which AI collects data from multiple sources and provides real-time insights for intelligent decision-making with the help of Algorithms like Ant Colony Optimization, Particle Swarm Optimization, or neural networks with fuzzy logic. It can simulate natural behaviors to optimize planting patterns and resource allocation. Improvements in resource effectiveness, productivity, environmental protection, and economic sustainability are among the anticipated consequences. Among the outcomes we expect are increases in resource efficiency, productivity, environmental preservation, and economic sustainability. When AI is applied to the horticulture industry, it has the potential to dramatically improve resource management, leading to greater longevity, output, and profitability.

Keywords: Artificial intelligence, Fuzzy logic, Horticulture, Swarm intelligence, Sustainable resource.

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Subir Gupta, Indrajit Ghosal, Keshav Kaushik & Monika Dandotiya (Eds.)

INTRODUCTION

The fusion of artificial intelligence and horticulture stands out as a beacon of hope in a time when environmental concerns are a top priority, and the push for sustainable practices has never been louder. In a time when environmental issues are of utmost importance, and the demand for sustainable practices has never been greater, the combination of artificial intelligence and horticulture stands out as a ray of hope. An in-depth exploration of the field of sustainable horticulture is provided in AI-Driven Sustainable Horticulture, which explores how cutting-edge AI technologies are transforming how we cultivate, manage, and protect our natural resources. An increase in greater numbers is expected to increase the demand for more quality and quantity of sustainable food. Two billion children under the age of five have had delayed development and growth due to a chronic lack of vital nutrients in their diet. This suggests that efforts to combat food insecurity and malnutrition brought on by climatic extremes and economic instability need to be prioritized more [1]. Sustainable growing of fruits and vegetables, or horticulture, can provide the healthy micronutrients needed to combat malnutrition. Horticulture stands out as a colorful thread in the great tapestry of India's agricultural legacy, intimately woven into the country's social, economic, and dietary fabric. For India's economy, sustenance, and biodiversity, this multifaceted and dynamic sector, which includes the cultivation of fruits, vegetables, spices, landscaping plants, and more, is of paramount importance. Numerous horticulture crops can flourish in India's favorable climatic conditions, which range from tropical to temperate. The country's diverse agricultural landscape, which extends from the enchanted apple orchards tucked away in the Himalayan Mountains to the luscious coconut groves surrounding the coastlines, is a monument to its intricate geographical tapestry. Horticulture plays a crucial role in helping India, a country with a population of over a billion, address its food security challenges. The production of nutrient-dense fruits and vegetables guarantees that millions of people have a varied and well-balanced diet.

Additionally, the industry provides a variety of employment options, particularly for marginal and small-scale farmers who find comfort in caring for their gardens and orchards. Horticulture crops boost farm output, provide jobs, and supply raw materials to various food-processing enterprises, all of which have a significant beneficial effect on the Indian economy. Despite the statistic, there is some space for horticulture, and a large bazaar for the harvests produced around. As a result, it might be difficult to meet demand while using the least amount of resources because sustainable practices need to be employed to guarantee a sustainable environment [2]. A new technology has entered the intricate interplay among tradition and innovation that defines India's horticulture journey: Artificial Intelligence (AI). AI weaves a contemporary thread into the tapestry of

horticulture, promoting efficiency and sustainability while honoring the region's agricultural legacy. By leveraging the ability to process massive datasets, AI derives insights that far exceed the analytical capacity of human observation alone. Small-scale farmers in a country where agriculture is AI have priceless tools. Artificial Intelligence mitigates risks and empowers farmers to make informed decisions. This includes advanced irrigation systems that optimize water consumption, as well as predictive analytics that forecast pest infestations and facilitate prompt actions.

