Artificial Intelligence And its applications in E-Commerce

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Abstract:

With the fast advancement of science, technology, and economy, Artificial Intelligence (AI) is playing an increasingly prominent role across various domains. As a leading technology of the Fourth Industrial Revolution (Industry 4.0 or 4IR), AI possesses the capability to integrate human behavior and intellect into machinery and systems, with profound implications for our work and lifestyle. In the realm of e-commerce, AI finds extensive application, yielding promising results. This article explores the pivotal role of AI in driving the expansion of the E-commerce industry. Specifically, it delves into the utilization of AI in various domains such as AI assistants, image search, recommendation systems, and optimized pricing. Through this investigation, we shed light on how AI deeply influences and enhances the evolution of E-commerce platforms.

Keywords: *Artificial Intelligence, E-commerce, chatbots, Online shopping, personalization, inventory management.*

ملخص:

مع التقدم السريع في مجال العلوم والتكنولوجيا ، نرصد استخدام الذكاء الاصطناعي بشكل متزايد في مختلف الميادين و له تأثير كبير على عملنا وأسلوب حياتنا. يعتبر الذكاء الاصطناعي تكنولوجيا رائدة في العصر الحالي ضمن الثورة الصناعية الرابعة ، حيث يتمتع بالقدرة على دمج سلوك الإنسان والذكاء في الآلات أو الأنظمة. و في مجال التجارة الإلكترونية، يتم استخدام الذكاء الاصطناعي بشكل واسع وقد أظهر نتائج مشجعة.حيث ظهر الذكاء الاصطناعي كقوة دافعة حيوية لتوسيع مجال التجارة الإلكترونية. المقالة المقترحة ستسلط الضوء على كيفية استخدام الذكاء الاصطناعي في صناعة التجارة الإلكترونية والآثار الناجمة عنه وعلى منصات التجارة الإلكترونية.كما سنتطرق إلى استخدامات الذكاء الاصطناعي في مجالات مثل مساعدي الذكاء الاصطناعي، والبحث عن الصور، وأنظمة التوصية، وتحسين التسعير. تتناول هذه الدراسة كيفية تأثير الذكاء الاصطناعي بشكل عميق وكيفية دعم تطور التجارة الإلكترونية .

الكلمات المفتاحية: الذكاء الاصطناعي، التجارة الإلكترونية، روبوتات الدردشة، التسوق عبر الإنترنت، التخصيص، إدارة المخزون.

1. INTRODUCTION

Artificial intelligence has been evolving for over six decades, and its exploration has touched every part of our economy and society, resulting in numerous remarkable accomplishments. As an illustration, in 1997, IBM's computer Deep Blue vanquished the world chess champion, demonstrating that AI was here to endure (De Spiegeleire & al. 2017, p37). Similarly, in 2016, Google's AlphaGo triumphed over a prominent human go player, portraying AI as a pivotal component of the future (Shashi, 2016, p3). AI, which has already showcased its worth in various sectors such as advertising, healthcare, finance, and instruction, is now introducing its presence in e-commerce. Lately, e-commerce has attained extraordinary feats. While indulging in the convenience facilitated by e-commerce, individuals are requesting progressively higher benchmarks. The advent of AI technology introduces novel notions and paradigms for the growth of e-commerce. According to Gartner, by 2020, over 80% of customer service positions will be substituted by AI (Xia Song and al, 2019, p2). Corporations like Alibaba, Rakuten, and Amazon will harness AI technology to conduct commentary analysis, formulate chatbots, present product suggestions, and handle substantial data (Vaughan Turekian, 2018, p9). Ubisend's study provides intriguing data: one in five consumers procures goods and services through chatbots; consumers expend over 317.74 pounds via chatbots; and 40% of consumers employ chatbots to unearth bargains. Furthermore, Google invested 400 million pounds in DeepMind, an AI company.

Based on this observation, the aim of our paper is to provide answer the following question: What are the most important applications of AI in E-commerce ?

This problem leads us to raise the questions hereunder:

- What is E-commerce?
- What is Artificial intelligence?
- how AI technologies are being integrated into e-commerce platforms

And we formed a hypothesis:

Hypothesis 1: The integration of AI technologies, such as chatbots, recommendation systems, and data analytics, into e-commerce platforms significantly enhances customer interactions, product recommendations, and overall shopping experiences, thereby positively impacting e-commerce sales and customer satisfaction.

