# BEHAVIOURAL ANALYTICS

## MACHINE LEARNING APPROACHES FOR PREDICTIVE INSIGHTS

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**Bentham Books**

# Applied Machine Learning for IoT and Data Analytics

## *(Volume 3)*

## Behavioural Analytics: Machine Learning Approaches for Predictive Insights

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# Applied Machine Learning for IoT and Data Analytics

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ISBN (Online): 979-8-89881-393-2

ISBN (Print): 979-8-89881-394-9

ISBN (Paperback): 979-8-89881-395-6



Published by Bentham Science Publishers Pte. Ltd. Singapore,

in collaboration with Eureka Conferences, USA. 

First published in 2026.

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# CONTENTS

# PREFACE

In a rapidly evolving landscape, where data drives decisions and insights fuel innovation, the field of Behavioral Analytics has emerged as a crucial domain for organizations seeking to understand and enhance their operations. This book, 'Behavioral Analytics: Machine Learning Approaches for Predictive Insight', aims to shed light on the powerful intersection of behavioral analytics and machine learning, illustrating how these methodologies can be leveraged to gain predictive insights that drive strategic decision-making. As we navigate through the chapters, we will explore the fundamental concepts that underpin behavioral analytics. This exploration is not merely theoretical; it is aimed at practical applications that can transform data into actionable strategies. By harnessing machine learning techniques, organizations can identify trends, anticipate challenges, and unlock opportunities that were previously obscured by the vast amounts of data they collect. We will delve into the challenges associated with integrating machine learning into behavioral analytics frameworks, addressing concerns related to data quality, privacy, and the ethical implications of data use. Transparency and ethical practices will emerge as recurring themes throughout our discussion, emphasizing the need for organizations to adopt a responsible approach to data analytics that respects consumer privacy while fostering trust. The significance of our analysis extends to various sectors, including human resources, marketing, and public safety. We will discuss how predictive insights generated through machine learning can enhance employee engagement and retention, improve customer experiences, and even aid law enforcement in crime prediction—thereby contributing to a safer society. Through case studies and empirical research, we aim to illustrate the real-world applications of behavioral analytics in promoting efficiency, accountability, and informed decision-making. Moreover, this book addresses the future of behavioral analytics, considering the impact of emerging technologies and methodologies. As we stand at the forefront of a data-driven era, it is essential to equip ourselves with the knowledge and tools necessary to navigate the complexities of human behavior through the lens of machine learning. In an era where data reigns supreme and technology continues to transform our understanding of the world, the exploration of emerging fields such as Natural Language Processing (NLP), Machine Learning (ML), and behavioral analytics has never been more pertinent. The intention of this book is to illuminate the intricate interplay between these cutting-edge technologies and various sectors, offering a comprehensive view of how they can enhance decision-making, optimize operations, and foster positive cultural changes in organizations.

As we explore the multifaceted ways NLP enhances behavioral analytics, we highlight powerful tools such as sentiment analysis, topic modelling, and named entity recognition that extract meaningful insights from text data. However, this journey is not without its challenges. We courageously confront issues related to data quality, privacy, and domain specificity while proposing innovative solutions that bridge these gaps. Our exploration extends to how data-driven insights can fundamentally transform workplace dynamics by identifying key engagement drivers that enhance morale, productivity, and retention. With advanced analytics, organizations can monitor employee sentiment in real time, enabling a proactive approach to nurturing a positive workplace culture. With the rise of recommendation systems, we investigate their profound influence on consumer behavior, focusing on patterns of purchasing, satisfaction, and brand loyalty. By analyzing different recommendation strategies, we aim to uncover how tailored suggestions shape customer interactions with retailers. In the educational sector, we discuss the significant role AI plays in improving student achievement and creativity. It is essential to evaluate the ways in which AI can inform learning methodologies, thereby benefiting students who are the ultimate clients of educational services.

As we navigate the ever-evolving landscape of ML in business, we offer a longitudinal analysis of its growth from a niche interest to a fundamental tool for strategic management in the 21st century. Our findings underscore the transformative potential of pedagogy informed by Automatic Speech Recognition (ASR) and its implications for fostering inclusive educational environments. Further, we investigate how digital technology can optimize the experience at the Puri Jagannath Temple, addressing the various challenges of overcrowding and safety. Through surveying Generation Z, we evaluate the feasibility of mobile applications that enhance access while acknowledging the trade-offs inherent in technology adoption. Amidst the wealth of data analytics, we stress the importance of ethical considerations. Through transparent practices in data collection and analysis, businesses can foster trust and prioritize consumer welfare. In the realm of public safety, we delve into how machine learning and time-series models can predict crime rates, advocating their use by law enforcement agencies to improve resource allocation. Lastly, we address the impact of digital currency on economic practices and its implications for society at large, questioning whether this shift represents a positive evolution in monetary transactions.

This book, **'Behavioral Analytics: Machine Learning Approaches for Predictive Insight,'** aims to bridge theory and practice, providing readers with insights that can inspire future research and applications. As we embark on this exploration together, we invite you to engage with the concepts presented and consider how these innovative approaches can be applied in your own context. We hope this book will be helpful to readers. The editors express their gratitude to the reviewers for their insightful criticism, which has helped to elevate the book's caliber. Bentham Books is also acknowledged by the editors for their assistance and publication.

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# DEDICATION

The editorial team would like to express their sincere gratitude to their families—spouses, parents, and kids—for their unwavering support during the production of this work. The editors would also like to thank their colleagues at their prestigious institution for their unfailing love, blessings, and support. Lastly, the entire research community, whose combined efforts continue to deepen our understanding of the world, is duly acknowledged in this book.

# ACKNOWLEDGEMENTS

The editorial team would like to express its sincere appreciation to our institution for creating a supportive research environment that served as the basis for this proposal. We express our sincere gratitude to the wide range of contributors from different countries and to the international reviewers who have carefully scrutinized every chapter to ensure the book's high caliber. Their astute criticism has been priceless. We want to express our gratitude to everyone for their commitment and readiness to take on challenges that took them outside of their comfort zones. We hope to see you again in our publication's upcoming edition.

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CHAPTER 1

# Enhancing Academic Development Through Automatic Speech Recognition and Natural Language Processing

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**Abstract:** The rapid advancement of Speech Recognition and Natural Language Processing (NLP) technologies offers transformative potential for academic development, aligning with the United Nations Sustainable Development Goal (SDG) 4: Quality Education. These technologies can revolutionize education by providing innovative tools that enhance inclusive and equitable quality education for all. Speech Recognition and NLP enable the automation of academic tasks, improve accessibility for diverse learners—including those with disabilities—and offer data-driven insights to improve student outcomes. The integration of these technologies into educational environments presents significant challenges like limited accessibility in under-resourced educational settings, accuracy issues that affect their reliability, and ethical concerns regarding data privacy and algorithmic bias. This study aims to explore the current state of Automatic Speech Recognition (ASR) and NLP in academia, identify key challenges, and propose solutions to enhance their effectiveness in promoting equitable and inclusive education. The research employs a mixed-methods approach, combining quantitative and qualitative methods. Surveys and interviews with educators, students, and administrators are conducted to gather insights into the use and challenges of ASR and NLP technologies. Additionally, experimental studies are carried out to test the effectiveness of existing ASR systems in educational contexts. By offering workable solutions using usable frequencies from a student perspective to improve the integration of speech recognition and Natural Language Processing (NLP) technologies in education, the study's findings will help achieve SDG 4, guaranteeing that all students have access to high-quality, inclusive, and equitable educational opportunities.

**Keywords:** Automatic speech recognition, Academic sector, NLP, Primary survey, SDG-4.

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

## INTRODUCTION

ASR and NLP technologies have the potential to greatly improve education and support SDG-4. These tools can make learning and teaching more inclusive and equitable. NLP can create personalized educational content that meets the specific needs of each student. It can also translate materials in real time, helping students understand content in languages they are not familiar with. This fosters a more diverse and accessible classroom environment. In addition to enhancing learning, these technologies can make teaching easier by automating tasks like grading and taking attendance. This allows teachers to spend more time on engaging activities that connect with students. NLP tools can also help educators create and update educational materials quickly, ensuring students have access to the best resources available. Another important advantage of ASR and NLP is their ability to improve accessibility for all learners, especially those with disabilities. For instance, speech-to-text tools provide real-time captions for students who are hard of hearing, while text-to-speech tools help those with visual impairments. Additionally, these technologies can support research by speeding up data analysis and encouraging collaboration among educators. By using insights from these advancements, teachers can identify students who may be struggling and provide timely help, creating a more effective and supportive learning environment for everyone [1 - 3].

