The Integration of Artificial Intelligence Techniques in E-Commerce: Enhancing Online Shopping Experience and Personalization

دمج تقنيات الذكاء الاصطناعي في التجارة الإلكترونية: تحسين تجربة التسوق عبر الإنترنت والتخصيص

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Abstract:

Objectives: The research seeks to introduce a fresh method to improve the online shopping experience by incorporating diverse Artificial Intelligence (AI) strategies. The goals include facilitating personalized shopping experiences, lowering customer churn in e-commerce platforms, and delivering efficient product suggestions. The study also aims to investigate the constraints and difficulties linked to integrating AI technologies in e-commerce.

Methods: The research utilizes an extensive examination of AI methods such as ML, neural networks, fuzzy logic, and evolutionary computation, along with their use in personalized marketing, product suggestions, chatbots, and fraud detection. The study combines current literature, case studies, and practical applications from top e-commerce platforms like Amazon and Alibaba, examining the utilization of AI methods to enhance user satisfaction and operational productivity.

Results: Incorporating AI methods in online business has displayed considerable promise in improving customer happiness, boosting revenue, and lowering operating expenses. Tailored recommendation systems and conversational agents have proven highly successful in enhancing user interaction and minimizing the time shoppers dedicate to product exploration. Still, obstacles like maintaining data privacy, connecting to current systems, and the high cost of implementing AI technology are major hindrances to wider acceptance, especially for smaller online retail sites.

Conclusion: AI-powered solutions could completely transform the e-commerce industry by providing personalized, efficient, and secure shopping experiences. Yet, achieving success involves addressing obstacles concerning data accuracy, integrating systems, and privacy issues. Future studies should concentrate on creating AI solutions that are more scalable and can be easily implemented across e-commerce platforms of all sizes.

Keywords: E-Commerce; Chatbots; Online Shopping; virtual Assistants; AI.

الملخص:

الأهداف: يسعى البحث إلى تقديم طريقة جديدة لتحسين تجربة التسوق عبر الإنترنت من خلال دمج استراتيجيات الذكاء الاصطناعي المتنوعة (الذكاء الاصطناعي). تشمل الأهداف تسهيل تجارب التسوق الشخصية، وتقليل اضطراب العملاء في منصات التجارة الإلكترونية، وتقديم اقتراحات فعالة للمنتجات. وتهدف الدراسة أيضًا إلى التحقيق في القيود والصعوبات المرتبطة بإدماج تكنولوجيات الذكاء الاصطناعي في التجارة الإلكترونية.

المنهجية: يستخدم البحث فحصًا مكثفًا لطرق الذكاء الاصطناعي مثل لغة الآلة، الشبكات العصبية، المنطق الضبابي والحساب التطوري، إلى جانب استخدامها في التسويق المخصص، اقتراحات المنتجات، روبوتات المحادثة واكتشاف الاحتيال. تجمع الدراسة بين الأدبيات الحالية ودراسات الحالة والتطبيقات العملية من منصات التجارة الإلكترونية مثل Amazon و Alibaba، حيث تدرس استخدام الأساليب الذكاء الاصطناعي لتعزيز رضا المستخدمين والإنتاجية التشغيلية.

النتائج: أظهر دمج أساليب الذكاء الاصطناعي في الأعمال التجارية عبر الإنترنت عددًا كبيرًا في تحسين سعادة العملاء وزيادة الإيرادات وخفض نفقات التشغيل. أثبتت أنظمة التوصية المصممة خصيصًا نجاحًا كبيرًا في تعزيز تفاعل المستخدم وتقليل الوقت الذي يخصصه المتسوقون لاستكشاف المنتج. ومع ذلك، فإن العقبات مثل الحفاظ على خصوصية البيانات، الاتصال بالأنظمة الحالية، والتكلفة العالية لتنفيذ التكنولوجيا الذكاء الاصطناعي هي عوائق رئيسية أمام القبول على نطاق أوسع، خاصة بالنسبة لمواقع البيع بالتجزئة الأصغر عبر الإنترنت.