An Overview of India's Horticulture Farming

The publication “Fruits and Vegetables Availability Maps of India” details each state's contribution to India's overall fruit and vegetable production. The regions of India where fruits are grown are covered in the study [3]. This also includes information on the number of hectares of land used for fruit cultivation and the productivity of fruits in the field. The number of acres of land utilized for fruit production, as well as the yield of fruits harvested in the field, are also included in this work. The conclusion derived from both works is that India's arable land and productivity are getting smaller every year. Intense drought, a lack of rain, fruit illnesses, *etc.*, are to blame for this. The production curves for fruits such as pomegranate, papaya, apple, and orange, among others, exhibit a downward trend [4]. Serious hazards to the development of the horticulture business include the loss of fertile soil, rising land costs, water scarcity, global warming, and the impossibility of low-cost labor. Abiotic stressors such as temperature extremes, salinity, pH, and drought are key hindrances to horticulture crops [5]. Crops used in horticulture are susceptible to daily variations in temperature, humidity, and other climatic conditions. Farmers may suffer large financial losses if they are unprepared for even a slight change in weather patterns. Often, horticulturists incur significant losses due to the spread of diseases across their fields, or at times, as a result of pathogens and pests. With all these natural problems, horticulture in India also faces certain problems. The primary marketing problems for horticultural products include the lack of markets for centralized production, a substantial number of middlemen, the absence of marketing organizations protecting farmers' interests, the ineffective pricing structure, and the lack of transparency in market information networks, especially in the export market.

CHAPTER 13

Artificial Intelligence: Utilizing a Cost-Safety Matrix to Assess Risk in Material Handling Systems

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Abstract: This chapter focuses on route selection by simultaneously evaluating the safety performance and transportation cost associated with each alternative path. It introduces the concept of a Cost–Safety Matrix as a tool for risk analysis of transportation routes. In this framework, the cost matrix quantifies the transportation expenditure for each route, whereas the safety matrix characterizes the safety-related attributes of those routes. The combined cost–safety matrix incorporates both the economic considerations and the inherent risk present on each individual path. The corresponding risk matrix is developed using a defined numerical scale derived from historical (past) data. The cost of transportation and risk level combine to make a matrix that can be divided into three parts. The categories used to describe the danger level are low, moderate, and high. This matrix may be used to pick a route before commencing the transport. Integrating Artificial Intelligence (AI) into material handling procedures is critical for increasing productivity and maintaining worker safety. The primary purpose of this study is to identify and reduce potential dangers associated with lifting, transporting, and handling products. The primary focus is on using AI to estimate the danger of material handling jobs. The study uses machine learning techniques, data analytics, and sensor technologies to examine large datasets relevant to material handling processes. By harnessing the power of AI, the research aims to develop a robust risk assessment framework that can automatically detect, predict, and mitigate potential risks associated with falling materials, collapsing loads, improper lifting techniques, and struck-by hazards.

Keywords: Artificial intelligence, Cost-safety matrix, Material handling, Risk analysis, Transportation.

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INTRODUCTION

Risk assessment principles have been established to provide a systematic basis for conceptualizing and managing risk, with a focus on refining core concepts, analytical methods, and the role of "risk thinking" in decision-making. In modern business practice, risk assessment and management are treated as science-based processes aimed at identifying, evaluating, and controlling factors that could distort managerial judgment, thereby safeguarding organizational performance and long-term viability [1].

In the context of materials management, structured risk management programmes provide an overarching strategy and framework for controlling uncertainties in material handling and associated operations [1]. Material management itself spans procurement, supply, and the movement of materials from warehouses to points of distribution, where delays in dispatch are recognized as a critical challenge for project time performance [2]. In industrial practice, risk management extends across procurement, storage, processing, internal logistics, supply chains, and outbound transportation of finished products. Construction-sector studies highlight that inadequate handling practices at the site level can compromise worker safety and productivity, and therefore emphasize systematic analysis of material-handling safety and corresponding countermeasures. Inventory-related risks have been modelled using multi-criteria tools such as the Analytic Hierarchy Process (AHP), providing a structured basis for prioritizing hazards and selecting appropriate control actions in inventory management. From an ergonomic standpoint, manual material handling is identified as a high-risk activity, and sensor-based, machine-learning approaches have been proposed for automated assessment of workers' postures and movements. Risk matrix methods have also been applied to material distribution processes to evaluate handling performance and to highlight critical stages in the internal flow of materials. Effective safety management in these contexts depends on competent professionals and appropriate mechanical handling equipment, particularly at construction and industrial sites where accident potential is high. Beyond physical operations, risk management in material handling increasingly intersects with information and communication technologies, with research on IT-system risk analysis proposing qualitative and quantitative frameworks for evaluating vulnerabilities in information systems that support logistics and inventory control. In parallel, industrial studies stress that the design and selection of material-handling systems, including material-flow configurations and technology choices, strongly influence profitability and operational efficiency. Automation through Programmable Logic Controller (PLC)-based systems is promoted as a means to reduce or completely replace manual handling in tasks such as filling, sorting, packaging, and loading. The development of integrated material-handling systems in manufacturing has

