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AI Evolution in the 5G Era: Revolutionizing E-Commerce

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***Abstract* – India has emerged as a rapidly growing e-commerce market, as reported by Forrester. The integration of AI technology has significantly impacted the way e-commerce companies attract and retain customers. The level of digital literacy in India is on the rise, particularly in rural areas where there is a higher number of telecom users. The introduction of 5G technology has further accelerated the growth of digital literacy by providing high-quality internet connectivity. The combination of 5G technology and Machine Learning algorithms in AI has enabled e-commerce companies in India to thrive and expand their reach. AI in Electronic Commerce has brought about new and innovative solutions. Major e-commerce players are now heavily investing in artificial intelligence technologies to enhance their trading platforms and stay competitive in the market. This research delves into the various applications of Artificial Intelligence in e-commerce, the emergence of 5G technologies in India, and the impact of AI on e-commerce in the 5G era. It also addresses the challenges associated with the deployment of 5G networks.**

***Keywords* – AI, e-commerce, 5G, Machine Learning**

I. INTRODUCTION

Artificial intelligence, commonly known as AI, is the creation of computer systems that mimic human intelligence by learning natural language, planning, perceiving, and processing information [1]. It involves the development of technology that can perform tasks typically requiring human intelligence, such as recognizing speech, making decisions, and translating languages. AI is a rapidly growing industry that focuses on creating machines capable of performing tasks that mimic human behavior. John McCarthy, considered the father of AI, defined it as the scientific and technical field dedicated to developing intelligent computer programs. Machine learning and deep learning are two popular methods used in AI, where models are trained on data to make predictions.

In industries like food, e-commerce, and finance, AI is being used to improve customer experiences, manage supply chains efficiently, and enhance operational processes [2]-[3]. The use of AI in these sectors aims to provide standard, reliable quality control methods, and innovative ways to reach and serve customers while keeping costs low. The introduction of 5G, the fifth generation of cellular networks, represents a significant advancement in communication technology. This milestone not only enhances connectivity but also opens up new possibilities for businesses and individuals. It aligns with the Digital India vision, propelling the nation towards greater digital connectivity and offering new opportunities for revenue generation through innovative business models.

This paper is organized as follows: section-II discusses about the applications of artificial intelligence in e-commerce; section-III illustrate the emergence of 5G technology in India; section-IV portrays the impact of AI on e-commerce in the era of 5G; section-V delineates the challenges faced in deployment of 5G networks; and finally section-VI proposes the conclusion of the research paper.

II. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN E-COMMERCE

This section delves into the diverse applications of Artificial Intelligence (AI) and Machine Learning (ML) in the realms of business management, e-commerce, and finance [7]-[12].

A. Chatbots:

E-commerce and financial websites increasingly leverage chatbots to elevate customer satisfaction and augment service offerings. Developed through the fusion of artificial intelligence and machine learning methodologies, these chatbots possess human-like capabilities. Equipped with learning mechanisms, they harness past data to furnish optimal recommendations to customers.

B. Image Search:

Artificial intelligence drives image search functionality on e-commerce platforms, underpinned by advanced image processing algorithms. This innovation enhances customer experiences by enabling visual searches, eliminating the need for keyword-based queries.

C. Handling Customer Data:

The vast reservoir of data associated with e-commerce operations necessitates sophisticated handling mechanisms. Machine learning algorithms facilitate comprehensive analysis of historical data encompassing sales, human resources, marketing, and customer purchasing behaviors. Insights derived from this analytical prowess serve as catalysts for profit maximization, sales optimization, and resource allocation. Such strategic utilization of data empowers e-commerce and fintech enterprises to tailor products and services to meet the nuanced preferences of their clientele.

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D.Recommendation Systems:

Harnessing machine learning algorithms, businesses can delve into comprehensive analysis of customers' historical data, encompassing their preferences and behaviors. Leveraging this insight, these algorithms adeptly predict customer choices and effectively recommend the most suitable products, thereby enhancing sales figures and customer satisfaction for e-commerce and financial enterprises.