الخلاصة: يمكن للحلول التي تعمل بنظام الذكاء الاصطناعي أن تحول صناعة التجارة الإلكترونية من خلال توفير تجارب تسوق شخصية وفعالة وآمنة. ومع ذلك، فإن تحقيق النجاح ينطوي على معالجة العقبات المتعلقة بدقة البيانات، دمج الأنظمة، وقضايا الخصوصية. يجب أن تركز الدراسات المستقبلية على إنشاء حلول الذكاء الاصطناعي أكثر قابلية للتطوير وسهلة التنفيذ عبر منصات التجارة الإلكترونية من جميع الأحجام.

الكلمات المفتاحية: التجارة الإلكترونية؛ روبوتات الدردشة؛ التسوق عبر الإنترنت؛ المساعدون الافتراضيون؛ الذكاء الاصطناعي.

1 Introduction

This research presents an idea for automatically integrating several Artificial Intelligence (AI) related approaches to improve online shopping experience. These methods include classification to forecast customer preferences, association rules to find relationships between products frequently purchased together, clustering to group similar products, and distribution-based mining to examine patterns in product distribution and customer behavior (Thomas, et al., 2022). The motivation is to automatically create related product recommendation relations as well as to guide, attract, and assist the e-shoppers throughout this process. With this work, the authors aim to exceed the presence of more traditional approaches and in-built techniques that often fail to meet the dynamic demands of real-time e-commerce environments, which do not cope with the performance and immediate fulfillment of the tasks. By applying a comprehensive ensemble of AI techniques, we address the diverse aspects of e-shopping, providing an all-encompassing approach to recommendation tasks. It provides an all-encompassed coverage approach for recommendation end-tasks. It provides e-commerce platforms with advanced knowledge extraction techniques that ease online shopping tasks and make the steps as close as possible to real-life money spending (Chaudhuri, Gupta, Vamsi, & Bose, 2021).

In the past 50 years, there has been a noticeable linkage between information technology and commerce. The rapid growth of the Internet and the World Wide Web (WWW) allows businesses to attract a wide customer base as well as make shopping much easier (Fahlevia, et al., 2024). E-commerce is the combination of hardware, software, databases, telecommunications, and methods of a firm with its customers, business partners, and organizational operations through electronic means. Research and development in the area of e-commerce has seen a boost in the past 10 years, providing different types of e-commerce such as e-shops, e-malls, e-business, and e-auctions (Zhang, Millan, Money, & Guo, 2024). The pre-set-up browsing and searching within e-commerce applications are often impersonal and time-consuming, causing the need to transform these steps in the direction of more user-friendly experiences. In recent decades, performing the tedious e-shopping assistance process manually has been decreasing in acceptance worldwide.

1.1 Background and Rationale

The personalization of websites not only increases customers' satisfaction and loyalty but also brings a significant improvement to the class of existing information systems by leveraging AI to achieve personalized customer content management (Zhang, Millan, Money, & Guo, 2024). Businesses have to react to this new challenge in order to be cost-effective and successful. Some strategies, such as reducing costs or increasing quality, are unproductive if consumers' wants and desires are in no way satisfied. This paper proposes that the correct blend of AI resources could satisfactorily develop the infrastructure required for personalized applications. This work contains the evaluation and exploration of a variety of business studies that apply AI technology to e-commerce to develop and further customize intelligent retail applications (Silitonga, et al., 2024).

Online shopping has changed the retail market by changing the way business is conducted. (Purnama, Kasman, & Yurisman, 2024) The concept of e-tailing (electronic retailing of goods and services) has taken off, leading to an ever-expanding list of companies trying to cater to everyone's needs and wants. Businesses need to provide a greater shopping experience to be competitive and to provide added value for their potential customers (Houcheimi & Mezei, 2024, March). Companies have to customize their products and adjust their services to differentiate. Artificial Intelligence techniques offer a unique capability to add value to traditional e-commerce business models, enabling businesses to use customer intelligence. They could potentially provide customer interaction capabilities that are far more sophisticated and personalized than ever before.

1.2 Research Objectives

RO1. To enable the electronic trading systems to provide a personalized shopping experience for each user. In this context, to carry out a study of the user product preferences in data such as demographic and socioeconomic, and propose personalized online product list generation suggestions that can take the user's preferences into account.