been shown to enhance organizational productivity while reducing overall manufacturing cost. Methodologically, several decision-support techniques have been integrated into material-handling planning; for example, artificial neural networks have been explored for forecasting and decision-making in engineering and logistics applications, offering predictive capability for material demand and system performance. Equipment selection has been optimized using multi-criteria decision models for choosing among alternatives such as conveyors, trolleys, and automated guided vehicles, particularly in sectors like pharmaceuticals, where reliability and throughput are critical. Complementary work on the classification and attributes of material-handling equipment provides structured guidelines for matching equipment types to operational requirements, cost constraints, and safety objectives [3]. Within this broader literature, material handling is consistently defined as the coordinated movement, protection, storage, and control of materials and products across manufacturing, warehousing, distribution, consumption, and disposal, supported by technologies such as forklifts, conveyors, cranes, pallet racking, automated storage and retrieval systems, inventory management systems, warehouse management systems, barcoding, and RFID to ensure safe, efficient, and cost-effective flow of goods.

Transport Equipment

Automated devices that transport goods along a preset route are called conveyors.

Pallets and big items can be lifted and moved by forklifts.

Pallet Jacks: Equipment, either electric or manual, used to move palletized items.

Storage Equipment

Pallet Racks: Systems with many levels for storing palletized items.

Shelving Units: Used to store boxes and smaller objects.

AS/RS: Automated systems with low human interaction that store and retrieve objects.

Unit Load Formation Equipment

Pallets: Platforms for stacking and transporting products. Containers are used for bulk storage and transportation.

Positioning Equipment

Robotic Arms: Used for precise handling in production.

SUBJECT INDEX

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X

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Dr. Subir Gupta is an Associate Professor in the Department of Artificial Intelligence and Machine Learning at Haldia Institute of Technology, West Bengal, India. He holds a PhD in Engineering from the Indian Institute of Engineering Science and Technology (IIEST), Shibpur, and brings over 24 years of teaching and academic experience. Dr. Gupta has authored more than 80 research publications in reputed Scopus- and SCI-indexed journals and conferences and holds six patents. He has served as an editor for three international academic books and is also the sole author of a scholarly book. His academic contributions reflect a strong commitment to advancing computer science education, research, and technological innovation.

Indrajit Ghosal

Dr. Indrajit presently serves as an Associate Professor and Research Coordinator in the Department of Management at Brainware University, Barasat, Kolkata, India. He was awarded a Ph.D. in Online Marketing (Management) in 2020 and an FRPM in 2017. He completed his master's degree in MCA and his undergraduate degree in BSc IT. He has more than 16 years of teaching experience. He has published 80 research papers in many reputed journals indexed in ABDC, ABS, Scopus, WOS, UGC, and others, and has published six patents, one granted patent, and two copyrights. He has presented papers at 36 international and 7 national conferences and has presented 4 case studies at various conferences. He is the author of six books and eleven edited books published by reputed publishers such as Taylor & Francis, Emerald, Springer, Nova Science, and IGI Global, and has also published many book chapters. He has supervised five Ph.D. scholars and four MPhil scholars who have already been awarded their degrees under his supervision. He is the editor of a special issue titled "Quality Education for All" published by Emerald, "Anveshak – International Journal of Management," and the "Journal of Polymer and Composites." He is also an advisory member and editorial board member of IJABM and the Malque Publishing Team NexusSDGs. He reviews for many reputed journals indexed in Scopus, WOS, ABDC, ABS, and SSCI. As a keynote speaker, resource person, and chairperson, he has been invited to 38 conferences, workshops, and seminars. Dr. Indrajit received the Research Excellence Award 2025 for Patent Inventive Steps, organized by Wegrow in collaboration with BHU, Varanasi. He received the Best Paper Award from Amity University, Patna, and Adamas University, Kolkata. He has also been awarded the Research Incentive Award from Poornima University, Jaipur, and the Best Citation Award from FIIB Delhi. He is associated as an examiner/external for Ph.D. DRC seminars at Seacom Skills University and JIS University

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Dr. Monika Dandotiya presently serves as an Assistant Professor at Poornima University, Jaipur, in the Department of Computer Science & Engineering. She holds a PhD in Computer Science & Engineering with a specialization in Network Security. She has completed her M.Tech in Cyber Security & Engineering. She has more than 7 years of teaching experience. She has published more than 20 research papers and 5 patents and has presented papers at 6 international and 5 national conferences. Four M.Tech scholars have already been awarded under her supervision.