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ARTIFICIAL INTELLIGENCE AND RETAIL INDUSTRY: A COMPREHENSIVE REVIEW AND FUTURE RESEARCH DIRECTIONS

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Abstract: With the rise of Big Data, advanced algorithms, simulation modelling, machine learning, social media analysis, and enhanced computational capabilities, Artificial Intelligence (AI) has gained widespread popularity. The present study offers a comprehensive bibliometric analysis of the multifaceted relationship between artificial intelligence (AI) and the retail industry. The diverse contributions of AI across various facets of retail operations are illustrated with the help of thematic analysis, co-occurrence of keywords and tree map. The initial search resulted in a total of 1141 articles from Scopus database covering the period from 2000 to March 2024. From these, 266 articles were selected for the final study based on their relevance. The data has been anaylsed by using software VOSviewer and Biblioshiny. Thematic exploration unveils critical themes such as AI adoption impacts, ethical considerations, customer behavior analysis, inventory optimization, decision support systems, interdisciplinary collaboration, transparency, explainability, sustainability, and the emergent role of blockchain in retail operations. The analysis identifies five distinct clusters, including AI applications in retail behavior, innovative machine learning applications, predictive intelligence hubs, strategic decision-making for

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profitable sales, and innovative retail data processing, highlighting the diverse areas where AI augments traditional retail practices. Interdisciplinary collaborations between AI and other fields, focus on transparency, application of AI for promoting sustainability, and blockchain technology would ensure customers trust. Notwithstanding the inherent limitations of scope and methodology, the study provides insightful information about the ever-evolving field of artificial intelligence in the retail industry, establishing the framework for further research and strategic developments in this field.

Keywords: Bibliometric analysis, Artificial Intelligence, Retail Industry, Consumer Interaction, Blockchain Technology, Strategic Planning

JEL Code: L81, O33, M31, L86

I. INTRODUCTION

In today's world, with the rise of Big Data, advanced algorithms, simulation modelling, machine learning, social media analysis, and enhanced computational capabilities, AI has gained widespread popularity (Singh et al., 2019; Syam & Sharma, 2018). It is now deeply integrated into digital frameworks, notably influencing human decision-making processes. Consequently, there's a growing need for information systems researchers to delve into AI's effects on decision making, both theoretically and practically, to support its continued development and successful implementation (Duan et. al., 2019). Various research studies have been conducted to tap the progress of AI in various fields of businesses whether is it Education, Health, Travel, Real Estate, Fashion, Hospitality, Banking and Financial services, Retail and E commerce and many more. But since, it is a fact that AI was there, is there and will be there and according to the various surveys conducted, it was revealed that it's usage and adaptability will going to be increased day by day in future (Asia, I., 2019, Bhutani & Wadhwani, 2019) and also, it is observed that here is a scope for systematic and comprehensive review of AI applications in businesses. We chose AI in retail as the research study due to its profound impact on contemporary commerce.AI encompasses various technologies like machine learning and predictive analytics, which enable the collection, processing, and analysis of large volumes of data. By leveraging this data, AI can provide insights and predictions that assist retailers in making informed and data-driven business decisions (Bughin et al., 2017).

1.1. Evolution of AI in Retail

The evolution of AI in the retail sector has been characterized by notable milestones that have established its importance within the industry. It commenced with the advent of expert systems during the 1980s, seeking to replicate human decision-making within computer system. This foundational era set the stage for AI's integration into various aspects of retail operations.

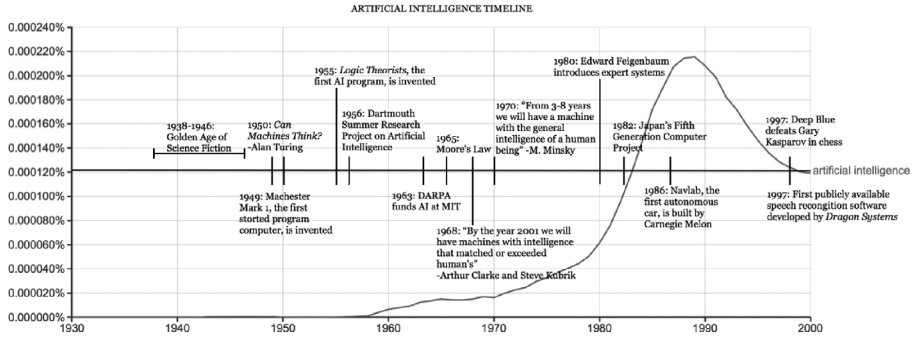

Figure 1: Timeline of Artificial Intelligence

Source: Anyoha. R. (2017)

The surge of the internet during the 1990s and early 2000s (Figure 1) proved instrumental in advancing AI within the retail landscape, notably in the domain of personalized recommendations (Pereira et al., 2022; Khatri, 2023). This period witnessed the early utilization of AI to enrich customer interactions by offering customized product recommendations and streamlining search capabilities (Pratama et al., 2020).

Entering the 2010s, AI underwent a substantial shift from a specialized tool to a widely adopted business asset in retail. Progress in machine learning was pivotal, facilitating intricate tasks like image and speech recognition. Retailers started harnessing AI for various purposes, from inventory control to customer service via chatbots, and precision-targeted marketing endeavours (Bala, 2012[b]).

In the present day, AI stands as a cornerstone of retail, providing a diverse spectrum of applications spanning operational streamlining, strategic planning, and customer interaction. Emphasis now lies on sophisticated AI features like natural language processing, predictive analysis, and autonomous functionalities, fundamentally transforming how retailers engage with customers and oversee their operations (Wei et al., 2020).