RO2. To analyze the data acquired with the help of user behaviors in the areas related to online electronic commerce models, so that the possibility of customers leaving the e-commerce system is predicted, and to reduce the risk of customer churn from e-commerce.

RO3. To use the data related to user behaviors in the e-commerce systems in order to analyze user shopping habits and suggest alternative products to the users. These can be considered as proposals related to automatic product suggestions.

The main objectives of our research are mentioned sequentially below, along with their associated explanations

1.3 Scope and Limitations

Moreover, some bookkeeping of the process in terms of a list of products and quantities must be taken into account, so most of the systems implement a so-called shopping cart mechanism. In the end, when the customer is ready, a typical e-commerce component should be responsible for the payment and shipment of the selected items (Houcheimi & Mezei, 2024, March). Given the wide set of related works in the mentioned subject, the fact that e-commerce is a typical human-computer interaction environment, where the main goal is to help human users in the task of choosing and, if the case proceeds, buying products, and the existence of some open real e-commerce environments made us think that the e-commerce domain could be a very interesting playing field to test the validity of the integration of AI techniques to add intelligence and flexibility to more traditional interactive components (Song, Xia, & Tang, 2024).

Among the numerous aspects related to e-commerce, we will focus on the customer purchasing process, which we will represent by some specific components such as product recommendation, shopping cart management, and payment. (Karl, 2024) These components cover several parts of the customer's purchasing process, beginning with the moment when the customer decides to buy some new products. In the case of web-based e-commerce merchants, for example, the number of potential interactions with the customer while he navigates through the site and points him to new products. However, as the number of available products is often quite large, some personalized product filtering and ranking mechanisms should be proposed and activated whenever a customer signals his desire to buy some items (Chaudhuri, Gupta, Vamsi, & Bose, 2021).

Nevertheless, various restrictions may pose obstacles in integrating these AI technologies into e-commerce platforms.

The quality and quantity of data: it is greatly impacting the effectiveness of AI-driven solutions. Inaccurate predictions and recommendations may result from inconsistent or incomplete data. Moreover, obtaining enough data that truly reflects customer behaviors and preferences can pose challenges, particularly for smaller e-commerce platforms (Eftimov, 2024).

Utilization of computational resources: it is essential for implementing AI techniques like deep learning models and large-scale data processing. Small businesses may face cost issues for the infrastructure for this type of hardware and software needed to support these technologies (Deldjoo, Jannach, Bellogin, Difonzo, & Zanzonelli, 2024).

Integration with current platform: Incorporating advanced AI models into current e-commerce platforms may prove to be a challenging and lengthy process. Significant changes to existing systems may be necessary, potentially causing disruptions to current activities. Furthermore, a technical challenge arises in guaranteeing that new AI components integrate smoothly with existing legacy systems (Zhang S. , 2024).

privacy and security: Concerns about user privacy and data security have increased along with the rise in AI usage. Gathering and examining significant amounts of user data poses ethical concerns, and companies need to guarantee adherence to data protection laws like GDPR. Not properly protecting customer data could lead to major legal and reputational outcomes (Wang, Liu, & Yao, 2024).

Prejudice and Justice in Artificial Intelligence Models: AI models, particularly those trained on past data, may unintentionally continue biases found in the data. Securing fairness and preventing discrimination in AI-powered suggestions poses a significant obstacle, especially when catering to diverse user populations with different preferences and behaviors (Raji, et al., 2024).

User Trust: Despite having advanced AI systems, it can still be difficult to earn user trust and promote adoption. Users might be hesitant about relying on automated suggestions or may favor more traditional ways of browsing. AI-driven features must be user-friendly to be widely accepted. (Ali, 2024)

2   Foundations of Artificial Intelligence

Independent Agents: In which the system plays an intermediate role between the user and the information system. These agents may actively store any number of transactional rules, for example, about the behavior of the data warehouse (Tarashandeh & Karimi, 2024).

Machine Learning: Finds correlations between different pieces of data, then uses that data to optimize systems. This is applicable for broad general data surface construction for exploratory analytics in which the wizard mode where data mining software can help guide the process to ensure the data is examined properly. In the future, as a computing tool, it is expected that these systems will make recommendations on what type of model, large-scale modeling issues, and other complex areas (Caton & Haas, 2024).