While ASR and NLP technologies bring many benefits to education, their use in classrooms poses significant challenges. One major issue is that schools in poorer areas often do not have the necessary resources, training, or funding to use these tools effectively. This can create a larger gap between well-funded schools and those that struggle, making it important to find ways to ensure that all students can benefit from these advancements. Another key challenge is the accuracy of ASR and NLP technologies [4]. When these tools do not work consistently, they can cause misunderstandings, especially in classrooms with students who have different language skills. For teachers and students to trust and use these technologies fully, they need to keep improving the accuracy and understanding of context. This means not just advancing the technology itself, but also providing training to help users make the most of these tools in real-life situations. Lastly, there are important ethical concerns related to data privacy and bias. Using student data raises questions about how that information is collected, stored, and used, so strong privacy protections are necessary. Additionally, algorithms can sometimes reflect biases from the data they were trained on, which can unfairly impact different groups of students. Addressing these challenges is essential to make sure that ASR and NLP technologies truly support fair and equal education for everyone. By addressing these problems, we attempted to develop a more

effective and inclusive educational system that maximizes the use of these technologies. This type of research is completely new [5, 6].

## Objectives

This study aimed to examine how ASR and NLP technologies were being used in education. It sought to understand the challenges these tools faced and suggested ways to improve their effectiveness for all students. By enhancing the use of ASR and NLP, the study hoped to promote more equitable and inclusive education. To achieve these goals, the research employed a mixed-methods approach, combining both quantitative and qualitative methods. Primary surveys and interviews were conducted with educators, students, and administrators to gather their thoughts and experiences regarding ASR and NLP technologies. This helped understand the benefits and problems encountered when using these tools in real classrooms. In addition to surveys and interviews, the study also carried out experimental studies to assess how well current ASR systems perform in educational settings. By analyzing the results of these experiments, researchers aimed to gain insights into the effectiveness of these technologies in supporting student learning and identifying areas for improvement.

## METHODOLOGY

The research was conducted in various technical institutes across Bhubaneswar, Odisha. Bhubaneswar is a vibrant educational hub, making it an ideal location for this research. Students from different regions, speaking various dialects, come together in one place. By studying these diverse groups, the research explored how ASR and NLP technologies worked for speakers of different languages. By examining how these technologies were used in such a dynamic environment, the study aimed to gather insights that could help improve these tools for all students. By including voices from different dialect speakers, the research aimed to identify specific challenges they faced with ASR and NLP technologies. This understanding can guide future improvements, ensuring that all students, regardless of their language background, have the same opportunities to succeed in their studies. Overall, conducting the research in Bhubaneswar allowed for a rich exploration of language diversity in education.

Students are more likely to engage in research when they are referred by someone they know, creating a comfortable environment for sharing their experiences. This is particularly crucial when talking about personal difficulties with technologies like ASR and NLP, as it may make participants feel more comfortable sharing their experiences [7]. For this reason, snowball sampling was used in this research

# CHAPTER 2

# The Influence of Behavioural Analytics-driven Recommendation Systems on Web-based Purchase Decisions

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**Abstract:** Behavioural Analytics-driven Recommendation Systems (BARS) have become increasingly popular in conjunction with the growth of e-commerce. Their goal is to improve customer experiences by providing customised product recommendations. This research delves into how these recommendation systems affect consumer behaviour, particularly emphasising purchasing patterns, contentment, and brand loyalty. By examining diverse BARS, including content-based methods, collaborative filtering, and hybrid filtering, this study aims to comprehend how customised recommendations impact customers' interactions with online retailers. The principal objectives of this study are to analyse the influence of BARS on consumer purchasing patterns, examine the correlation between BARS and customer perception, and assess the algorithms that have the highest impact on customised recommendations from the standpoint of the consumer. The research employs an empirical approach, collecting data from 200 online consumers. The study found that behavioral analytics and recommendations have a moderate effect on purchases, with relevance being a key factor. Accuracy and trust-building are important because collaborative filtering lacks trust. While younger, more frequent shoppers respond best, suggesting targeted, customised marketing, content-based, or hybrid filtering approaches improve engagement in product discovery, with a strong positive correlation among them.

**Keywords:** Artificial intelligence, BARs, Behavioural analytics, Digital economy, E-commerce.

## INTRODUCTION

The e-commerce marketplace has boosted the number of online shoppers globally. Among such segments are the millennial and the Gen Z groups [1]. Millennials, born between 1981 and 1996, and Gen Z, born after 1996, are

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

important categories of young adult consumers with considerable spending power, making them easy targets for retail businesses [2]. These generations have been termed digitally native, that is, comfortable with technology and with navigating the internet better [3]. Also, a global report conducted in 2022 revealed that millennials and Gen Z contributed around 77% and 76%, respectively, to direct purchases on e-marketplaces. With five billion internet users worldwide, there is a growing trend toward online shopping that appears to be continuing for some time, thereby consolidating e-commerce as an integral element of the global retail segment [4].

E-commerce offers abundant returns to businesses and customers alike. For business users, e-commerce means streamlining operations from traditional paperwork to electronic systems, providing 24/7 service availability, and enabling data-driven decision-making based on insights into what their customers do and want, which ultimately boosts output [5]. For customers, the e-commerce experience is suitable for buying, as one can place orders for a wide range of goods and services and use online reviews to make a decision [6]. Thus, e-commerce plays a very pivotal role in propelling the digital economy forward. Retail e-commerce revenue globally is projected to have exceeded US$6.3 trillion by 2024 [7]. E-commerce is gaining ground in Egypt, and according to the outlook, Egypt is ranked 53rd globally in e-commerce, with an anticipated value of US$2,533.2 million by 2024. The Egyptian government also promotes small and medium-sized businesses to digitise in order to hasten the expansion of the digital economy. Retailers had to deploy AI-driven services like voice assistants, chatbots, and personalised recommendations to make sure that customers had a better shopping experience as e-commerce grew in popularity.

AI can read external data, learn from it, and adapt that knowledge for strategic application towards specific ends [8]. A wide set of business data, including buying history and attribution data on referral activities resulting from customer interactions with retail platforms. AI systems that are deployed for analyzing such data could conclude customer preferences, forecast prospect behaviour, and offer personally relevant synchronized recommendations. These facilities help retail businesses understand the marketplace trend as well as introduce changes in products to shift consumer preferences [9]. Additionally, by enhancing cross-selling and upselling capabilities and improving critical processes like customer service and relationship management, Artificial Intelligence (AI) helps retail firms boost online sales [10]. As a result, directly integrating AI into e-commerce transactions has several benefits that enhance online operations, increase productivity, and optimise e-commerce use [11]. This, however, has been fuelled by interest in the adoption of AI technologies by retailers, as it has an immense impact on the growth of e-commerce [12].

## REVIEW OF LITERATURE

This segment of the study classifies all schools of thought in related areas into three segments focusing on the conceptual framework of the recommendation system, its impact on buying behaviour, and its exploration through perception.

### Recommendation System (RS): Concept and Types

A well-built, precise recommender system is critical for e-commerce businesses to achieve success and profitability [13]. The main problem visitors and customers face on business sites, especially those selling clothing, is the presence of numerous, often nearly identical, products. This abundance may confuse the buying process, stretch out the buying cycle, and even confuse customers, sometimes driving potential buyers away from completing a purchase in the online store. Thus, an online retailer needs to implement a recommender system to address these problems [14]. Recommender systems assist customers in making a sensible purchase decision through the elimination of unnecessary options irrelevant to their needs, while at the same time offering them products of interest [15].

In this way, BARSs enhance shopping experiences, making it easier for customers to be satisfied during purchase and improving business efficiency [16]. Several recommender systems were developed to improve the precision and diversity of recommendations for end users [17]. Such developments would also enhance the overall effectiveness of recommendations toward better decision-making and customer satisfaction in an online shopping environment.

Despite the view that recommendations by RS lack credibility or knowledge about a particular thing as compared to other sources, they play a great role in the consumer decision-making process in the virtual world [18]. The availability of options *via* RS turns out to be very effective for decision-making at specific sites. This fact underscores that the value of product recommendations by intelligent agents increases when such systems interact with users during product evaluation. A good RS should therefore combine multiple sources of data to better support online shopping [19].