Hypothesis 2: As AI technology continues to advance, e-commerce businesses that effectively embrace and implement AI solutions will experience a substantial competitive advantage, leading to increased market share, improved operational efficiency, and higher profitability in the evolving AI-driven e-commerce ecosystem.

The importance of this study lies in exploring the profound impact of AI on the e-commerce industry, addressing vital questions about its definition, integration, and applications. It aims to uncover how AI enhances customer interactions, product recommendations, and overall shopping experiences, ultimately boosting e-commerce sales and customer satisfaction. This research is crucial for understanding the transformative potential of AI in shaping the future of e-commerce.

This study aims to provide valuable insights into the evolving landscape of e-commerce driven by AI, shedding light on how businesses can effectively embrace these technologies to meet customer demands, enhance operational efficiency, and remain competitive in an AI-driven e-commerce ecosystem. We will also focus on how AI technologies, such as chatbots, recommendation systems, and data analytics, are being integrated into e-commerce platforms to improve customer interactions, product recommendations, and overall shopping experiences.

For providing purpose of the necessary answers to the questions posed above, we have structured the study in two distinct axes, together with a section

devoted to the results and the discussion. The first axis is dedicated to define E-commerce and Artificial intelligence. As for the second axis of our paper, we will focus on the most important applications of AI in E-commerce.

2. Definition of E-commerce and Artificial Intelligence

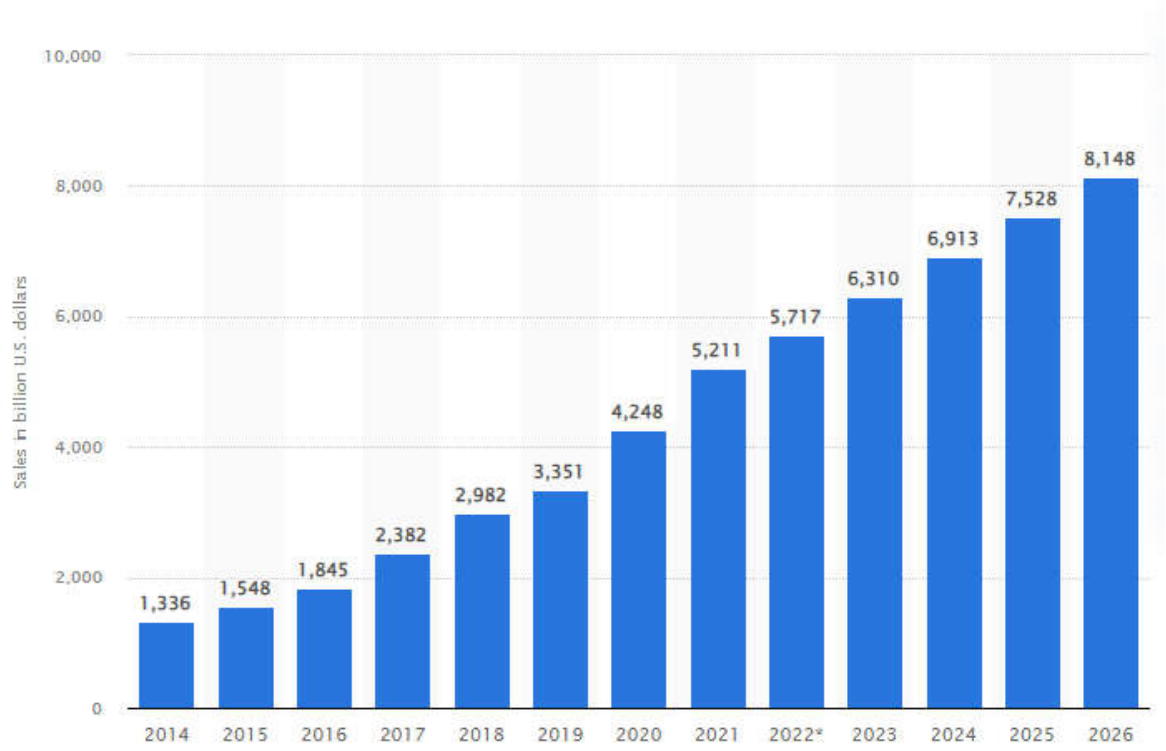
2.1 Definition of E-commerce

Online business, also known as electronic commerce, involves establishing connections and facilitating corporate transactions, which encompass the sale of information, services, and goods through computer telecommunication networks (Britannica money, 2023). As the Internet became extensively employed and the World Wide Web was unveiled in 1991, online trade commenced transitioning online. Subsequently, in 1993, the first web browser facilitated individuals in reaching the Internet, bringing about even more digital commerce on the internet (Sharma, G., 2014). Afterward, with the prevalence of smartphones and the accessibility of rapid Internet connections, e-commerce also transferred to mobile devices like tablets, notebooks, and wearable gadgets such as watches.