Further the paper is structured as follows: The Introduction is discussed in the first section followed by literature background of the study in the second section and on the basis of literature background, research questions are formed. The Research Methodology is presented in third section where bibliometric analysis, data base choice, extraction and data cleaning are elaborated. The results and analysis including Publication Trend, Citation Trend, Keywords' Based Analysis generated using VOSviewer software, Tree Map generated using Biblioshiny, and Thematic Map based on the bibliometric analysis discussed in fourth section. Section fifth presents future research area identified by different authors on the basis of thematic areas. Finally, conclusion is presented in sixth section which includes future areas of research and policy implications of the study.

II. LITERATURE REVIEW

Artificial Intelligence encompasses algorithm-based machines designed to learn from data through various techniques like artificial neural networks, machine learning, robotic process automation, and text mining (Huang & Rust, 2018,(Wei *et al.*, 2020), (Khatri, 2023)).

Looking towards the future, AI trends in retail are set to catalyze continued innovation and evolution within the sector. Concepts like AI-powered omnichannel retailing to deliver tailored experiences, hyper-personalization via dynamic customer profiles (Daqar and Smoudy, 2019), and improved inventory management through predictive analytics are poised to reshape the retail landscape, offering enhanced shopping experiences for both consumers and retailers through AI-powered automated stores (Pillai *et al.*, 2020a). Retailers can offer tailored product recommendations and customized discounts, enticing customers and boosting sales (Ionuț Anica-Popa, Liana Anica-Popa, Cristina Rădulescu and Marinela Vrîncianu, n.d.).

Furthermore, studies have addressed the societal implications of potential job displacement due to AI technologies. Risse (2019) and (Sun & Medaglia, 2019) suggested that AI poses challenges to human workers, potentially altering the nature of work and affecting individuals' societal roles. Moreover, trust deficits and ethical concerns surrounding AI systems and their utilization of shared data are evident among individuals and organizations (Sun and Medaglia, 2019). To counteract this, regulators

should take a collaborative approach to ensure regulations keep pace with technological advancements and establish adequate policies, regulations, ethical guidelines, and crafting a legal framework to prevent misuse of AI in different fields (Duan et al., 2019). (Ionuț Anica-Popa, Liana Anica-Popa, Cristina Rădulescu and Marinela Vrîncianu, n.d.)highlighted that in addition to numerous advanced solutions and advantages, AI introduces risks within various sectors of the retail industry. As AI technologies are increasingly integrated and their potential applications expand, both governmental bodies and organizations face notable challenges in managing their implementation (Dwivedi *et al.*, 2021a).

Based on this, scope to do a comprehensive review of Artificial Intelligence in Retail Industry using bibliometric analysis method is identified. Bibliometric Analysis is a science that analyses bibliographic data with quantitative tools and help researchers to effectively handle large amounts of data, enabling more accurate analysis and decision-making processes (Donthu et al., 2021; Goel et al., 2022[b]). Based on the literature review, the following research questions are identified:

- RQ 1: How has the research landscape on artificial intelligence in retail industry evolved over time?
- RQ 2: What are the key research themes and emerging areas within the field of AI and retail industry?
- RQ 3: What are the potential future directions for research on AI in retail industry?

III. REASEARCH METHODOLOGY

3.1. Bibliometric Analysis

The method of bibliometric analysis is utilized to explore the subject of AI in the retail sector. Bibliometric analysis is a scientific approach that employs quantitative tools to analyze bibliographic data, allowing researchers to manage large datasets without introducing bias (Donthu et al., 2021; Goel et al., 2022[b]). The performance analysis facilitates the visualization of developmental trends in the field, as well as identifying prominent authors, institutions, and countries. Author-provided keywords are utilized to encapsulate the central theme of the study.

3.2. Database Choice

To make the comprehensive review of literature on Artificial Intelligence in retail industry, Scopus database is used in the present study. (Donthu *et al.*, 2021) recommended to select one suitable database in order to reduce the necessity for consolidation, (Singh *et al.*, 2021) stated that 99.11% of the journal indexed in Web of Science are also indexed in Scopus and (Tanwar and Verma, 2024) observed that Scopus has 60% more inclusion than Web of Science. Additionally, advanced search functionalities of Scopus database ensure a focused approach towards the most relevant research through filters like publication dates and specific keywords.

3.3. Extraction and Data Cleaning

3.3.1. Search Query

Bibliometric information was collected using the keywords 'Retail' 'Artificial Intelligence' 'Sales' 'Retail Stores' 'Commerce' 'Electronic Commerce' 'Retailing' 'Machine Learning' 'Artificial Intelligence Technologies'. The combination of these keywords has been used to retrieve information from the Scopus database.

3.3.2. Search Results

The initial search resulted in a total of 1141 articles from Scopus database. The results that contain information such as paper title, abstract, authors, publisher among others was obtained in comma separated value (CSV format).

3.3.3. Refinement

The inclusion and exclusion criteria were applied to the initial search results. The inclusion criteria are given below.

(a) IC1- Papers published under subject area 'Business, Management, Accounting, Economics, Computer Science' only.

(b) IC2- Papers written in English only

(c) IC3- Only research articles to be included.

The exclusion criteria were-

I. EC1- Papers not fulfilling the objectives of the study.

II. EC2- Conference proceedings, chapters in edited books and editorials were excluded.

The period of the study was 2000- March, 2024. The procedure for final selection of the studies is depicted in flowchart as shown in Figure 2 below.