Thus, in this respect, the research points out three key perspectives: the recommendations generated by the RS, predictions of user preferences, and feedback from other community members [20]. According to researchers, recommender systems are the tools by which e-commerce platforms make purchase recommendations to customers. The recommendations may be considered based on several factors, including the top-selling items on the online

CHAPTER 3

# Mapping People Analytics for Strategic Human Resource Management

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**Abstract:** Managing human resources has undergone a trajectory of change from its evolution to the understanding of people analytics. The integration of People Analytics (PA) into Strategic Human Resource Management (SHRM) is reshaping the way organizations optimize workforce potential and achieve strategic goals. This paper explores the synergies between PA and SHRM, emphasizing the transformative role of data-driven decision-making in addressing contemporary human resource challenges. The theoretical underpinnings and methodological techniques for exploring the HR investments and performance linkages based on a technologically adaptive skill orientation are promising for bringing in a new perspective on micro-managing the challenges of the dynamic environment. Predictive analysis based on empirical estimates is where research is focusing and exploring, with a focus on longitudinal intra-firm research. This work aims to investigate the essential components that people analytics teams need in order to improve organizational performance through a narrative literature review. The findings and results of the study reveal that predictive analytics has the potential to significantly enhance strategic HR management by bolstering theoretical, contextual, and practical insights. Subsequent research can enhance academic understanding and guide effective implementation. Using data-driven decisions that require interdisciplinary collaboration among management, data science, information systems, and organizational psychology strengthens HR's position as a strategic partner.

**Keywords:** Organizational performance, People analytics, Strategic human resource management.

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## INTRODUCTION

In today's data-driven world, organizations are increasingly turning to analytics to gain insights into their operations. People analytics, a subset of this trend, applies data-driven approaches to understand and optimize human capital. By leveraging data from various sources, including HR systems, performance reviews, and employee surveys, organizations can make informed decisions about their workforce, leading to improved performance, increased employee satisfaction, and enhanced organizational effectiveness. The field of human resource management has undergone a significant transformation in recent years, with the emergence of data-driven approaches known as people analytics. People analytics, or HR analytics, refers to the systematic application of analytical methods to human resources-related data, enabling organizations to make more informed and strategic decisions about their workforce [1].

Innovation in human resource management is at the core of improving an organization's performance, creativity, and competitive advantage. Innovation in human resource management is about the dynamism of doing business in modern times. The conventional forms of HRM have evolved to become more strategic, technology-driven, and employee-friendly, constituting innovation in HRM [2]. As emphasized by most research studies, HRM is a function that can help an organization support innovation by properly linking employee capabilities and organizational purposes, providing a favourable environment for creativity, and offering high-involvement work practices to motivate employees to reach for the best. Among these emerging trends are HRM practices like decentralization, performance management, and technological integration. On the other hand, formal training, teamwork, and incentives are ways to foster creativity, which has also improved innovation in organizations. Furthermore, these methods improve productivity and are also important for long-term organizational growth as they enable effective management while remaining flexible regarding human capital. Therefore, innovative HRM practices are no longer an option but a necessity for organizations striving to maintain relevance and growth. By embracing creativity, technology, and employee empowerment, HRM fosters an environment that nurtures innovation, leading to improved organizational outcomes.

The growing importance of people analytics is driven by the rapid digitalization of work processes, which has led to an exponential increase in the volume, velocity, and variety of HR data [3]. By leveraging people analytics, the tech startup was able to identify the root causes of employee attrition and implement effective retention strategies. People analytics demonstrates the power of data-driven insights in improving organizational performance and employee satisfaction.

People analytics has the potential to revolutionize the way organizations manage their workforce. By leveraging data-driven insights, organizations can make informed decisions, improve employee performance, and enhance overall organizational effectiveness. However, it is crucial to address the challenges and ethical considerations associated with people analytics to ensure its successful implementation. As technology continues to advance, the future of people analytics is bright, offering exciting opportunities for organizations to unlock the full potential of their human capital.

HRM plays a role in stimulating innovation and creativity within the work environment. Creativity and innovation, which form the foundation of business survival, are perceived to reside within human resources. The challenge lies in the management of people and teams in such a manner that brings new ideas forward for implementation. It is HRM practices that form the core of influences on behaviours, with a double role for both the macro-level management of policy and micro-level employee engagement [4].

The biggest competitive edge for companies navigating the upheaval and uncertainty causing significant changes in today's workplace is employee and workforce insights. This is entwined with the increasing demand on the HR function to comprehend how workforce analytics drives performance and enhances the business. This chapter aims to investigate the essential components that people analytics teams need in order to improve organizational performance. Because of the fragmented nature of currently available data, it is challenging for firms to comprehend what successful people analytics execution requires. By laying the groundwork and providing particular recommendations for empirical research that connects people analytics to HR strategy, the study advances our understanding of the relationship between the two.

The study is significant because it highlights people analytics as a strategic HR tool and demonstrates how it can enhance workforce optimization, alter decision-making, and align talent management with organizational goals. By focusing on its effectiveness, the study highlights its role in advancing evidence-based, meaningful, and sustainable human resource strategies.

## LITERATURE REVIEW

In recent years, the integration of People Analytics (PA) into Strategic Human Resource Management (SHRM) has attracted considerable attention, as organizations increasingly acknowledge the importance of data-driven decision-making in improving workforce performance and meeting business goals [5, 6]. People analytics involves utilizing data, statistical tools, and predictive models to

CHAPTER 4

# Tracing the Journey of Machine Learning in Business, Management, and Allied Disciplines: A Comprehensive Review

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**Abstract:** This review provides a comprehensive evaluation of the role of Machine Learning in business, management, and related social sciences. Utilising a substantial sample size of 3682 articles from 53 years (1970-2023) from the Scopus database, this study meticulously traces the development of ML as a pivotal tool in the business sector. The analyses employ RStudios and VOSviewer software to identify prominent trends, influential contributors, and the thematic research landscape. One of the key findings is the significant uptick in ML research post-2020, reflecting the rapid adoption and diversification of ML techniques in response to global digital transformation. The study highlights "forecasting," "learning systems", and "learning algorithms" as the most preferred keywords, underscoring the emphasis on predictive analytics and the development of adaptive systems within the diverse ML field. The United States of America (USA), India, and China are the driving forces behind cutting-edge ML research in the business world. This study recommended a thorough examination of new research topics, questions, and keywords for the future that emphasize the convergence of machine learning, artificial intelligence, and other business domains. Ten major themes are identified by the analysis, demonstrating the wide range of possible business applications of machine learning and artificial intelligence. These themes include sentiment analysis, dynamic pricing, sustainable business practices, personalized marketing, and AI-driven human resource management. The study's novelty lies in its extensive longitudinal analysis of the integration of ML across business disciplines. This groundbreaking research stands out for its extensive temporal scope and dedicated focus on business disciplines. This study traces the evolution of ML from a niche research interest in the 1970s to a widely used tool with diverse applications in 21st-century business processes and strategic management.

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**Keywords:** Artificial Intelligence (AI), Business intelligence, Business applications, Comprehensive review, Machine Learning (ML), Predictive analytics.

## INTRODUCTION

Machine learning has revolutionised business practices by empowering organisations to effectively utilise large volumes of data for decision-making and operational efficiency [1]. Over the past decade, ML techniques have evolved significantly, offering capabilities that empower businesses to identify patterns, predict trends, and enhance performance through data-driven insights [2]. Integrating ML into business processes has led to advancements in diverse domains, including marketing [3], finance [4], human resources, and operations, shaping the modern business landscape. This growing integration of ML across various business functions has transformed industry practices and prompted scholars to define and explore ML concepts from multiple perspectives. Table **1** presents comprehensive definitions of ML from distinguished authors.

**Table 1. ML definition as per prominent authors.**

| Authors | Definition of ML |
|---|---|
| Sha (1993) | *"Machine learning involves deriving insightful knowledge from data, observations, or past solutions."* |
| Chaturvedi *et al.* (1993) | *"Machine learning is the automated acquisition of knowledge about a specific domain from available data. This process can be supervised or autonomously guided."* |
| Bose & Mahapatra (2001) | *"Machine learning definitively automates the process of acquiring knowledge through computational methods."* |
| Al-Omary & Jamil (2006) | *"Machine learning enables systems to improve through experience and aims to explore different learning mechanisms and their limitations."* |
| Helm *et al.* (2020) | *"Machine learning uses large datasets to train the machine to make independent recommendations or decisions."* |

*Self-Analysed.

The adoption of ML in business, management, and allied disciplines has gained considerable momentum, especially with the recent advancements in computational power, data storage [6], and algorithmic sophistication [5]. COVID-19 has hastened the adoption of AI-powered tools, leading businesses to reconsider traditional models and to utilise technology to build resilience. Consequently, the academic research community has been actively investigating the impact of machine learning on business strategies [7], customer interactions [8], operational efficiency [9], and overall competitiveness.