E. Inventory Management:

Artificial intelligence algorithms play a pivotal role in optimizing inventory management for e-commerce entities. By scrutinizing past sales data, these algorithms unveil correlations between current sales trends and future projections. Armed with this foresight, managers can make informed decisions regarding inventory maintenance, ensuring alignment with anticipated demand.

F. Cybersecurity:

Machine learning algorithms excel in fortifying cybersecurity protocols by detecting vulnerabilities within systems and proposing tailored security solutions to safeguard e-commerce platforms. In the financial sector, these algorithms prove invaluable in detecting and preventing fraudulent activities, bolstering overall security measures.

G. Customer Relationship Management (CRM):

Artificial intelligence revolutionizes CRM practices by autonomously forecasting client purchasing behaviors and optimizing customer interactions. AI applications leverage machine learning techniques to discern emerging trends, enabling proactive planning and personalized engagement strategies. Advanced CRM systems continuously refine their capabilities over time, adapting to evolving market dynamics.

H. Credit Scoring, Loan Underwriting, Portfolio Management:

Machine learning algorithms proficiently analyze past data to predict future trends, offering invaluable insights for credit scoring, loan underwriting, and portfolio management processes. By minimizing risks associated with financial transactions, these algorithms empower companies to make informed decisions, enhancing operational efficiency and financial stability.

I. Human Resources:

AI engines streamline candidate sourcing processes by identifying optimal recruitment channels, while Natural Language Processing (NLP) facilitates resume screening. AI-driven bots facilitate video interviews, expediting initial screening phases and enhancing recruitment efficiency. Beyond recruitment, AI interventions enhance employee engagement through innovative training techniques, fostering a dynamic and skilled workforce.

J. Sales:

AI augments sales strategies by assessing organizational objectives alongside diverse data sources to recommend optimal client acquisition avenues. Price optimization, guided by AI and ML, maximizes profitability, while AI-driven consumer suggestions and market basket analyses refine sales tactics, driving enhanced revenue generation.

III. EMERGENCE OF 5G TECHNOLOGIES IN INDIA

The history of cellular networks dates back to 1982 when the first generation mobile phones were introduced [18]. These phones became fully operational by 1990, offering a speed of 2.4 kbps. The second generation (2G) mobile technology emerged in the early 1900s, providing a speed of 64 kbps. This was followed by the introduction of 2.5G, which implemented packet transfer networking for faster internet connectivity. The arrival of third generation (3G) technology in the early 2000s focused on delivering high-speed internet with speeds of up to 2 Mbps. This technology utilized circuit switching for data transfer. In 2010, the fourth generation (4G) technology was introduced, featuring an all IP-based network system that prioritized voice and data services, multimedia, and internet connectivity over IP [18]. The current focus is on the development of 5G technology, which aims to connect various wireless devices to the existing 4G IP architecture. 5G technology is designed to support and integrate all 4G technologies, including LTE Broadcast, unlicensed spectrum, and device-to-device discovery [19]. The future of cellular networks is evolving towards seamless connectivity and enhanced capabilities with the advancement of 5G technology.

The evolution of 5G networks as per [17] is given below in Table-1:

Table-1: The evolution of mobile networks

	1G	2G	3G	4G	5G
Approximate Deployment Date	1980s	1990s	2000s	2010s	2020s
Theoretical Download Speed	2 kbps	384 kbps	56 mbps	1 gbps	10gbps
Latency	N/A	629 ms	212 ms	60-98 ms	<1 mbps

In India, mobile internet speeds have seen a significant growth of 115%. With the introduction of 5G technology, India has climbed up 49 positions on the Speedtest Global IndexTM, rising from 118th place in September 2022 to 69th place in January 2023. The implementation of 5G services has resulted in a boost in LTE speeds for both Jio and Airtel, showcasing the success of their network modernization efforts. The average download speed over 5G is reported to be 25 times faster compared to 4G [4].