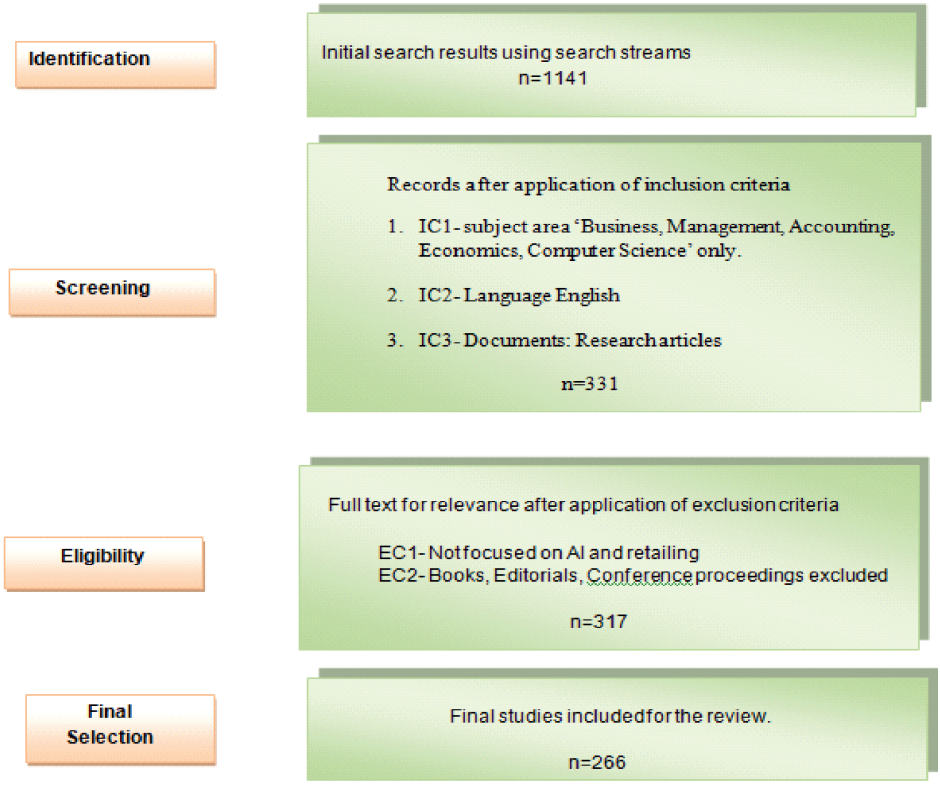

Figure 2: Flowchart Depicting Selection Procedure (Created by Authors)

This study is based on a bibliographic analysis, which offers an extensive and structured approach for understanding the progression and status of research comprising application of artificial intelligence in the retail industry. VOSviewer offers a graphic representation of the research landscape, and bibliographic analysis enables an extensive understanding of the theoretical and practical underpinning of AI in retail.

This rich pool of literature allowed to trace the historical development of research themes, analyze publication trends over time (RQ1), and identify prominent research questions and areas of focus. Additionally, content analysis

of these studies enabled to extract key themes and emerging areas within the field of AI and retail. Thematic maps and word tree maps provide a clear and intuitive overview of the relationships between different AI technologies (RQ2). By critically examining the literature, potential gaps and under-explored avenues are identified, paving the way for future research directions (RQ3). Overall, the bibliographic technique offers a valuable foundation for mapping the research landscape, identifying key trends, and charting a course for future exploration within the dynamic field of application of Artificial Intelligence in retail sector

IV. DATA ANALYSIS AND RESULTS

4.1. Publication Trend

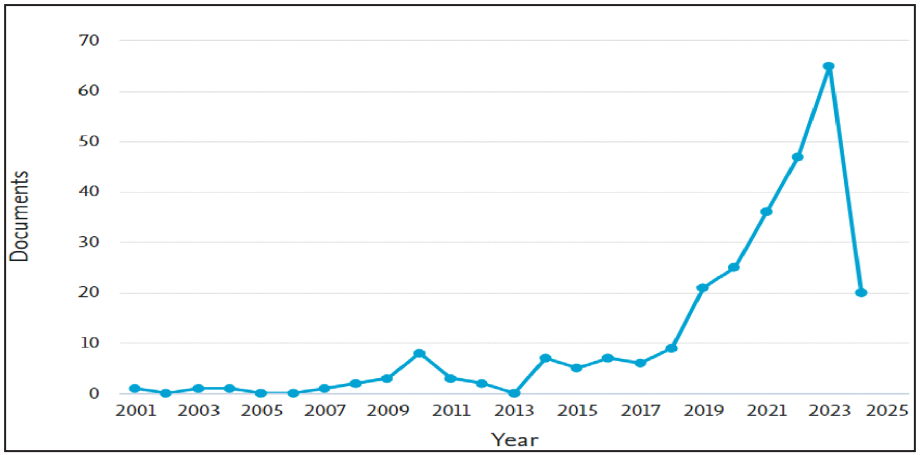

Figure 3: Publication Trend

Source: Scopus Data Analysis

As depicted in figure 3, the no. of the articles on AI in retail is increasing 2017. There has not been much work on it for several years. With the growth in AI since 2017, academic work on AI in retail has started to progress, as evidenced by the figure. Major articles (65) are published in the year 2023.