As a research method, a comprehensive review provides a systematic approach to examining the evolution, impact, and research trends within a specific field. Researchers can use it to visualise the intellectual framework of a specific field, identify influential authors, and explore the themes that drive research. A comprehensive study on machine learning can help readers understand the current status of research, identify areas that need attention, and plan future studies.

The motivations for conducting a comprehensive review stem from the exponential growth of ML research and its transformative impact on various business functions. As businesses increasingly adopt ML technologies to enhance decision-making, optimise operations, and drive innovation, it has become crucial to understand the dynamics of research in this domain. Despite the vast number of studies being published, there is a significant need for a comprehensive analysis that can effectively capture the entire scope of ML research in the business context, including emerging trends, collaboration patterns, and influential authors. A thorough review can help address this gap by providing insights into the evolution of research, identifying knowledge clusters, and mapping future opportunities. Such an understanding is vital for researchers, practitioners, and policymakers to navigate the rapidly evolving field, allocate resources effectively, and foster advancements that align with the needs of the communities.

This study aims to explore potential research questions on machine learning in business and related studies:

$RQ_1$: What are the significant trends and patterns in the publication of ML research within the said domain since its inception?

$RQ_2$: Which countries, institutions, and authors have significantly contributed to ML development in business research?

$RQ_3$: What are the key themes and knowledge clusters that emerge from the ML analysis?

$RQ_4$: What are the current gaps and underexplored areas in the literature that present opportunities for future research on ML?

This study aims to enhance understanding of the field by tracing the development of ML research, helping academics, practitioners, and policymakers recognise the opportunities and challenges presented by ML. The findings offer valuable insights into the areas where ML is being applied, the most popular methods and algorithms, and the interdisciplinary nature of its application. This study aims to underscore the transformative influence of machine learning on the future of business and management.

# CHAPTER 5

# Crime Count Prediction in India

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**Abstract:** Crime count prediction is essential for improving public safety and guiding law enforcement strategies. This chapter examines the effectiveness of various machine learning and time series models for crime prediction in India, focusing on the Autoregressive Integrated Moving Average (ARIMA) and Neural Network Autoregression (NNAR) models. We conduct a comparative analysis to evaluate the predictive performance of these models using metrics such as Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and Mean Squared Error (MSE). Our findings provide key insights into the strengths and limitations of each model, highlighting their applicability for crime prediction tasks in the Indian context. The results indicate that the NNAR model's ME is marginally higher than that of the ARIMA model. The average magnitude of the discrepancies between the expected and actual values is measured by RMSE. It provides a clear picture of the prediction performance and accuracy of the model. By more successfully identifying underlying patterns in crime data with fewer errors and more precise performance metrics, the ARIMA model exhibits its overall superior predictive ability. Moreover, this study offers valuable recommendations for law enforcement agencies and policymakers, demonstrating how machine learning and time series modeling techniques can be leveraged to forecast crime rates and optimize resource allocation for crime prevention in India.

**Keywords:** ARIMA, Crime count prediction, NNAR, Temporal analysis.

## INTRODUCTION

Crime is any act that violates the law in a particular location. It can refer to a wide range of offenses, including fraud, drugs, theft, assault, and much more. It can

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

cause harm to individuals, groups, and society as a whole. It can upend social order, endanger lives, and erode confidence. Any action or behavior that breaks the law and is dealt with by the legal system is considered a crime. An act that is criminal by law and is typically seen as wicked is generally understood to be a crime.

Predicting crime patterns is vital to law enforcement and public safety efforts, allowing authorities to allocate resources effectively and proactively address criminal activity. In contrast, time series models such as the Autoregressive Integrated Moving Average (ARIMA) and Neural Network Autoregressive (NNAR) models specialize in analyzing sequential data points over time. These models capture temporal dependencies and seasonality within crime data, enabling accurate forecasts based on historical trends (Fig . **1**). ARIMA, a traditional statistical approach, offers simplicity and interpretability, while NNAR models, powered by neural networks, excel at capturing nonlinear relationships and intricate patterns within the data. By assessing their predictive accuracy, computational efficiency, and practical usefulness, this study aims to guide law enforcement, policymakers, and researchers in selecting effective crime prevention strategies tailored to the Indian context, thus improving public safety.

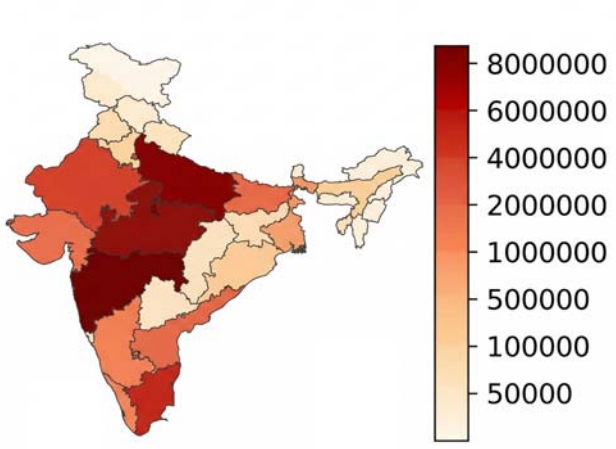


**Fig. (1).** Heat Map of Crime across India.
*Self-Analysed

A comprehensive overview of crime prediction techniques, focusing on their application and effectiveness in forecasting crime occurrences [1], states the logical utility of this approach in various applications. It was also proposed to

utilize spatial analysis to predict and monitor crime, demonstrating how geographic information enhances crime prediction models [2]. Crime pattern detection and prediction can be emphasized through data mining techniques, showing promising results for early detection of criminal activities [3]. Another study employs machine learning algorithms to detect and predict crime patterns, underscoring the growing role of predictive analytics in crime prevention [4]. A study demonstrates the effectiveness of clustering algorithms in predicting crime rates, providing insights into the relationship between crime types and locations [5]. A GUI-based system was developed to highlight the practical application of machine learning in predicting crime rates, making it accessible to law enforcement [6]. A comparative analysis of crime prediction methods is provided, showcasing the advantages and limitations of various techniques and offering a foundation for selecting appropriate algorithms [7]. Spatial and temporal analysis of crime hotspots is conducted to enhance crime prediction, illustrating the value of integrating different data types [8]. A few more studies explore crime analysis using data mining, highlighting the ability of these methods to discover hidden crime patterns and trends [9, 13]. A crime prediction model is developed using deep neural networks that demonstrates significant improvements in accuracy over traditional methods [10]. Crime prediction and analysis using machine learning techniques, with a focus on enhancing understanding of criminal behavior, are also studied [11]. A research work explained that trend analysis of crime rates in India reveals historical patterns and provides insights into socio-economic factors influencing crime [12]. Using spatio-temporal crime data for smart city applications contributes to more precise crime forecasting in urban environments; this study leverages big data analytics to visualize and forecast crime trends, showcasing the role of advanced data mining techniques in crime prevention [13, 14]. When it comes to predicting crimes, several statistical tools are used by practitioners, yet in this field what matters most is the robustness of these models. Basically, traditional methods like regression and correlation coefficients are used for this purpose. But, in today's AI era, upgraded models and software are used for this purpose. This present research work aims to test models like ARIMA and NNAR for predicting crime. Accordingly, the research design is prepared and discussed as follows.

## Data Source

The data used in this study consists of criminal records for India, with states and union territories. The dataset spans 1985 to 2022. This dataset only utilized data about crime counts under the Indian Penal Code (IPC). The Ministry of Home Affairs' National Crime Records Bureau (NCRB) publishes annual crime data in India.

# CHAPTER 6

# Leveraging Data Analytics for Sustainable Improvements in Employee Engagement and Organizational Culture

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**Abstract:** In today's dynamic business landscape, organizations are increasingly leveraging data analytics to enhance employee engagement and foster a thriving organizational culture. It explores how data-driven insights can be utilized to boost workforce morale, productivity, and retention by identifying key engagement drivers and promoting a positive work environment. Advanced analytics tools, such as sentiment analysis, performance metrics, and feedback systems, enable organizations to monitor employee sentiments and behaviours continuously. The study examines data analytics to boost employee engagement, identifying drivers, best practices, cultural impacts, and future trends such as AI for proactive, tailored organizational strategies. By integrating predictive modelling and machine learning, organizations can gain deeper insights into engagement trends, allowing for tailored interventions at the individual, team, and organizational levels. Such strategies not only improve workforce satisfaction but also contribute to better alignment between employee goals and organizational objectives. The ability to identify disengagement early and implement corrective measures enhances retention and productivity, fostering sustainable growth. The use of employee data requires ethical considerations. This paper examines the ethical implications of data usage in employee engagement strategies and suggests best practices to uphold fairness and respect. Clear communication about data collection and its purposes is essential to maintain employee confidence. The findings underscore the transformative potential of data analytics in human resource management. Implemented responsibly, data-driven approaches can significantly improve employee well-being, drive organizational success, and build a culture that adapts to the evolving needs of the modern workforce.