2.2 The Development of E-commerce

The surging trend of E-commerce can be attributed to the enhanced user experience in online shopping, which gained significant traction during the pandemic. The digital transformation compelled consumers to embrace a more online-centric approach to shopping, resulting in a pervasive shift towards digital accessibility for nearly all types of products and services. While many industries faced challenges during the COVID-19 pandemic, the retail E-commerce sector stood out, recording global sales that surpassed an impressive 4.2 trillion USD in 2020, marking a remarkable 25.7% increase (UNCTAD, 2023).

Fig.1. Retail E-commerce sales worldwide from 2014 to 2026 (in billion USD).



Source: www.statistica.com

Available on : https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/

Consulted on 28/09/2023

A substantial segment of the E-commerce industry is anticipated to experience robust growth, largely attributable to the dynamism of the Asia Pacific region, where China stands out as the primary driver (refer to Figure 2). Despite the ongoing development journey of several Asian nations, they are poised to sustain a high level of competitiveness, bolstered by their continuous investments in infrastructure and cutting-edge technology.

In the near term, one can attribute this trend to the fact that Americans generally wield greater disposable income in comparison to their counterparts in Asia (refer to Figure 2). However, it is imperative to recognize that Asia holds tremendous potential for exponential expansion in the long run, mainly due to its vast and burgeoning population, offering a compelling growth trajectory when juxtaposed with more mature markets.

Recent growth statistics in the e-commerce sector, analyzing the rate of increase in the largest e-commerce markets, indicate a promising trajectory for online shopping in the United States in the coming years. Projections suggest that e-commerce sales in the U.S. are poised to surge by an impressive 50%, soaring from $907.9 billion in 2022 to a staggering $1.4 trillion by 2025. (OBERLO, 2023)

Conversely, in Europe, the growth rate is anticipated to be slightly more gradual, clocking in at 47%. Meanwhile, China, which currently boasts the highest e-commerce sales volume, is expected to witness a 15% expansion in its online retail sector during the same period. Analysts attribute the comparatively slower growth rate in China to the fact that the country already experienced its peak in online shopping growth in previous years.

In sharp contrast, the rest of the world is forecasted to witness a robust 52% increase in online sales, surging from just over $1 trillion in 2022 to a substantial $1.5 trillion in 2025. (OBERLO, 2023)

Fig.2. Global Ecommerce Sales by Region 2022

Source: eMarketer

2.1 Definition of Artificial Intelligence

Artificial Intelligence (AI) stands as an emerging domain of technology that strives to imitate and extend human intelligence through theoretical approaches and practical implementations (Mukhamediev R.I. & al. 2022, p 4). Its inception dates back to 1956 when a group of visionary scientists, including McCarthy, Minsky, Rochester, and Shennong, convened to explore the utilization of machines to emulate intellect. They coined the phrase " artificial intelligence," signifying the official birth of this interdisciplinary field (Xia Song et al, 2019, p 2). McCarthy (1956) defines (KUMAR KASHYAP A. 1 al. , 2022, p 7350) AI as “the science and engineering of making intelligent machines” . In the initial phase of AI development, it was resembled to “Department of Clever Tricks” in the realm of computer science (Andrew AM., 2006).

AI focuses on automating mental tasks by emulating and amplifying human intellect. The essence of AI lies in intelligent technology, facilitating the creation of machinery, such as robots, voice recognition systems, and image recognition software, that can promptly react to command directives. AI technology involves various domains ((Xia Song et al, 2019, p 2), including computer science, psychology, biology, linguistics, and medicine. Other sectors like Transportation, industry, health, agriculture, business, finance, and security (Sarker IH., 2022, p16) could also benefit from the advantages of intelligent systems.