Evolutionary Computation: Techniques are primarily for problems where many satisfactory solutions exist, but no algorithm is known to find the best solution. These techniques will find a good approximation quickly. These include genetic algorithms, genetic programming, and classifier systems (Wu, Wu, Wu, Feng, & Tan, 2024).

Neural Networks: Constructs systems modeled on the human brain, which can be used for various problems. The designs are built on the processes of learning and generalization that make it possible to perform tasks the neural network was not explicitly programmed to do (Latha & Rao, 2024).

Fuzzy Logic: Introduces grading levels to conclusions instead of traditional logic's binary true/false approach. A good example is the control of air conditioning in a building (Lazić, Milić, & Vukmirović, 2024).

Expert Systems: Programs used for tasks that would normally require a human expert can define functions that draw on extensive knowledge of a specific domain, including diagnostics, financial and network analysis, and specialist areas such as medicine, agriculture, business, and marketing. Systems of all sizes can be constructed, from those that act as extensions of existing programs to large-scale projects. Graphical user interface tools from expert system shells allow for the easy construction of expert systems (Manoharan, Durai, Rajesh, & Ashtikar, 2024).

With such enormous data available and complex knowledge involved, it is natural to turn to advanced computing technologies (Fahlevia, et al., 2024). Among various existing techniques, different categories of artificial intelligence technology can be utilized. The term artificial intelligence is best defined by listing the sub-areas of the development of intelligent systems.

2.1 Overview of Artificial Intelligence

AI facilitates capturing what, when, and how of customer behavior on the web, to enhance customer attention and satisfaction (Babatunde, Odejide, Edunjobi, & Ogundipe, 2024). In addition, AI helps online consumers personalize their services and goods according to their tastes and needs and attain a better understanding of e-commerce applications to obtain the biggest benefit (Thomas, et al., 2022). These technologies have the goal to better understanding how to approach a customer with a tendency to leave for the primary reason of charges or new offers from a competitor. These and other similar applications of AI have the goal of empowering sales and marketing departments through an intelligent understanding and monitoring of a variety of customer types that interact with the firm (Marti, Liu, Kour, Bilgihan, & Xu, 2024).

AI can be implemented in many areas, including e-commerce. AI can help organize, evaluate, personalize, and evaluate information from databases enabling e-commerce applications (Zhang, Millan, Money, & Guo, 2024). AI can help online firms to build better profiles of their customers and develop better and more personalized marketing approaches on the web. Most modern online commercial applications can use AI techniques such as expert AI-based systems, unstructured text analysis programs, and user-oriented AI to help sellers improve the quality of their products and services, have a better segmentation of their markets with more personalized service, and reduce the informational problems on the web. (Babatunde, Odejide, Edunjobi, & Ogundipe, 2024)

Artificial intelligence (AI) involves a variety of methods and techniques intended to infuse machines with a form of reasoning through the learning process (Frasnetti, et al., 2024). Classical AI is a theory focused on propositions and logic and is a major trend in the AI area known as "good old-fashioned artificial intelligence" (GOFAI), implemented in classical rule-based expert systems. Recent work in AI has been on building and studying systems, often called "connectionist" or "artificial neural networks," which exhibit intelligent behavior

(Kalmykov & Kalmykov, 2024). The basic purpose of AI is to automate different cognitive tasks normally accomplished by humans and to transfer information between humans and machines more efficiently and intelligently (Babatunde, Odejide, Edunjobi, & Ogundipe, 2024).

2.2 Key Techniques in Artificial Intelligence

Machine Learning: The whole subset of AI is directly related to machines or computers having the capability to learn and adapt to the experiences they have gone through (Song, Xia, & Tang, 2024). What makes machine learning so interesting is that once it has been authorized to act without being programmed, it tends to reduce the costly upfront human service associated with computer programming. Due to the exponential increase in data, it is now more feasible than ever to develop and implement ML algorithms, generating business value in applications like personalized gadgets and consistently enhancing e-commerce channels with economic activities (Xu, Zhou, Zheng, Zhu, & Xin, 2024).