**Keywords:** Data driven, Employee engagement, Employee well-being, Organizational success, Workplace culture.

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

# INTRODUCTION

## Overview of Employee Engagement and its Significance for Organizational Success

Employee engagement refers to the emotional and mental dedication employees feel toward their work, colleagues, and organization. Engaged employees are passionate, driven, and willing to go above and beyond in their tasks. They align their personal goals with the company's objectives, fostering a strong connection between individual and organizational success. More employee engagement leads to numerous benefits for organizations. Engaged employees are more effective in delivering higher-quality work and driving innovation. They are also less likely to leave the company, resulting in lower turnover costs associated with recruitment, training, and lost productivity. Furthermore, engaged employees positively influence workplace culture, contributing to a collaborative and supportive environment that can enhance team dynamics and communication. From a customer perspective, engaged employees tend to deliver better service, which can improve customer satisfaction and loyalty. This, in turn, translates into increased profitability and a stronger market position for the organization.

Low engagement levels, on the other hand, can result in absenteeism, decreased productivity, and a disengaged workforce, all of which can negatively affect organizational performance. In today's highly competitive business landscape, promoting employee engagement is more than just a human resources responsibility—it is a strategic necessity. Organizations that focus on engagement are better positioned to attract and retain top talent, boost employee morale, and foster a resilient culture capable of adapting to change and uncertainty. In conclusion, employee engagement is a critical factor in achieving long-term business success, productivity, and sustainable growth. Through the identification of drivers, best practices, and cultural effects, this study investigates the role that data analytics can play in comprehending and improving employee engagement. It also looks at upcoming developments like AI and predictive modeling, providing more in-depth behavioral insights. These methods make it possible to implement proactive, customized strategies that promote dedication, creativity, and long-term organizational success.

## Role of Organizational Culture in Employee Satisfaction and Performance

The culture of an organization significantly impacts employee satisfaction and performance. A positive and supportive culture creates an environment where employees feel appreciated, connected, and driven. As [1] highlighted in a study, a rich organizational culture cultivates a sense of belonging, which directly affects

job satisfaction and loyalty. When employees resonate with the company's norms, they are likely to experience job satisfaction and achieve higher performance levels.

Culture also affects how employees collaborate and communicate. A transparent and inclusive culture encourages open communication and knowledge sharing, leading to enhanced team performance and innovation [2]. Employees trust their organization and feel their contributions are recognized; their motivation and productivity improve, which ultimately boosts overall organizational performance.

Conversely, a toxic or misaligned culture can have detrimental effects. Employees in negative cultural environments often report higher stress levels, lower satisfaction, and decreased commitment to their work, leading to poor performance and higher turnover rates [3]. Research [4] found that companies with a strong alignment between organizational culture and employee values tend to have higher retention rates and better performance metrics. Organizational culture is a critical driver of both employee satisfaction and performance. Organizations that invest in building a positive culture that aligns with employee values and fosters trust, collaboration, and recognition are more likely to see improved outcomes across the board.

## The Impact of Data Analytics on Modern HR Practices

Data analytics has revolutionized modern HR practices by enabling data-driven decision-making and improving efficiency across human resources functions. Traditionally, HR decisions were often based on intuition or anecdotal evidence, but with the rise of data analytics, organizations can now base decisions on factual, objective insights. According to Patel, R [5], HR analytics has transformed how companies manage talent acquisition, employee engagement, and performance evaluations, leading to more strategic and precise interventions.

By analyzing employee surveys, performance data, and behavioral patterns, organizations can identify key factors that influence engagement and predict potential turnover risks [6]. This allows HR teams to proactively address issues before they escalate, improving employee satisfaction and retention rates.

Moreover, data analytics has enhanced recruitment practices. Predictive analytics helps in identifying candidates with the highest potential for success within an organization, thereby reducing hiring errors and improving the overall quality of new hires [7]. Analytics also play a role in diversity and inclusion initiatives, enabling companies to track and address biases in recruitment, promotions, and pay equity.

CHAPTER 7

# Behavioural Analytics and Natural Language Processing for Data-Driven Business Insights

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**Abstract:** Behavioral analytics helps organizations understand human behavior to guide decisions on products and services. Much of the data managed by businesses is unstructured text, such as customer reviews and social media posts, which contains valuable insights. Natural Language Processing (NLP) techniques, including sentiment analysis, topic modelling, and named entity recognition, transform this data into actionable business intelligence. This work explores how NLP enhances behavioral analytics across marketing, customer service, and Human Resources. It also addresses challenges like data quality, privacy, and domain specificity, offering solutions to integrate NLP into analytics frameworks. Case studies show how companies use NLP to understand customer behavior, forecast trends, and refine strategies. The findings reveal that NLP and behavioral analytics improve decision-making by extracting insights from unstructured text using tools like sentiment analysis, topic modelling, and NER. Sentiment analysis tracks customers' emotions, with advanced models boosting accuracy. By combining behavioral analytics with NLP, organizations gain deeper insights into customer profiles, improving decision-making and operational efficiency.

**Keywords:** Business behavioural analytics, Business intelligence, Behavioural analytics frameworks, Natural language processing, Real-life case studies.

## INTRODUCTION

Organizations are realizing that data-driven decision-making is now essential rather than a luxury for businesses to be able to use massive volumes of data to inform their strategy [1]. By using data to analyse and interpret human behaviour, behavioural analytics helps companies make strategic decisions about customer engagement, product development, and marketing [2]. Customer reviews, social media interactions, emails, and internal conversations are examples of data that

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

can be insightful but challenging to analyse through conventional means [3]. This unstructured material has enormous potential to yield actionable intelligence, but to fully realize it, advanced analysis methods must be employed.

Through the use of sophisticated algorithms and machine learning methods, Natural Language Processing (NLP) allows businesses to handle and analyse large volumes of textual data, turning it into insightful business information [4]. Using techniques like named entity identification, topic modelling, and sentiment analysis, NLP can identify patterns and trends that guide strategic decision-making [5]. This chapter investigates the nexus between NLP and behavioural data analysis, offering an in-depth examination of the ways in which these two fields can complement one another to improve business insights. Starting with the essentials of behavioural analytics, we will look at how it may be used for a range of company operations, including marketing, customer support, and human resources [6]. Organizations must manage issues such as data quality, confidentiality concerns, and domain specificity to adopt these technologies [7]. The paper examines possible solutions to these problems and emphasizes the benefits of integrating behavioural analytics with NLP, such as improved decision-making, better customer experiences, and greater operational effectiveness.

Real-world case studies are cited to demonstrate how companies use Natural Language Processing (NLP) to anticipate market trends, gain a deeper understanding of consumer behavior, and refine their entire business plan in order to implement these concepts [ 8 ]. This chapter concludes by emphasizing that the integration of NLP and behavioral analysis is a revolutionary approach that could have a significant impact on business intelligence going forward, not just a fleeting trend. By leveraging the strengths of both industries, businesses can obtain a more comprehensive understanding of the values and characteristics of their clientele. In a market that is becoming more and more competitive, this can lead to intelligence-driven insights that spur growth and innovation.

## LITERATURE REVIEW

The intersection of behavioral analytics and Natural Language Processing represents a significant opportunity for innovation and deeper insights into consumer behavior. One of the primary challenges in the current landscape is the lack of effective methodologies for analyzing unstructured data, particularly various forms of textual data such as customer reviews, social media interactions, and forum discussions [9]. For instance, analyzing the language used in customer reviews can uncover not only what customers appreciate about a product but also what they find lacking, providing actionable feedback for businesses [10].

However, methods for extracting meaningful information from this type of data are still underdeveloped [11]. Therefore, a more nuanced approach to NLP that considers these variations is essential for enhancing the quality of insights derived from unstructured data [12]. While the theoretical frameworks for integrating NLP into behavioral analytics are established, there remains a lack of empirical studies that provide clear guidelines for implementation. Many organizations express interest in utilizing NLP to enhance their behavioral analytics capabilities, but lack a structured approach to doing so [11]. This uncertainty can lead to underwhelming results and a hesitance to invest in these technologies. Research that explores practical case studies and implementation strategies will be invaluable [13]. Moreover, understanding the pitfalls and challenges faced during these integrations could help mitigate risks associated with adopting new technologies.