4.2. Citation Trend

As shown in the Figure 4, it was observed that the number of citations per year has generally increased over time, with some fluctuations. The average number of citations per year has also increased over time, but it is more variable than the

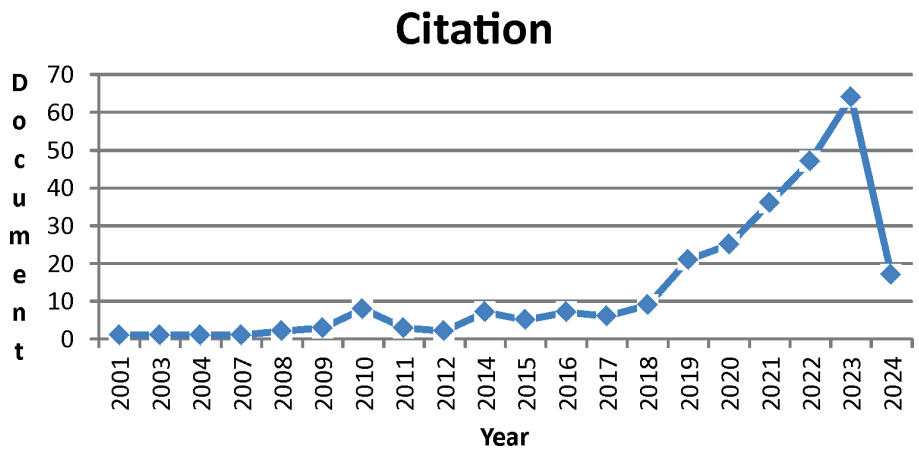

Figure 4: Year-Wise Citation Trend

Source: Scopus Data Analysis

number of citations per year. In terms of the number of publications in last 15 years, it was increasing year-by-year where 2023 was the most productive year. This implies that the research in this field started picking up after 2018 with the advent of AI technologies implemented worldwide. The papers published in the years (2019-2023) with the highest citations revealed that research was extremely prominent and significantly impacted research studies.

4.3. Most Productive and Influential Countries

Figure 5 shows the top countries working on the area of Artificial intelligence in retail industry (2000-2024). It showed that United states that stood at first level cited more than 55 articles followed by India and China. Indian researchers are also active in this field, and the number of publications is encouraging.

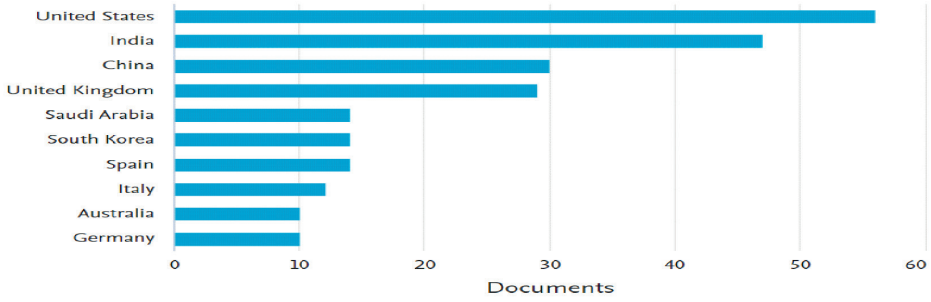

Figure 5: Most productive and influential countries

Source: Scopus Data Analysis

4.4. Most Prolific Authors

The table below shows the top 10 authors based on total number of citations. The key findings and research methodologies used in these papers is also explained in the table 1 below.

Table 1: Depicts the most prolific authors (Source: Created by Authors)

S. No.	*Paper Title*	*Research Methodology*	*Key Findings*	*Total Citations*
1	Artificial Intelligence (AI): Multidisciplinary Perspectives on Emerging Challenges, Opportunities and Agenda for Research, Practice and Policy Multidisciplinary (Dwivedi *et al.*, 2021b)	Insights from the experts	Highlights potential and challenges of AI, outlines research agenda.	936
2	Developing and Validating a Service Robot Integration Willingness Scale (Lu *et al.*, 2019)	Quantitative approach, develops and validates SRIW scale.	Identifies four dimensions of SRIW, consumer perceptions influence willingness to integrate robots.	371
3	Genetic Algorithm-based Heuristic for Feature Selection in Credit Risk Assessment (Oreski and Oreski, 2014)	Proposes HGA-NN method, evaluates on real-world datasets.	HGA-NN effectively selects features, improves accuracy and reduces complexity.	328
4	A Data Mining based System for Credit-Card Fraud Detection in e-Tail (Carneiro *et al.*, 2017)	Data mining approach for fraud detection, evaluated on e-commerce transactions.	Promising results in fraud detection accuracy, highlights importance of feature selection.	176
5	Omni-channel Management in the new Retailing Era: A systematic review and future research agenda (Cai and Lo, 2020)	Systematic review of research on omni-channel management in new retail.	Identifies key themes, challenges, and future research directions.	173
6	Shopping Intention at AI-powered automated retail stores (AIPARS) (Pillai *et al.*, 2020b)	Quantitative study investigates shopping intention at AIPARS.	Perceived ease of use, usefulness, and trust in AI positively influence shopping intention.	164

S. No.	*Paper Title*	*Research Methodology*	*Key Findings*	*Total Citations*
7	Smart Contract Privacy Protection using AI in Cyber-Physical Systems: Tools, Techniques and Challenges (Gupta *et al.*, 2020)	Systematic and comprehensive review analyzes AI-based privacy protection for smart contracts in Cyber Physical Systems.	Identifies AI tools, techniques, and challenges for privacy protection.	151
8	In-store Consumer Behaviour: How Mobile Recommendation Agents Influence Usage Intentions, Product Purchases, and Store Preferences (Kowatsch and Maass, 2010)	Quantitative study investigates impact of Mobile Recommendation Agents (MRAs) on in-store consumer behavior.	Perceived usefulness of MRAs influences usage intentions, purchases, and store preferences.	131
9	Fashion Retail Forecasting by Evolutionary Neural Networks (Au *et al.*, 2008)	Proposes Evolutionary Neural Network (ENN) approach for short-term sales forecasting in fashion retail.	ENN outperforms traditional methods for low-demand, weak seasonal products.	126
10	Drivers, Barriers and Social Considerations for AI Adoption in Business and Management (Cubric, 2020)	Systematic Literature Review (SLR)	Identifies factors for adopting AI, barriers in adoption of AI and social and ethical considerations.	120