As modern science and technology progress, the purview of AI widens, and intelligent machines become more advanced, proficient in executing tasks guided by human instructions. AI's development is closely connected with computer technology, with both domains mutually influencing and progress in tandem (Weber FD., 2019). In AI, two pivotal technologies encompass machine learning and interactive learning (Park SC., 2018). Machine learning constitutes a segment of computer science encompassing domains such as pattern recognition, artificial intelligence, data mining, probability theory, and statistics. It entails numerical enhancement and finds extensive utilization in the field of AI (Song X., 1 al. 2019) .

3. Applications of AI in E-commerce

As science and technology progress, Artificial Intelligence (AI) technology is improving and transforming how individuals do their jobs and live. This is notably accurate in the realm of online shopping, where AI is evolving into a potent instrument to assist companies in enhancing sales and refining their operations.

3.1 Chatbots

Chatbots are smart and intelligent computer programs that mimic humans through conversation or text (Marjerison, R.K; et al., 2022, p3). Chatbot utilizes a simple text interface that enables users to access information or offer entertainment through an online messaging platform (Klopfenstein, 2017).

When interacting with Chatbots, users can communicate through various methods, such as vocalizing commands, typing text messages, utilizing graphical interfaces, or engaging with graphical widgets (Carayannopoulos S., 2018) and (Vincze J., 2017). Conversational interfaces encompass language processing, intelligent dialogue, and human-computer interaction, enabling real users to feel, even if only temporarily, that they are engaging with another human and emulating the experience of conversing with a human companion (Ahmad N.A., 2018).

A chatbot can understand diverse human inquiries and identify different expressions. To engage in meaningful and efficient conversations with users, it must possess a diverse vocabulary, similar to how individuals converse with one another. Moreover, developers can enhance chatbots by integrating prevalent internet jargon. As a result, chatbots with chat interfaces have gained popularity and quick adoption due to their extensive vocabulary and prompt responses (Adam M., 2021).

The success of chatbots is attributed to their capacity to employ algorithms to select the appropriate responses from a developer-supplied database(Ahmad, 2018). In 2020, over 85% of customer interactions were handled by various forms of chatbots. (Li L., 2021)

3.2 Image recognition

Image search is a crucial facet of Artificial Intelligence (AI) with substantial implications in diverse sectors. The ability of AI to precisely and effectively explore images permits us to extract valuable insights, identify objects, and comprehend visual content on a large scale (De Spiegeleire & al. 2017, p41). In areas like healthcare, AI-fueled image search assists in medical diagnosis by recognizing patterns and anomalies in medical images. Elakkiya & al. establish a healthcare system for diagnosing cervical cancer utilizing hybrid object detection adversarial networks in their paper (Elakkiya & al., 2021). Pan & al. exhibited a visual recognition system founded on deep learning for categorizing navigation marks (Pan & al., 2020). In the field of e-commerce, it empowers users to discover products through visual search, enhancing the shopping experience. Furthermore, AI-driven image search contributes to content

moderation, detection of copyright infringements, and organization of visual content. By tapping into the potential of image search in AI, we unlock a multitude of opportunities that augment decision-making, effectiveness, and user engagement across a wide spectrum of applications.

3.3. Recommendation systems :

Recommendation systems in E-commerce represent sophisticated algorithms that exploit machine learning and data analysis methods to offer customized product recommendations to users (Anakkala T., 2021). These systems analyze extensive quantities of user data, comprising browsing history, purchase patterns, and preferences, to forecast and anticipate individual user preferences accurately (Shashi, 2016, p 3). By employing collaborative filtering, content-oriented filtering, and hybrid approaches, these recommendation systems provide personalized and pertinent product suggestions, thus augmenting user involvement and conversion rates. The integration of such advanced systems into E-commerce platforms contributes to enhanced customer satisfaction, augmented sales, and the establishment of long-term customer loyalty (Shashi, 2016, p 3) and (Babayev N. & Israfilzade K., 2023, p 144). The utilization of recommendation systems in E-commerce underscores the escalating importance of AI-powered technologies in enhancing user experiences and encouraging smooth interactions between consumers and online retailers (Nimbalkar A., 2022, p 139).