Some of the significant contributors to AI include machine learning (such as deep learning), knowledge representation and reasoning, natural language processing (NLP), genetic programming, video analysis, feature extraction and convolution networks, digital holograms and time of flights, logistics-automated vehicles, data analytics, collaborative filtering algorithms, and recommendation systems, neural-linguistic programming, computer vision, sentiment analysis, and persona-based sentiment analysis (Chaudhuri, Gupta, Vamsi, & Bose, 2021). Each of these techniques has its respective features and applications in the enhancement of the e-commerce platforms. For this current work, and to properly understand its application in the review protocols developed in this context paper, we present the contents of these techniques.

3   E-Commerce Landscape

The online marketplace permitted technology to meet small and medium dealers. In addition to saving a lot of executive expenses, dealers might boost the services of their clients on a 24-hour, 7-day once-week basis (Karl, 2024). With the surprising development of societal commerce that Facebook, Twitter, and others have used, e-commerce has penetrated different proportions to promote businesses. A business without a powerful internet marketplace will usually lose a large market. Social media procedures, SEO plus SEM perform an energetic task as appearing and boosting paths.

Nowadays, traders generally make purchases not just locally, but from time to time from numerous countries or regions. For this motive, the Internet e-market has crafted a structure for worldwide exchanges. Several online commerce dealers generate proceeds from the global online marketplace. As the online sale strategy banks on details of the outlying areas, the market attracts a broad customer source (Zhang S. , 2024). As stated in its feeling, the e-market consists of a community of purchasing and offering processes, programs, electronic communications, information streams, and data dispensation, associated with the employment of numerous kinds of applications. The e-market offers an electronic institutional structure, topics such as products and services, online transfer, and settlement structures. It enables clients to enter the supplier, the trading companions, and the network of subcontractors.

3.1 Evolution of E-Commerce

The potential of e-commerce has been accepted. Some firms, notably dot.com companies, have taken visionary steps in marketing, providing a wide range of commerce and content solutions such as entertainment, multimedia, and online community services. These companies have spent heavily on brand-name advertisements, sponsorships, purchasing rights for conventions and political events, and unveiling promotional or cause-based websites shading coveted outside links to increase traffic to their sites, optimize public relations on the Internet, and achieve high traffic ratings. Many companies that have pursued e-commerce recognize that success depends on understanding, enabling, and engaging customers within local and global markets. The future will revolve around the incorporation of web-based solutions that support, enable, and optimize the shopping experiences they provide.

The electronic economy, including e-commerce, has greatly evolved. It is expected that the use of the Internet and the World Wide Web will continue to grow due to the development of telecommunication hardware and software, content development, and more efficient protocols. A study by International Data Corporation (1996) showed that the use of the Internet as a vehicle for business-to-business business would

grow from $8 billion in 1996 to $436 billion by 2001, and the use of the Internet for business to consumers would grow from $654 million to $53 billion during the same period. IBM recently predicted that e-commerce activities will account for only 5% of total retail revenue by 2001.

Figure 1 presents the graph titled "Global E-commerce sales growth from 2017 to 2023" which illustrates the significant annual growth of worldwide e-commerce sales, measured in trillions of U.S. dollars, with the following values: 2017: $2.382 until 2023 with $6.542 trillion. The graph demonstrates the exponential growth of global e-commerce sales, providing valuable insights for businesses, investors, and policymakers to understand and leverage the expanding e-commerce market. [1]
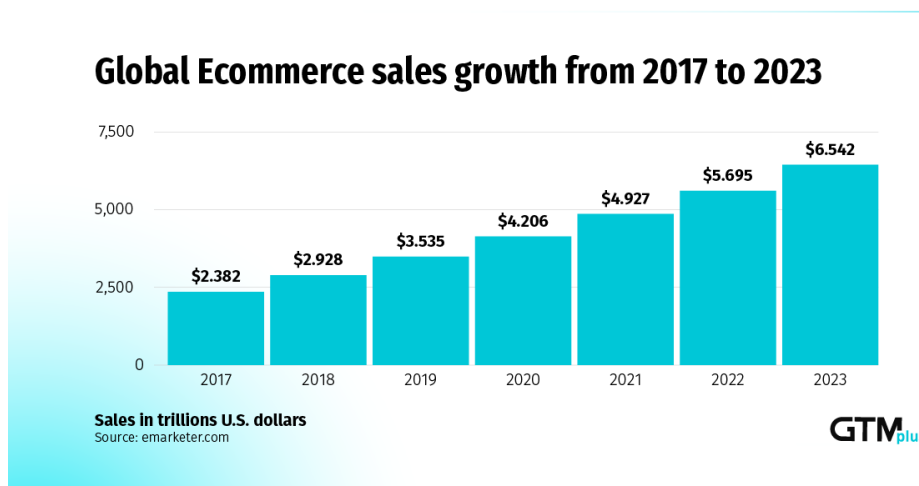