4.5. Keywords' Based Analysis

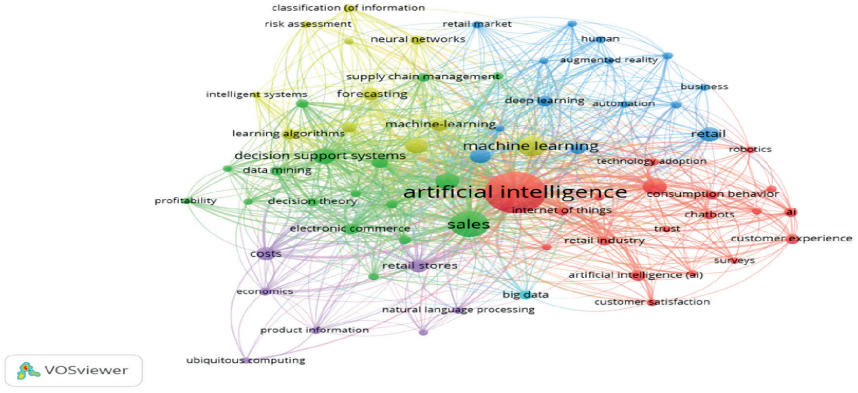

Figure 6: Keywords' based analysis

Source: Generated using VOSviewer software

The figure represents the analysis of the keywords. The figure shows the network of key words appeared together. VOSviewer software used 69 keywords that has a frequency of occurrence atleast 5 times. Based on the resulted network following five clusters are identified.

4.5.1. Artificial Intelligence in Retail Behavior

The first cluster highlights the existence of artificial intelligence (AI) in retail industry. It encompasses keywords like customer experience, consumer behaviour, chatbots, artificial intelligence highlighting the focus on application of artificial intelligence in the retail behaviour. Artificial Intelligence has proved to be transformational in retail sector (Sivaram *et al.*, 2021). It explains the incorporation of AI for personalization (Adomavicius and Tuzhilin, 2006), customer journey optimization (Verhoef *et al.*, 2010),impact of chatbots on customers' sentiments (Tran *et al.*, 2021), and impact of AI on customers' willingness to pay (Sohn *et al.*, 2021), prediction of customer behavior in retail services (Tsukasa *et al.*, 2011), consistent customer experience (Behera *et al.*, 2021). These applications can enhance customer experience, improve marketing effectiveness, and drive sales. (Cheung *et al.*, 2003) explores the use of deep learning for personalized product recommendations, (Pereira *et al.*, 2022) recommends use of AI to tailor suggestions to individual customer preferences. (Khatri, 2023) investigates the application of AI-powered tools to provide personalised customer experience, efficient decision making and better resource allocation. Future researchers can explore how AI can complement and augment human capabilities in retail tasks, fostering collaboration and leveraging the strengths of both humans and machines (Pappas *et al.*, 2023). The concerns about potential job displacement due to AI automation and exploring strategies for reskilling and upskilling the retail workforce for the future can be addressed.

4.5.2. Innovative Machine Learning Applications

The second cluster emphasizes the development and application of intelligent systems and innovative applications that can lead to increased efficiency, improved product offerings, and better customer engagement.

It demonstrates strong focus on application of machine learning (ML) algorithms to enhance various aspects of retail operations and customer

sentiment analysis to boost business performance (Ahmed *et al.*, 2022). (Kumar *et al.*, 2021) concluded that application of machine learning techniques helps retail sector in general and create competitive advantage by identifying purchase pattern to achieve customer retention. (Pratama *et al.*, 2020) explored the use of collaborative filtering algorithms for personalized marketing and increasing cross-selling because of providing customized recommendations to customers, a common application of machine learning in retail. (Monil, 2020) investigated the application of Machine Learning (ML) for customer segmentation, enabling retailers to target specific customer groups and to maintain customer relations with distinct marketing strategies. To study the use of ML for predicting demand, (Carbonneau *et al.*, 2008) concluded that it would result in lower costs and higher customer satisfaction because of timely delivery and (Bala, 2012a) listed benefits like reduction in costs, better inventory management by enhanced accuracy of demand forecast and reduce stockouts. Thus, retailers can apply ML to personalize the shopping experience, acquire valuable information from customer data, streamline processes, and eventually increase sales and profitability. Future studies could investigate how to incorporate unstructured data into machine learning models for deeper customer insights, such as sentiment analysis using social media, reviews from customers, and image identification. Futures researchers may explore creating safe and privacy-preserving machine learning methods that let businesses use consumer data in a responsible manner without compromising user privacy.