Many regions across the country have witnessed an improvement in 5G performances, with Kolkata leading the pack with the fastest median 5G download rates in January 2023, exceeding 500 Mbps. In Kolkata, Jio recorded the highest median 5G internet speed of 506.25 Mbps, while Airtel clocked

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in at 268.89 Mbps in Delhi. The availability of 5G has increased significantly, growing by 55 times [4].
Airtel and Jio have set ambitious targets for the implementation of their 5G networks. Since the rollout of 5G services, the availability of 5G has increased for both Airtel and Jio, reaching 8.0% and 5.1% respectively. The introduction of 5G has further intensified the competitive landscape in the telecom sector. Users of Speedtest® have been switching from Vi to other providers, with the absence of 5G being a key factor in this shift [4].

The theoretical download speed using 5G networks can be depicted as per [17] in Figure-1 below:

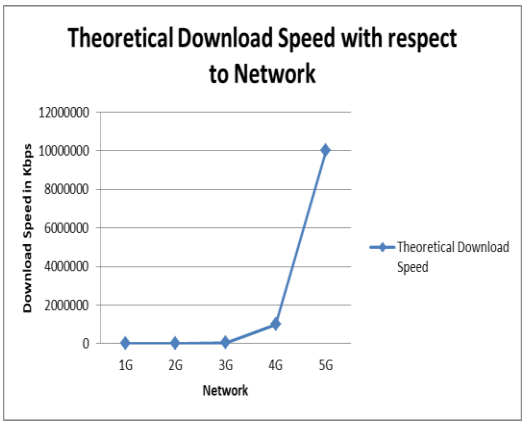

Figure-1: Theoretical download speed of networks from 1G to 5G

The decreased latency of networks from 2G to 5G is depicted using the bar graph as per [17] is shown in Figure-2 below:

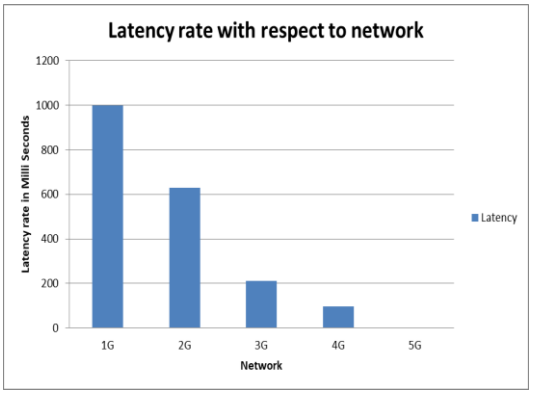

Figure-2: Latency rate of networks from 1G to 5G

From the above two graphs it is observed that the 5G networks are not only quite faster for downloading, but also they perform much reduced latency rate.

IV. IMPACT OF AI ON E-COMMERCE IN THE ERA OF 5G

Social media platforms utilize artificial intelligence to enhance personalization and effectiveness by providing users with relevant content. E-commerce is increasingly being integrated with social networking sites, with a significant rise in online shopping through social commerce in India, showing a 51% increase in just one year. Despite the perception that rural areas may be lagging behind in e-commerce usage, data reveals that rural users are actively participating in online activities such as gaming, digital commerce, digital payments, and online learning. However, the penetration of these online services is higher in urban areas compared to rural regions in India.
Interestingly, rural India has a higher number of over-the-top (OTT) platform users, while in urban areas, the majority of OTT users come from small towns, highlighting the diverse digital landscape across different regions of the country [5].
According to a recent study conducted by IAMAI and Kantar [5], it is projected that a significant portion of new telecom users in the upcoming years until 2025 will be originating from rural areas of India. Surprisingly, the report also highlights the fact that there are more active social media users in rural India compared to urban regions. This shift in digital behavior suggests that service providers must reconsider their strategies to cater to the needs of rural India.
The development of 4G and the forthcoming 5G networks is expected to bring high-quality connectivity to rural and remote areas, offering new possibilities for growth in e-commerce as more people in these regions join the digital marketplace.