Figure 1: Global e-commerce sales growth from 2017 to 2023

3.2 Current Trends and Challenges

Already, many e-commerce sites exist where customers can purchase goods and books (for example, Amazon, Barnes & Noble, Walmart, buy.com, etc.). However, the depth and efficiency of their customer interaction are limited to simple text searches performed by the customer or prompts made by a small set of rules (Fahlevia, et al., 2024). Users despise spam for a similar reason. Rather, what is clearly of interest to most customers, in addition to seeing a list of what the system has for sale, is the ability of the system to understand what customers want (their requirements, needs, desires, etc.). Systems that do this increase customer satisfaction, as well as the chances of customer acquisition and retention. Unfortunately, most e-commerce sites do not collect detailed customer profiles, and the development of complex 'user personalization' features is both difficult and expensive (Akin, 2024). These features are especially challenging if they must include a sensory experience of the customer – for example, website display or content, language, product catalog, or system function that can be heard or seen, etc. Personalized response at an appropriate time to those needs is also important, where personalization is realized through the use of individual customer routines with the company or through profiling cooperatively made using information shared through the customer interface by each customer.

3.2.1 Enhanced Personalization Information (user)

Qualified labor shortage and greater opportunities for customer interaction and retention have driven many companies to offer features such as 'chat' systems and 'user personalization.' Systems that provide collaborative filtering can analyze user behavior on e-commerce sites and make product recommendations. Additionally, customization of customer interface or sensory experience optimizes design by utilizing relevant customer data. Web systems that successfully provide these features have enormous potential for increasing profits (Karl, 2024). Unfortunately, the numerous naturally unknown, variable, and rapidly changing customer requirements make developing such systems very difficult.

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[1] Evolution of eCommerce: eCommerce Trends to Expect In 2021 (gtm-plus.com)

4   Artificiel Intelligence Applications in E-Commerce

It is used for personalized recommender systems. Recommender systems are specifically developed to help a user select the most relevant information items in an autonomic, personalized, and intelligent way, based on individual preferences (Xu, Zhou, Zheng, Zhu, & Xin, 2024). Recommender systems have become a popular tool in e-commerce for companies that are attempting to ensure that their customers have easy access to the products and services that are most relevant. The recommender system is typically based on previous purchase information from already existing customers, matched with demographic and general information to help analyze the behavior of potential customers, thereby generating sales. Such analysis and matching processes often take into consideration likelihood models and rule-based systems to yield such systems (Raji, et al., 2024). The concept of developing e-commerce user interfaces into intelligent, attentive, convenient, secure, simple, user-friendly, helpful, and educational interfaces represents a new philosophy and vision of e-business portal customer experience and services where the customer is taken care of vitally, intensively, and emotionally, and the user interface assists, advises, and educates the customer online (Karl, 2024). This forms the basis for suggesting integrating e-commerce systems with different artificial intelligence techniques. In the remainder of this research article, we explore the different types of AI approaches that can be utilized to empower e-commerce applications and systems and discuss actual and potential contributions from the use of these techniques.

4.1 Product Recommendations

Various artificial intelligence-based techniques have been developed for making recommendations, including knowledge-based reasoning, case-based reasoning, content-based filtering, collaborative-filtering-based recommendation, human-computer-interaction-based recommendation, and hybrid-recommender system (Xu, Zhou, Zheng, Zhu, & Xin, 2024). However, most e-commerce platforms rely on collaborative-based filtering techniques to make recommendations to the users. Although these recommender systems are good for making recommendations, various problems affect the effectiveness of collaborative-based filtering in e-commerce platforms. The lack of user expert knowledge, excessive simplicity, and the cold-start problem are the primary issues encountered using collaborative-based filtering techniques. Other recommender techniques are also widely used, such as content-based filtering and hybrid-recommender systems, but they also have problems similar to those of collaborative-based filtering (Ogundipe, Babatunde, & Abaku, 2024).