Each sector, whether retail, healthcare, finance, or technology, faces unique challenges and opportunities that affect how behavioral analytics and NLP can be applied [12]. For instance, the regulatory environment in the healthcare industry might limit the types of data that can be processed, while the fast-paced nature of retail may require rapid sentiment analysis to respond to changing consumer trends [10]. By conducting industry-specific studies, researchers can develop tailored approaches that account for these unique characteristics. This granularity would enhance the relevance of findings for practitioners, enabling them to implement strategies that resonate more deeply with their specific operational contexts [13]. Most existing research provides a snapshot of the effectiveness of integrating NLP into behavioral analytics, but organizations operate in dynamic environments where factors can change rapidly [9]. Longitudinal studies would enable researchers to track the long-term impacts of these integrations, revealing how they adapt and evolve. For instance, a longitudinal approach could investigate how organizations refine their use of NLP as they collect more data and gain experience with the technology [11]. This could lead to insights into best practices for continuous improvement and adaptation in response to shifting consumer preferences and market conditions.

Such a roadmap could outline key steps for successful implementation: Data Collection and Preparation (Establishing best practices for gathering and preprocessing unstructured data to ensure high quality and relevance), Technology Integration (Identifying suitable NLP tools and technologies that align with the organization's goals and resources), Analytical Framework Development (Creating frameworks for analyzing insights from NLP in conjunction with behavioral analytics, allowing for richer interpretations of data). By focusing on unstructured data, empirical implementations, industry-specific nuances, and longitudinal perspectives, researchers can provide the insights

CHAPTER 8

# The Dawn of A New Era: Digital Currency and its Impact on Banking

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**Abstract:** In recent times, banks and other sectors have implemented substantial innovations in modern electronic payment systems. The Reserve Bank's initiative to foster a less-cash society has led to widespread adoption of digital payment methods in the country. Amidst the surge in electronic payment systems, digital banking stands out as a significant milestone in banking history. In today's landscape, banks are exploring innovative ways to differentiate their services. Considering this evolution in banking practices, the introduction of digital currency by banks as a mainstream alternative to physical currency could have far-reaching implications. This paper delves into the potential consequences of integrating digital currency as a standard form of currency alongside physical cash in banking and various transactions. It explores the implications of incorporating digital currency into everyday e-payment practices within the framework of digital banking. Furthermore, it investigates the effects of digital currency on the broader economy, questioning whether its adoption would be advantageous or detrimental to society. Additionally, the study examines how this technological shift in monetary transactions would impact the general public. The survey shows high familiarity with e-payment options, with 91.1% using them, 7.3% avoiding them, and 1.6% relying on others. Awareness ratings were 26.6% excellent, 62.1% good, and 8.9% fair. While 71.8% were aware of digital currency, only 39.5% understood it fully, 36.3% partially, and 24.2% not at all. In terms of investment, 23.4% had invested, 46% had not, 26.6% planned future investment, and 4% were unaware. Advantages were acknowledged by 64.5%, while 35.5% disagreed. Acceptance stood at 38.7% outright, 16.9% in disagreement, and 44.4% conditional on centralized assurance. Regarding economic impact, 44.5% were positive, 15.3% were negative, and 41.2% were uncertain.

**Keywords:** Bank, Bitcoin, Digital currency, E-payment systems.

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

## INTRODUCTION

Every country's banking sector serves as its economy's backbone, regardless of its development status. It strategizes and implements various monetary policies that shape the economic landscape. Any alterations or advancements in this domain, particularly through the adoption of technological innovations, can profoundly impact economic growth.

The Reserve Bank's initiative to foster a less-cash society has led to widespread adoption of digital payment methods in the country. Amidst the surge in electronic payment systems, digital banking stands out as a significant milestone in banking history. Despite the numerous benefits it offers to customers, online banking also presents several key challenges for marketers in the sector, prompting banks to prioritize the security of e-transactions. Consequently, efforts have been directed towards building a robust technological infrastructure to ensure the smooth functioning of essential payment and settlement systems nationwide.

In today's landscape, banks are exploring innovative ways to differentiate their services. Considering this evolution in banking practices, the introduction of digital currency by banks as a mainstream alternative to physical currency could have far-reaching implications [1].

As digitalization progresses, there has been a rise in privately issued digital currencies, lacking physical counterparts. It is crucial to differentiate between these private digital currencies and the digitalization of fiat money. Currently, there is no authorized entity with complete control over existing digital currencies in India, although the concept of digital currency remains a prominent topic in the economy. Therefore, by analyzing this trend and leveraging its positive impact on the economy, it may be possible to introduce digital currency in a centralized manner with regulatory oversight from the Reserve Bank of India.

## ABOUT DIGITAL CURRENCY

Digital currency, also known as cybercash, electronic currency, or electronic money, refers to currency that exists exclusively in electronic or digital form. Transactions involving digital currency are conducted through computers or electronic wallets connected to the internet or specific networks. Unlike traditional currencies, digital currencies often do not require intermediaries, making them a cost-effective means of trading currencies. They offer seamless value transfer and reduce transaction costs.

At the heart of digital currencies lies their blockchain network, which serves as a public ledger recording all transactions. Built on blockchain technology, digital currencies rely on this protocol for their creation and use as a viable form of money. The blockchain network maintains a record of all transactions, with new transactions grouped into blocks. These blocks undergo validation by multiple users across the network before being added to the chain. Miners play a crucial role in confirming transactions within new blocks by competing to generate unique cryptographic sequences called "hashes." Once a miner successfully completes a hash, the new block is confirmed, and the hash is stored alongside it. The blockchain protocol regulates the currency supply and controls inflation by adjusting mining difficulty and governing the issuance of new coins, ensuring that new blocks are added at a predictable rate as network hash power increases [2].

Digital currencies are stored in digital wallets when mined or transferred among users, where they remain until their new owner decides to use them. Digital currencies can be stored in these wallets securely for an indefinite period.

## Advantages of Digital Currency

- *Faster Transactions:* Digital currencies often settle transactions much faster than traditional methods like ACH or wire transfers, which can take days. This means faster access to your funds and quicker completion of purchases.
- *Lower Fees:* Transactions involving digital currencies often have lower fees compared to traditional financial institutions, especially for international transfers. This eliminates the need for intermediary fees and saves you money.
- *Accessibility:* Anyone with an internet connection and a digital wallet can access and use digital currencies. Thus, financial inclusion is promoted by opening up these financial services to unbanked and underbanked individuals.
- *Security:* Digital currencies like Bitcoin utilize blockchain technology, offering a high level of security and transparency. Transactions are encrypted and publicly recorded, making them resistant to fraud and counterfeiting.
- *24/7 Availability:* Digital currency markets operate 24/7, unlike traditional banks. This allows for instant transactions and greater flexibility in managing your finances.

## Disadvantages of Digital Currency

However, in spite of its tremendous benefits, there are several issues that raise serious concerns and need to be adequately addressed to ensure the safety and security of the stakeholders' investments. These are shown in Fig. (**1**). Among all the disadvantages, the prime concerns are the high risk involved in digital

CHAPTER 9

# Exploring the Role of AI in Enhancing Academic Performance: A Study on Management Students of Odisha

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**Abstract:** In today's world, Artificial Intelligence has become extremely important, as it has the power to revolutionize many industries, including the educational sector. Student feedback on educational services is crucial since they are the ones who will ultimately benefit from it. Improved student accomplishment, attitudes towards learning, study motivation, and learning methodologies are some of the aspects that are focused on in this investigation of the link between AI and students' academic performance. It also aims to evaluate and investigate how Artificial Intelligence enhances students' ideas and creative thinking. Snowball sampling was used to select 104 respondents, based on preset parameters. The results imply that almost all identified variables are positively related, and that AI successfully meets the unique learning needs of students, resulting in more thorough and improved educational experiences. AI identifies students with academic difficulties and provides them with the support and treatment they need to improve. Furthermore, AI offers accurate assessments and enhancements for students' attitudes towards learning, leading to a more comprehensive comprehension of the learning process. Additionally, it boosts students' enthusiasm for learning and their study habits. AI's adaptive learning techniques provide students with insightful feedback and guidance for their learning. Moreover, the adaptive learning features of AI provide valuable feedback and guide students on their learning journeys.