Customer service stands as a cornerstone of organizational advancement, integral to the trajectory of company growth. While contemporary businesses strive to offer expedited shopping experiences, the provision of round-the-clock customer support remains a challenge. Enter artificial intelligence assistants, colloquially known as chatbots, designed to field customer inquiries, execute basic commands, and furnish recommendations leveraging sophisticated language processing tools. Employing machine learning algorithms, these chatbots engage in adaptive interactions with clientele across e-commerce platforms and mobile interfaces. Customers harness the capabilities of chatbots to navigate product selections, explore inventory availability, conduct product comparisons, and complete transactions seamlessly. Moreover, these intelligent agents serve as conduits for directing queries to appropriate support personnel, ensuring prompt resolution of customer concerns. In essence, artificial intelligence emerges as a pivotal ally in fortifying customer service efficacy, particularly in scenarios where dedicated human resources for customer interaction may be constrained[6]. As per [5], 50% people in India are not having the opportunity of utilizing the services of internet due to non availability of the network and several other reasons. The emergence of 5G makes it possible which in turn leads to the increased growth of e-commerce firms.

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V. CHALLENGES IN THE DEPLOYMENT OF 5G

The research paper [13] scrutinized the primary issues and obstacles associated with the implementation of 5G, revealing that the distinctive characteristics of 5G inherently contribute to these challenges. Notably, the study recognized the challenge of network densification arising from 5G's capacity to connect with diverse devices and deliver high-speed access. Consequently, this phenomenon is anticipated to give rise to challenges in managing substantial data volumes and ensuring comprehensive data coverage due to the accelerated data transmission speeds.In a comparable fashion, an investigation into the diverse prerequisites and hurdles of 5G networks revealed that a notable challenge stems from the suboptimal propagation of frequencies within the spectrum. This issue arises from the contrasting high and low frequency demands, necessitating the deployment of advanced antennas and compact cell sizes to uphold signal quality effectively [14].

Another research inquiry [15] focused on the 5G communication system, highlighting challenges associated with the network that could significantly influence the overall functionality of the 5G network. The investigation identified that certain devices connecting to the 5G network may necessitate low levels of data transmission, allowing for operation during periods of substantial delays, while others may demand high-speed real-time data. Additionally, various devices may pose challenges related to network coverage due to their specific geographical locations. Therefore, depending on the unique needs and requirements of the devices, it becomes imperative to conduct proper prioritization and allocation of limited resources.A parallel investigation [16] navigated through the diverse challenges anticipated in the course of implementing 5G. This study underscored that the foremost challenge inherent in a network as intricately designed as 5G lies in sustaining network performance according to expectations. Network performance, gauged in terms of user experience, emerges as a pivotal metric. Consequently, enhancing and refining the user experience involves expanding coverage areas, mitigating handover issues, and optimizing battery life. Moreover, addressing challenges such as minimizing latency and concurrently delivering high-speed internet access were additional focal points highlighted within the research.

VI. CONCLUSION

Numerous obstacles in the progress of online shopping can be effectively addressed by utilizing 5G networks. The combination of 5G with cutting-edge technologies like AI, VR, and AR is set to have a significant impact on the e-commerce industry. This fusion has the potential to create a strong online shopping ecosystem and enhance the overall customer experience. E-commerce businesses are dedicated to providing comprehensive services to customers, including understanding their needs, analyzing their preferences, recommending personalized products, and offering continuous customer support. The integration of AI has transformed the online shopping landscape by changing how people buy, sell, and browse products. Many businesses are integrating AI into their daily operations to improve efficiency. As AI technology advances, it is reshaping the way people interact with online shopping and enhancing profit margins. In particular, AI is becoming a crucial tool for optimizing e-commerce operations, especially with the rise of 5G technology.

REFERENCES

[1] Paulraj Prabhu, Neelamegam Anbazhagan, 2014. Improving Business Intelligence Based on Frequent Itemsets Using k-Means Clustering Algorithm. In: Meghanathan N., Nagamalai D., Rajasekaran S. (eds) Networks and Communications (NetCom2013). Lecture Notes in Electrical Engineering, vol 284. Springer, Cham, ISSN 1876-1100, ISBN 978-3-319-03691-5, ISBN 978-3-319-03692-2 (eBook), DOI : 10.1007/978-3-319-03692-2_19, pp 243-254.