4.5.3. Predictive Intelligence Hub

The third cluster focuses on utilizing deep neural networks techniques for tasks like product image recognition, customer behavior prediction, and various retail applications like demand forecasting and fraud detection, further enhancing operational efficiency and customer engagement. (Wei *et al.*, 2020); (Khatri, 2023); (Dutta, 2018) and (Kaneko and Yada, 2016) demonstrate the prominence of neural networks, particularly deep learning, within the retail domain. Deep neural networks excel other machine learning methods in prediction accuracy(Chaudhuri *et al.*, 2021), helps in identifying marketing campaigns for potential customers (Ładyżyński *et al.*, 2019), demand forecasting (Priyadarshi *et al.*, 2019), (Narayanan *et al.*, 2019) and customer segmentation and targeted promotions for improved marketing outcomes (Zhang and Wedel, 2009).

Neural networks are increasingly being employed in supply chain management (SCM) to predict demand, logistics and warehousing and generate predictive insights for route and logistics optimization, mitigation of risk (Soori *et al.*, 2023). Retailers use various methods like machine learning and deep learning to forecast demand based on past data, market trends, and external factors. Choosing the right method and adapting continuously are crucial for accurate predictions (Seyedan and Mafakheri, 2020). The security of retail transactions can be improved by using machine learning algorithms to examine transaction data to identify and prevent unauthorized transactions (Zhang *et al.*, 2020).

Further research in this area may employ a number of approaches, such as creating more sophisticated predictive analytics models that are suited to specific industry segments. To ensure responsible and equitable deployment, researchers may look into the ethical aspects of predictive intelligence systems. Studies may also focus on developing stakeholder trust, improving the interpretability and transparency of predictive intelligence systems, and addressing emerging policy and regulatory issues.

4.5.4. Strategic Decision-Making for Profitable Sales

The fourth cluster emphasizes on enhancing profitability in e-commerce and other sales channels through data-driven decision-making. It makes use of the concepts of decision theory to maximize resource allocation, marketing, and pricing. Decision support systems (DSS) offer analytics, scenario modeling, data visualization, and optimize strategies (Gupta *et al.*, 2022). Big data analysis can help in dynamic pricing by retailers (Shankar, 2019), increasing sales due to information about products, social media exposure, recommendation, and flexible payment methods (Hejazi *et al.*, 2022), to predict sales, plan inventory levels and use of pricing algorithms to update prices (Boileau, 2023).

The cluster explores predictive analytics for sales forecasting, inventory optimization, and customer behavior analysis, contributing to enhanced profitability and customer satisfaction. (Sese and Verhoef, 2016) highlight the importance of omnichannel retailing, which integrates online and offline channels through information systems, to provide seamless customer experiences across all touchpoints. Machine learning based decision-

making can benefit both businesses and customers by using personal data to create accurate forecasts that optimize pricing decisions (Gerlick and Liozu, 2020).

Future researchers may investigate the interface of consumer behavior, sales forecasting, and data analytics to create effective decision support systems. Future research endeavours may explore the influence of developing technologies on strategic planning, encompassing the advantages of automation and artificial intelligence. In addition, ethical issues like consumer privacy in the use of data may be investigated in order to ensure ethical and customer-focused decision-making procedures in the pursuit of maximizing sales.

4.5.5. Innovative Retail Data Processing

The fifth cluster explores advanced techniques for processing and analyzing retail data to gain valuable insights and improve business operations. This cluster highlights the importance of CRM systems, omnichannel integration, and data analytics in managing customer interactions and gaining valuable insights from customer data. Predictions of sales using data mining (Loureiro *et al.*, 2018), use of AI in enhancing the customer satisfaction by providing personalized product recommendations (Adomavicius and Tuzhilin, 2006), synthesis of information and making advanced decisions (Zhong *et al.*, 2016), analyses of past spending of customers to predict future behavior to enhance sales (Lee *et al.*, 2024),use of data analysis for time specific, location and channel specific as well as customer specific CRM strategies (Shankar, 2019), use of AI/ML to identify potential opportunities and to enhance consumer experiences (Lee and Trim, 2022). These systems serve as crucial for refining operations, personalizing customer journey, and strategic decision-making. Future researchers in this domain may investigate into the development of advanced data processing technologies, examine how retail processing techniques are environmentally sustainable, and evaluate how data integration affects overall retail operations.

4.6. Tree Map

The Tree map generated using biblioshiny (R studio package) displays hierarchical information about distribution of key words based on bibliographic

data. This visualization tool helps understand the patterns and relationships between the key words.