3.4. Augmented Reality:

Augmented Reality (AR) plays a pivotal role in the field of E-commerce, offering profound implications for improving customer engagement, interactive product visualization, and personalized shopping experiences. By seamlessly amalgamating virtual components with the tangible world, AR technology allows users to perceive and engage with digital information in real-time, enhancing their comprehension of products and their contexts (Farrugia & Merienne, 2017).

This immersive and interactive character of AR in E-commerce fosters increased consumer participation, bolstering customer satisfaction, and positively influencing purchase choices. The strategic integration of AR holds considerable potential in reshaping the E-commerce landscape, optimizing customer interactions, and completely redefining the future of online shopping.

Augmented Reality brings great tangible benefits to your E-commerce business like:

- Enhanced customer engagement
- Significantly fewer returns
- Considerably wider customer reach

This all leads to one conclusion: AR is a perfect solution for different types of E-commerce businesses. Developing this additional feature may result in much higher revenues in the long run, so it's definitely worth the effort.

3.5. Inventory management :

Inventory management in E-commerce involves the strategic and effective oversight of product inventory levels, involving the utilization of data-driven methodologies and optimization techniques. This procedure entails predicting demand, monitoring inventory levels, and executing inventory restocking strategies to ensure sufficient stock availability while minimizing surplus inventory expenses.

By utilizing advanced algorithms (Weber FD., Schütte R., 2019) and analytics, E-commerce enterprises can analyze historical sales data, seasonal patterns, and market tendencies to make informed choices regarding inventory allocation and procurement (Shashi, 2016, p5). Implementing inventory control systems that integrate with supply chain operations streamlines inventory management and logistics. By embracing scientific inventory control practices, E-commerce businesses can optimize (Srivastava A., 2021, p. 173) resource distribution, cut down carrying costs, and enhance overall operational

effectiveness, ultimately boosting customer satisfaction and maximizing profitability.

3.6. Cyber security:

In the field of E-commerce, Artificial Intelligence (AI) plays a pivotal role in strengthening cybersecurity measures. AI technology augments cyber defense by continuously monitoring and analyzing extensive datasets to detect anomalies and potential security risks. Utilizing advanced algorithms (Weber FD., Schütte R., 2019), AI can identify patterns indicative of malicious activities, such as unauthorized access attempts or unconventional transaction behavior. Furthermore, AI-powered systems can promptly respond to emerging threats by autonomously implementing security protocols and countermeasures.

This proactive approach safeguards sensitive customer information, financial transactions, and personal data from cyber assaults and breaches. By adapting to and learning from evolving threats, AI-driven cybersecurity solutions offer a dynamic defense mechanism, ensuring a more secure online shopping environment for both businesses and consumers in the E-commerce sphere. AI and machine learning will remain pivotal technologies in cybersecurity for identifying and predicting threats (Sarker IH., 2021) and (Sarker IH., 2020). AI will be as a crucial instrument for financial security due to its capacity to analyze vast data sets, anticipate fraud, and detect it (Sarker IH., 2022, p. 16)

4. CONCLUSION:

Artificial Intelligence (AI) represents a pivotal component of computer science, dedicated to the development of intelligent systems capable of emulating tasks traditionally undertaken by humans. For instance, AI manifests itself in the form of sophisticated virtual assistants like Siri and Alexa, conversational chatbots, and the personalized content recommendations provided by platforms such as Netflix.

Within the realm of E-commerce, AI plays a pivotal role for online retailers. This multifaceted technology empowers businesses to engage in meaningful conversations with customers through the deployment of chatbots, analyze customer feedback effectively, and offer tailored assistance to enhance the overall shopping experience. AI's pivotal methodologies in E-commerce encompass various aspects, including the provision of real-time support through chatbots and virtual aides, the generation of intelligent product recommendations based on user interactions and past purchases, leveraging customer data for personalized services, and monitoring product popularity and availability.

And therefore, we can say that the first hypothesis is valid, the integration of AI technologies into E-commerce platforms can significantly enhance customer interactions, product recommendations, and overall shopping experiences. This, in turn, has the potential to positively impact E-commerce sales and customer satisfaction. We have also verified the validity of the second hypothesis, businesses that effectively embrace and implement AI solutions in the e-commerce space are likely to gain a competitive advantage, leading to increased market share, improved operational efficiency, and higher profitability.

In summary, the integration of AI within the E-commerce landscape assumes paramount significance. Businesses are making substantial investments to harness the full potential of AI, ensuring they remain competitive in an ever-evolving market.

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