[2] P. Prabhu, N. Anbazhagan, FI-FCM Algorithm for Business Intelligence. In: Prasath R., Kathirvalavakumar T. (eds) Mining Intelligence and Knowledge Exploration. Lecture Notes in Computer Science, vol 8284. Springer, Cham, pp 518-528 ISSN 0302-9743(Print ISBN 978-3-319-03843-8), (Online ISBN 978-3-319-03844-5), 2013. doi: 10.1007/978-3-319-03844-5_52 December 2013.

[3] R. Manne, S.C. Kantheti, Application of artificial intelligence in healthcare: chances and challenges, Curr. J. Appl. Sci. Technol. 40 (6) (2021) 78–89, https://doi.org/10.9734/cjast/2021/v40i631320.

[4]https://www.ookla.com/articles/5g-india-performance-jio-airtel-q1-2023.

[5]https://www.iamai.in/sites/default/files/research/Internet%20in%20India%202022_Print%20version.pdf

[6] Rushikesh Shahaji Dhanvate, Akash Ashok Gujar, I. Y. Inamdar, ARTIFICIAL INTELLIGENCE IN E- COMMERCE, International Research Journal of Modernization in Engineering Technology and Science, Volume:05,Issue:05 (May-2023), pp. 7848-7849.

[7] S. Nandhini, J. Marseline K.S., ‘‘Performance Evaluation of Machine Learning Algorithms for Email Spam Detection,” 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), 2020, pp. 1-4, doi: 10.1109/ic-ETITE47903.2020.312.

[8] N. Soni, E.K. Sharma, N. Singh, A. Kapoor, Artificial Intelligence in Business: From Research and Innovation to Market Deployment. Procedia Comput. Sci. 2020, 167, 2200–2210.

[9] A. Di Vaio, R. Palladino, R. Hassan, O. Escobar, Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. J. Bus. Res. 2020, 121, 283–314.

[10] A. Di Vaio, F. Boccia, L. Landriani, R. Palladino, Artificial Intelligence in the Agri-Food System: Rethinking Sustainable Business Models in the COVID-19 Scenario. Sustainability 2020, 12, 4851.

[11] T. Kumar, M. Trakru, The Colossal Impact of Artificial Intelligence. ECommerce:Statistics and Facts. Int. Res. J. Eng. Technol. (IRJET) 2020, 6, 570–572. Available online: https://www.irjet.net/archives/V6/i5/IRJET - V6I5116.pdf (accessed on 3 December 2020).

[12] N. Soni, E.K. Sharma, N. Singh, A. Kapoor, Impact of Artificial Intelligence on Businesses: From Research, Innovation, Market Deployment to Future Shifts in Business Models. arXiv 2019, arXiv:1905.02092.

[13] A. Kumar, “Keys Technology and Problem in Deployment of 5G Mobile Communication Systems, ” vol. 1, no. 3, pp. 4–7, 2015.

[14] N. Loharia, S. B. Rana, and N. Kumar, “5G Future Communication : Requirements & Challenges 5G Future Communication : Requirements & Challenges, ” no. April, 2016.

[15] N. Panwar, S. Sharma, and A. K. Singh, “A survey on 5G: The next generation of mobile communication, ” Phys. Commun., vol. 18, pp. 64–84, 2016.

[16] D. T. Editor et al., “European Technology Platform for Communications Networks and Services NetWorld2020 ETP Expert Working Group on, ” no. August, pp. 1–44, 2014.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 08, August-2024

[17]https://www.techtarget.com/searchnetworking/feature/A-deep-dive-into-the-differences-between-4G-and-5G-networks

[18] Gemalto, “Introducing 5G networks – Characteristics and usages, ” 2017.

[19] A. Jaswal, P. K. Singh, and Y. Singh, “5G: Survey of Technologies and Challenges, ” Int. J. Latest Trends Eng. Technol., vol. 2, pp. 1–5, 2016.