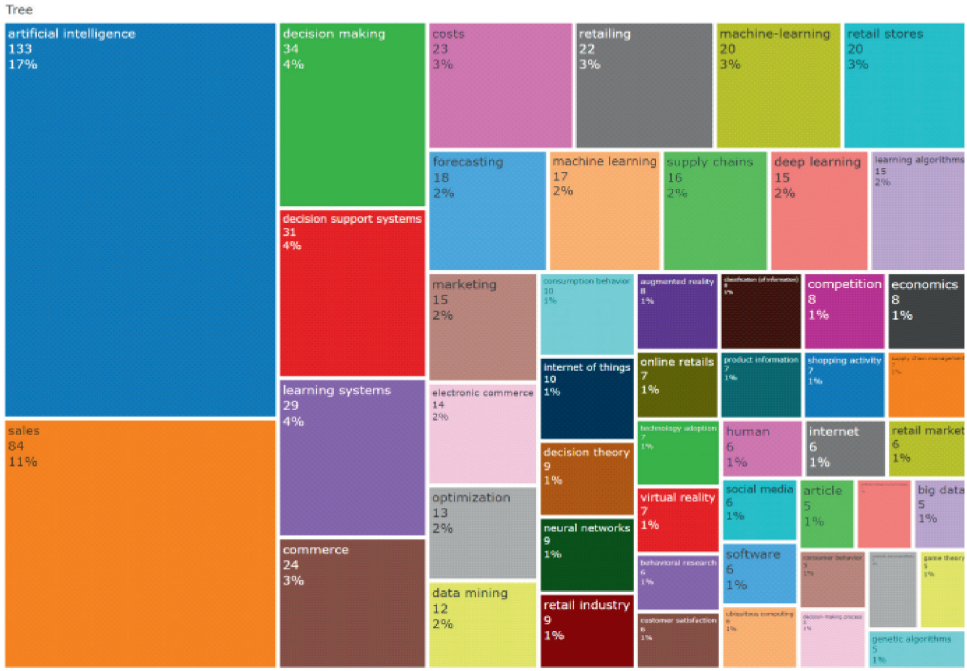

Figure 7: Tree Map

Source: Generated using Biblioshiny

The tree map displays a diverse framework, with sales and artificial intelligence emerging as the most important branches. The terms "decision making," "decision support system," "learning systems," and "commerce" encompasses significant space within this framework and incorporate techniques for forecasting, regression, and classification. With the use of data-driven insights, these capabilities enable retailors to customise marketing efforts (Monil, 2020), optimise pricing tactics (Beer and Heinrich, 2022), (Zakaria *et al.*, 2024)and make informed business decisions (Shekhawat, 2023). This dominance highlights how machine learning and AI applications are fundamental to transform the technologies essential for transforming retail sector.

The term Forecasting has a prominent place, highlighting the importance of predicting future trends and customer behaviour within the retail domain.

Machine learning algorithms facilitate accurate demand forecasting(Priyadarshi *et al.*, 2019), allowing for optimized inventory management and preventing stock shortages or oversupply situations (Bala, 2012b). Additionally, Learning Systems contribute significantly, encompassing algorithms for anomaly detection, pattern recognition, and recommendation systems. These systems enable retailers to identify unusual patterns in sales data, personalize product recommendations for individual customers, and create a more engaging shopping experience (Khatri, 2023).

The various and significant facets of AI in retail are covered by the other branches of the tree map. The extraction of important knowledge and insights from large datasets is a key component of data mining, deep learning, and neural networks. Retailers can use this information to uncover hidden patterns and customer preferences for improving customer experiences and thereby sales(Cheung *et al.*, 2003).

4.7. Thematic Map

The thematic map divides the bibliographic data in four quadrants representing the themes namely basic, emerging or declining, niche and motor. The size of the circles represents the centrality of the themes.

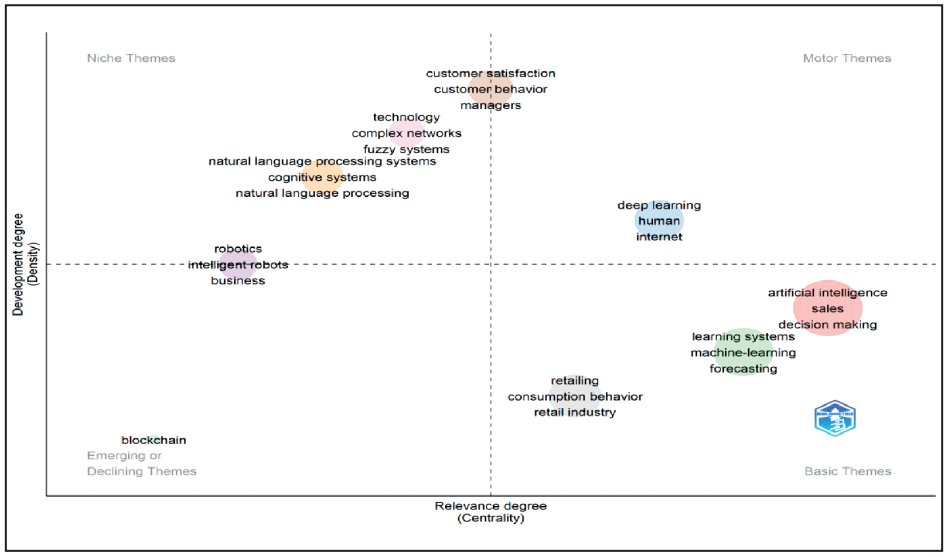

Figure 8: Thematic Map

Source: Generated using Biblioshiny

This graph is a thematic map based on the bibliometric analysis. It shows different research topics in the four quadrants and their importance based on publication numbers and centrality. This helps visualize research trends and relationships between various AI applications in retail. The graph also includes two axes namely Development degree (density) that represents the number of publications on a particular theme and Relevance degree (centrality) which represents the importance of a theme to the overall body of research.

The first quadrant shows motor themes, that is the established area of research, deep learning, human-centered artificial intelligence and internet infrastructure. The second quadrant contains basic themes that are represented by three clusters - application of AI in sales and decision making, use of machine learning systems in forecasting and consumption behavior in retail industry. The third quadrant exhibit emerging theme potential of blockchain in retail sector. The fourth quadrant shows niche themes namely complex networks and fuzzy systems, natural language processing and cognitive systems, robotics and business, and customer satisfaction. The central theme is application of AI for predicting customer behaviour and maximizing customer satisfaction and to support managerial decision making.

Future research agenda in AI identified by (Dwivedi *et al.*, 2021b) are listed as "impact of society industry and education, regulatory implications for AI, bias within AI, boundaries between people and AI, scientific problems towards achieving full scale AGI, AI and strategic decision making, AI leaders of the world, The debate on AI being good or bad."