**Keywords:** Artificial intelligence, Academic process, Educational sector.

## INTRODUCTION

With major improvements in "computing power, increasingly sophisticated algorithms, and the ability to process enormous volumes of data, artificial intelligence represents a new level of scientific and technological development

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

that will fundamentally change how the world functions as we know it" [1]. In the current situation, the application of Artificial Intelligence in the educational sector is becoming more receptive and flexible in creating a learning climate that improves students' learning and fulfills their requirements. Artificial Intelligence deals with robotic technologies that combine cognitive functions with human intelligence. Education is one of the numerous sectors that artificial intelligence has impacted. The higher education department is also affected by it, since "universities are the main producers of highly trained labour and knowledge and are vital in the development of societies and economies based on knowledge" [2]. Students should be placed at the core of a value creation process as active participants and co-creators of services, according to the service-dominant logic and co-creation; they can even be viewed as customers.

In order to make the use of AI in education simpler and more student-centered, it is important to understand students' characteristics. This is because AI technology has the ability to impact the student experience. Artificial intelligence technologies may one day make it easier to tailor lessons and course materials to each student. Students' diverse backgrounds necessitate a deeper comprehension of their learning requirements, which means that instructional materials must be tailored to meet those needs [3]. With an emphasis on the educational process, some researchers have examined artificial intelligence from the viewpoint of the students. Several studies looked at how students felt about artificial intelligence in the classroom. According to the results of these research studies, most people think AI will be a good thing for schools. Furthermore, the perceived advantages and disadvantages of AI in the classroom were also investigated. Regarding the learning experience, students mainly appreciated the presence of the virtual assistant. When considering learning itself, the key benefit recognized was universal access, whereas, in terms of the assessment process, many students pointed out continuous feedback as the principal advantage. One of the main limitations of AI is the decrease in interaction between teachers and students.

## LITERATURE REVIEW

### Artificial Intelligence in Education

The term "Artificial Intelligence" is often thought of in conjunction with computing devices. An analysis of different articles, particularly those focusing on education, indicates that while computers have played a crucial role in AI development, it is more than just hardware, software, or technology. "The advent of embedded computers, sensors, and other emerging technologies has facilitated the incorporation of artificial intelligence into machines and various entities, including structures and robots, which together provide a dual definition and

characterization of AI" [4]. "Artificial Intelligence (AI) is a branch of computer science dedicated to tackling various cognitive challenges generally associated with human intelligence, such as learning, problem-solving, and pattern recognition, while also enabling adaptation". "As a theoretical framework, AI guides the creation and use of computer systems that exhibit human-like abilities, particularly intelligence and the capability to perform tasks that require human intelligence, including visual perception, speech recognition, decision-making, and language translation" [4].

## Artificial Intelligence in Higher Education

From various research studies, it is clearly evident that AI tools and techniques improve writing quality and students' academic performance. Several studies have brought attention to the significance of AI writing tools for universities. The impacts of Grammarly, an AI-based grammar and style checking tool, on the writing abilities of undergraduate students were studied by several studies [5, 6]. The results showed that compared to the control group, students whose assignments included Grammarly had more grammatical correctness and higher-quality writing. Researchers have looked at how well AI language models, such as ChatGPT, can guide students as they write [7, 8]. Studies have found that graduate students used ChatGPT to help them draft their research proposals. The results showed that AI-generated content was useful for generating initial ideas and organizing suggestions; however, students needed to refine and elaborate on the material produced. Researchers [9, 10]surveyed students to find out what they thought about AI tools and how they understood how to utilize AI-generated material correctly. The results underscored the necessity for adequate teaching and instruction on the utilization of AI tools to prevent plagiarism and uphold academic integrity.

## Effect of AI on Students' Thought Process

Education is only one of several areas where Artificial Intelligence (AI) is having an enormous effect. As AI becomes increasingly integrated into the academic landscape, it is profoundly influencing how students think, learn, and approach problem-solving. One of the most significant ways AI affects students is by enhancing access to information. With AI-powered tools like search engines, virtual tutors, and personalized learning platforms, students can quickly retrieve vast amounts of data and receive immediate feedback. This speeds up the learning process, but it can also make students more reliant on AI for answers, potentially reducing their willingness to engage in deep, critical thinking. When information is readily available, the temptation to seek quick solutions might discourage the

CHAPTER 10

# Balancing Transparency and Ethics in Behavioural Analytics for Business Insights

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**Abstract:** Businesses may improve operations, tailor consumer experiences, and hone their strategy by analysing enormous volumes of data. But there are serious ethical questions raised by the growing use of behavioural analytics, especially regarding consent, privacy, and the potential for manipulation. This chapter explores the delicate balance between leveraging data for valuable business insights and maintaining ethical standards, with a focus on transparency. The chapter outlines strategies for transparency in data practices, emphasizing clear communication on data collection, usage purposes, and safeguards to protect consumer information. Additionally, it addresses the need for businesses to be accountable and to adopt practices that prioritize consumer welfare alongside business objectives. The chapter also discusses regulatory frameworks that govern data use, such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), and their implications for businesses that employ behavioural analytics. The findings reveal that ethical behavioural analytics fosters trust, strengthens brand loyalty, and supports sustainable growth. Balancing data-driven insights with privacy protection encourages consumer partnership, enhances transparency, and aligns corporate values with societal expectations, ensuring innovation while safeguarding individual rights in an increasingly data-dependent business environment. It concludes that businesses should integrate ethics into their behavioural analytics strategies, balancing insights with ethical practices to achieve objectives while fostering trust-based, long-term customer relationships.

**Keywords:** Behavioural analytics, Business insights, CCPA, Data ethics, Data regulation, Ethical data practices, GDPR, Transparency.

## INTRODUCTION

In today's commercial world, behavioural analytics is a powerful tool that involves gathering, analysing, and interpreting data on the interactions, behaviour,

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

and patterns of customers. Extraction of actionable insights that can inform company decisions and enhance customer engagement, retention, and overall business success is the main objective of behavioural analytics [1, 2]. Businesses can better understand client preferences, forecast future behaviour, and adjust their tactics to better suit the demands of their target audiences by analysing vast, diverse data.

Many different sources of data are employed in behavioural analytics, which enables the creation of a full picture of client behaviour. Usually, these sources consist of online activity, wherein information about page views, click-through rates, and duration spent on particular pages is examined to ascertain the elements of a website that captivate users. Through likes, shares, comments, and total follower growth, social media interactions also reflect trends in customer sentiment, engagement levels, and brand perception. Additionally, companies can monitor consumer preferences and loyalty over time by tracking purchasing habits such as transaction history, frequency of transactions, and average order value [3]. Chat logs, call centre transcripts, and feedback forms are examples of customer service interactions that offer valuable insights into consumer satisfaction levels and point out areas where organizations can enhance their service offerings.

The capacity of behavioural analytics to handle and interpret massive amounts of data utilizing cutting-edge technologies like big data analytics, Artificial Intelligence, and machine learning is one of its main advantages [4, 5]. In today's digital age, where vast and increasingly complex amounts of data are generated daily, these technologies have become indispensable. In data, machine learning algorithms can automatically spot correlations and patterns that human analysts might not notice right away. This makes it possible to continuously improve business plans based on current information.

Machine learning algorithms, for instance, can provide personalized product suggestions for businesses by analysing client purchasing behaviour to forecast what a customer is likely to buy next. By automating decision-making based on these data, AI further improves this process and enables businesses to respond swiftly to the demands and preferences of their customers. Big data analytics is essential because it helps companies handle, store, and analyse massive volumes of data from many sources in an effective and scalable manner.

For firms, behavioural analytics offers several important advantages. Firstly, it gives businesses a comprehensive grasp of customer preferences, allowing them to tailor their advertising efforts, product lines, and clientele. Secondly, it assists companies in recognizing patterns in consumer behaviour, which enables them to predict future demands and changes in the market and maintain an advantage over

rivals [6]. Thirdly, by detecting inefficiencies or bottlenecks in the client journey, it helps companies optimize their operations. In the long run, behavioural analytics gives companies the ability to make data-driven decisions that improve customer satisfaction and boost overall company performance, resulting in an operations strategy that is more specialized, effective, and customer-focused.

The study can be divided into 3 segments. The first part deals with highlighting the importance of modern business and behavioural analytics. The second part deals with focusing on challenges faced by citing selected case studies. The third part deals with the regulatory environment and concludes the strategies that help in strengthening customer-preferred relationships. A wide range of literature related to the theme of the paper is discussed and cited in the appropriate places.