(Gupta *et al.*, 2020) identified research challenges in amalgamation of AI and Smart Contracts (SCs); (Tanwar and Verma, 2024) suggested to explore how integration of AI technologies with chatbots can impact the customer experiences and thus customer satisfaction; (Weber and Schütte, 2019) identified impact of timings of AI and ML adoption in the competitive success of a firm for the future researchers.

V. FUTURE RESEARCH AREAS

Following table shows the future research area identified on the basis of thematic areas.

Table 2: Future Research Area (Identified by Authors Based on Thematic Analysis)

Thematic Area	*Future Research Areas*
1. AI Adoption and Impact (Sese and Verhoef, 2016), (Kumar *et al.*, 2021)	Investigate impacts of AI adoption on different facets of retail operations, including supply chain management, customer interactions, and overall business performance.
2. Ethical Considerations in AI Implementation (Dwivedi *et al.*, 2021b), (Gerlick and Liozu, 2020)	Explore ethical frameworks tailored for the retail context, focusing on fairness, transparency and accountability in AI-driven decision-making.
3. AI and Customer Behaviour Analysis (Kumar *et al.*, 2018), (Naik *et al.*, 2023), (Rane *et al.*, 2023)	Investigate the effectiveness of AI-driven customer behavior analysis and its potential for hyper-personalization in retail marketing.
4. AI and Inventory Optimization (Soori *et al.*, 2023), (Cai and Lo, 2020), (Bala, 2012a)	Explore advanced AI algorithms for dynamic inventory management, considering factors like demand forecasting and real-time market trends.
5. AI driven Decision Support Systems(Chaudhuri *et al.*, 2021), (Zhong *et al.*, 2016), (Gupta *et al.*, 2022)	Develop and assess the effectiveness of AI-supported decision-making frameworks for optimizing pricing strategies, product positioning, and overall sales processes.
6. Interdisciplinary Collaboration in AI Research (Kumar *et al.*, 2021), (Zeller and Dwyer, 2022), (Burton *et al.*, 2020)	Investigate successful models of collaboration between AI specialists, retail experts, and industry professionals, emphasizing effective knowledge transfer and innovation.
7. AI Transparency and Explainability (Dwivedi *et al.*, 2021b), (Behera *et al.*, 2023), (Balasubramaniam *et al.*, 2022)	Explore methods and techniques to enhance the transparency of AI algorithms, ensuring understandable decision-making processes for both consumers and industry professionals.
8. Human-AI collaboration (Pappas *et al.*, 2023)**,** (Kumar *et al.*, 2023)	Designing AI systems that complement human expertise and decision-making, empowering internal and external customers in retail sector.
9. AI and Sustainability in Retail (Behera *et al.*, 2023), (Ahmad *et al.*, 2020), (Wang *et al.*, 2018)	Investigate how AI applications can be aligned with environmentally sustainable practices in retail, considering energy consumption, waste reduction, and overall ecological impact.
10. Blockchain Applications in Retail (Gupta *et al.*, 2020), (Chakrabarti and Chaudhuri, n.d.), (Mukherjee *et al.*, 2023)	Explore the integration of blockchain in retail for supply chain transparency, secure transactions, and enhanced traceability, considering the impact on overall business processes

VI. CONCLUSION

The study illuminates key facets of the symbiotic relationship between artificial intelligence and the retail industry. The identified clusters encompassing AI applications in retail behavior, innovative machine learning applications, predictive intelligence hubs, strategic decision-making for profitable sales, and innovative retail data processing underscore the multifaceted contributions of AI. Thematic analysis reveals critical themes such as AI adoption impacts, ethical considerations, customer behavior analysis, inventory optimization, decision support systems, interdisciplinary collaboration, transparency, explainability, sustainability, and the emergent role of blockchain. The co-occurrence analysis shows the multidimensional nature of retail and its growing reliance on data and technology. The study demonstrates the range of applications influencing retail transformation, from powerful information systems and tailored suggestions to chatbots driven by AI and sophisticated customer behavior prediction. Further analysis can delve deeper into specific applications, explore interconnections across techniques, and contextualize the findings within broader industry trends and ethical considerations. This study adds to the growing body of knowledge on artificial intelligence in retail by outlining future research directions that take into account the dynamic interactions between technology and business, in addition to offering a thorough overview of the situation as it stands today. Understanding these technological advancements and their potential impact is crucial to navigating the ever-evolving retail landscape.

To stay ahead in the ever-evolving retail landscape, understanding artificial intelligence (AI) is crucial. This study dives into practical applications of AI, showcasing how retailers can leverage it to personalize the shopping experience, optimize operations, and gain a competitive edge. From analyzing customer behavior for targeted marketing to streamlining inventory with AI-powered insights, the research explores a range of tools that empower retailers. However, it also emphasizes the importance of ethical and transparent AI use, alongside its environmental impact. By embracing these AI-driven strategies, retailers can unlock a future of smarter retail.

The limitations of the study, including the consideration of papers published only in the subject areas of 'Business, Management, Accounting, Economics, Computer Science', English language restriction for bibliometric

analysis, and exclusive review of research articles, suggest avenues for future research. Future researchers could delve deeper into how to incorporate unstructured data into machine learning models for deeper customer insights, such as sentiment analysis using social media, reviews from customers, and image identification. Also, future researchers may investigate the interface of consumer behavior, sales forecasting, and data analytics to create effective decision support systems and may explore the influence of developing technologies on strategic planning, encompassing the advantages of automation and artificial intelligence. In addition, ethical issues like consumer privacy in the use of data may be investigated in order to ensure ethical and customer-focused decision-making procedures in the pursuit of maximizing sales.

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