## IMPORTANCE IN MODERN BUSINESS

Success in the fiercely competitive corporate world of today depends on having a solid understanding of consumer behaviour. In order to better retain customers, customize consumer experiences, and provide goods and services that cater to particular demands, behavioural analytics is essential for businesses. Predicting consumer trends and industry shifts helps businesses to drive innovation, optimize marketing campaigns, and streamline operations. Furthermore, behavioural analytics improves decision-making by offering data-driven insights, which are critical for maintaining competitiveness and agility in a market that is rapidly changing. Businesses that successfully apply behavioural analytics frequently observe increases in profitability, operational effectiveness, and customer happiness [7, 8].

Understanding consumer behaviour has become essential for achieving success and preserving a competitive edge in the fast-paced, fiercely competitive commercial world of today. Businesses today have access to previously unheard-of volumes of data due to the growing digitization of consumer interactions. Proper analysis of this data can provide profound insights into the preferences, habits, and decision-making processes of customers. At the forefront of this change is behavioural analytics, which is essential to an organization's ability to tailor its offerings, adjust to the demands of its clients, and make wise strategic choices.

One of the primary benefits of behavioural analytics in modern business is its ability to personalize customer experiences. Businesses that employ behavioural analytics can use information from online activity, buying patterns, and customer feedback to give individualized recommendations, offers, and messages in a market where consumers demand highly customized interactions. To boost

# CHAPTER 11

# Integrating Digital Technology to Overcome Tourist Difficulties in Puri: A Solution-oriented Approach

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**Abstract:** The Jagannath Temple in Puri, Odisha, is one of the holiest pilgrimage sites in India and a key destination in the sacred Char Dham circuit of Hindu culture, attracting millions of devotees annually. The Puri Jagannath Temple faces overcrowding, inadequate infrastructure, safety concerns, environmental issues, and post-pandemic travel hesitancy, affecting the spiritual experience. This study explores using digital technology to address these problems. A survey of 200 Generation Z respondents during the holy month of Kartik assessed the feasibility of a mobile app for managing temple visits. Strengths include personalized experiences, reduced physical contact, and streamlined access. Weaknesses include technological limitations, digital literacy challenges, and privacy concerns. Opportunities for crowd management and virtual booking are noted, while threats include technical glitches and resistance from traditional pilgrims. Results show that a Darshan Booking App can simplify booking, provide real-time information, and manage crowd density despite technical issues and privacy concerns. The findings highlight the need for targeted improvements for the app's success and broader adoption. The novelty of this paper lies in its pioneering approach to integrating digital technology for managing religious tourism activities at the Puri Jagannath Temple. Unlike previous studies that primarily focus on traditional management methods, this research investigates the feasibility and effectiveness of a Darshan Booking App, offering a comprehensive solution to mitigate challenges like overcrowding, safety concerns, and accessibility issues.

**Keywords:** Experience enhancement, Gen Z, Jagannath Temple JEL: Z32, Overcrowding, Religious tourism, Z12, O33.

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**Shradhanjali Panda, Leena Priyadarshini Singh, V. Ramasamy & S. Balamurugan (Eds.)**

## INTRODUCTION

Puri, renowned for the iconic Shri Jagannath Temple and its expansive golden beach, is one of the holiest destinations in India. It is part of the sacred Char Dham pilgrimage circuit, alongside Dwarika, Badrinath, and Rameswar. Known as Purushottama Kshetra, Puri is the abode of Lord Jagannath, his sister Devi Subhadra, and his elder brother Lord Balabhadra [1]. These revered deities are enshrined on the Ratna Simhasana, a bejeweled pedestal within the temple. The Shri Jagannath Temple, an architectural marvel built in the 12$^{th}$ century by King Ananta Varman Chodaganga Deva of the Ganga Dynasty, stands as one of Odisha's most significant monuments. Located by the sea, this magnificent temple is designed in the Kalinga architectural style and rises 65 meters above the ground on an elevated platform. Throughout the year, Puri hosts numerous vibrant festivals in honor of Lord Jagannath, attracting devotees and tourists from around the world [2]. Tourists visiting the Puri Jagannath Temple, one of the four significant religious sites in India, face several challenges that hinder their pilgrimage experience [3]. These difficulties stem from infrastructural limitations, environmental issues, and management of large crowds, all of which can diminish the sanctity and safety of the site. One of the major challenges identified is the overwhelming number of visitors, especially during peak religious events, which results in overcrowding. This not only causes discomfort for the tourists but also puts pressure on the existing infrastructure. The temple's limited space and the surrounding area's inadequate facilities exacerbate this problem, creating a chaotic environment that detracts from the spiritual experience [4, 5]. Efforts to improve infrastructure are ongoing, but remain insufficient to handle the volume of pilgrims [6]. Tourists also face safety concerns, particularly related to the temple's vulnerability to natural disasters. As Puri is located in a cyclone-prone region, safety measures for both devotees and visitors need to be robust. Inadequate preparedness for such events can cause panic, and recent cracks in the temple's boundary wall highlight the need for urgent restoration [7]. Furthermore, the risk of natural calamities like earthquakes or storms often leads to temporary closures or disruptions in temple activities, affecting the pilgrimage experience [8]. Environmental degradation in and around the temple site also poses significant challenges. Pollution, poor waste management, and the degradation of surrounding heritage sites reduce the aesthetic and spiritual appeal of the area. The poor condition of the local environment, especially air and water pollution, negatively affects both visitors' health and the temple's sanctity [9]. This ongoing degradation diminishes the overall tourist experience and raises concerns over sustainable tourism practices [10].

The COVID-19 pandemic led to a significant decline in the number of tourists visiting the temple, with many pilgrims hesitant to return due to health concerns.

This change in travel behavior, along with ongoing fears about overcrowding and inadequate health protocols, has continued to affect tourism recovery [11]. This travel avoidance has further strained the temple's economic model, which heavily relies on pilgrim tourism. A critical challenge discussed in the literature is finding a balance between facilitating tourism and maintaining the spiritual and religious sanctity of the temple. The influx of tourists, particularly non-devotees, has led to concerns that the temple may become too commercialized, thereby diminishing its sacred atmosphere. The pressure to develop more tourism facilities often conflicts with the temple's cultural and spiritual heritage [12 - 14].

## RELIGIOUS TOURISM IN DIGITAL INDIA

Technology significantly shapes religious tourism in India, playing an essential role in crowd management, visitor experience, infrastructure, and safety. During large religious gatherings like the Kumbh Mela and Hajj, technologies such as Radio Frequency Identification (RFID), mobile applications, and wireless networks assist authorities in tracking crowd density and movement, helping prevent overcrowding and reduce the risk of stampedes. These tools enable real-time updates, allowing event managers to respond swiftly to ensure public safety and enhance the overall visitor experience [15]. Furthermore, digital tools like mobile apps and virtual reality have transformed how visitors engage with religious sites. These tools improve accessibility by offering navigation assistance, information on rituals, and virtual tours that deepen pilgrims' connections to sacred spaces before they arrive, contributing to a more informed and fulfilling pilgrimage experience [3].

Smart infrastructure is also a priority, as seen in policies like the Odisha Tourism Policy 2022, which promotes digital tourism to create seamless visitor experiences. Efforts include digital payment systems, automated check-ins, and interactive kiosks at major tourist locations, which together aim to create a responsive tourism ecosystem that aligns with sustainable tourism practices [8]. Health monitoring systems are also crucial, especially during events with high-density gatherings, where technology assists in emergency medical responses and the management of communicable diseases. Data analytics and digital health monitoring enhance safety by supporting timely interventions, especially in events with heightened health risks [15].

Additionally, government programs such as PRASAD (Pilgrimage Rejuvenation and Spiritual Augmentation Drive) and Swadesh Darshan are embedding technological advancements to develop and conserve pilgrimage sites. These initiatives enhance infrastructure, support public-private partnerships, and safeguard heritage through digital tools, making spiritual tourism in India both

# SUBJECT INDEX

## E



## F



## G



## H



## I



## K

## L



## M



## N



## O



## P



## R



## S

## T



## V

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- Three Lifetime Achievement Awards;
- Dr. A. P. J. Abdul Kalam Sadhbhavana Award from Hon. Balmiki Prasad Singh, Former Governor of Sikkim, India;
- Jewel of India Award from Mr. Gurpreet Singh, General Secretary, India;
- Star of Asia Award from Mr. Korn Debbaransi, Former Deputy Prime Minister, Thailand;
- Pride of Asia Research Excellence Award from Hon. Anant V. Sheth, Deputy Speaker, Goa Legislative Assembly, India;
- CSI Young IT Professional Award;
- National CSI Youth Award.