By allowing businesses to suggest complementary products (e.g., keyboard and mouse, cufflinks for a suit, completing furniture sets) and hence maximize the potential value of a customer's visit, recommendation of cross-category products is a critical and challenging task for an e-commerce system. Cross-category recommendations include suggesting items from many categories that enhance the user's original choice. For instance, when a consumer purchases a laptop, they might also be recommended to purchase accessories like a laptop bag or an external hard drive. This recommendation goes further than just item-to-item similarity and involves comprehending the wider context of user needs and preferences.

The complexity of cross-category recommendations arises from several factors:

Diverse Product Relationships: Unlike same-category recommendations, where products are often directly related, cross-category recommendations involve more nuanced relationships. For example, recommending a camera to a user browsing for travel gear requires understanding the implicit need for capturing travel memories. These relationships are not always straightforward and require sophisticated algorithms to uncover hidden connections (Marti, Liu, Kour, Bilgihan, & Xu, 2024).

User Intent and Context: Understanding the user's intent is critical for making relevant cross-category recommendations. In the case of someone looking for a formal suit, suggesting items such as shoes, ties, or cufflinks requires understanding the formal setting. User's purchase history, browsing behavior, and time-sensitive factors are crucial in improving the relevance of these recommendations (Houcheimi & Mezei, 2024, March).

Personalization Challenges: Cross-category recommendations must be highly personalized to be effective. The challenge lies in accurately predicting the user's complementary needs based on limited data. This is especially difficult when the user has a sparse purchase history or when recommending items that are typically outside the user's usual buying habits (Fahlevia, et al., 2024).

Cold-Start Problem: This issue is particularly pronounced in cross-category recommendations, as new users or users with limited interaction data may not have enough history to generate accurate recommendations. Addressing this requires leveraging additional data sources, such as demographic information or real-time behavior analysis, to make educated guesses about the user's needs.

Finding a balance between recommending new products: To ensuring they are still useful to the user's needs is crucial for cross-category recommendations. Providing an excessive number of irrelevant recommendations can be overwhelming for the user, whereas excessively cautious suggestions may not effectively expose the user to beneficial new products (Cao, 2013).

Another challenging problem is to derive the reasons behind the recommended items instead of just showing them, as giving reasons to users can improve the user experience, e.g., user trust or confidence in the personalized recommendations (Wang, Liu, & Yao, 2024).

Modern commerce platforms such as Amazon, eBay, and Alibaba maintain large product bases with numerous customers. Developing algorithms for providing effective product recommendations for any particular user at any given time is the primary problem of the commerce platforms (Zhang, Millan, Money, & Guo, 2024). The user's current preferences, the set of relevant products, and the user's context, including the user's physical location and social setting, can all potentially affect the suitability of the products the platform presents.

Product recommendation has become a common feature of most e-commerce platforms. It is a personalized selling approach that aims to provide an individual user with a professional salesperson's assistance. Accurate product recommendations can help the platform generate more revenue, increase user satisfaction, and improve the success of online shopping (Wang, Liu, & Yao, 2024). Effective product recommendations also have consequences for various areas such as information retrieval, knowledge management, electronic catalogs, and personal digital assistants.

4.2 Chatbots or Virtual Assistants

Virtual assistants for shopping replicate the interactions seen in physical stores between shoppers and sales associates, improving consumer experiences with tailored suggestions. They also help consumers identify the products that best fit their demands (Ali, 2024). By integrating multi-user or collaborative recommendation systems, personalization services can be further implemented by performing dialogs among not only the customer but also the customer's friends during their shared shopping experience. With chatbots, online shopping can be treated as a leisure activity and can be a fun and interesting experience for consumers by providing social and entertainment values or a learning activity of purchasing knowledge or shared experience through recommendation dialogs.

Apart from speech-based dialogue systems, text-based conversation agents, also named as chatbots or virtual assistants, have a more widespread application. Chatbots are mostly deployed on websites or messaging platforms. They aim to provide information, answer specific questions, or fulfill tasks, all in an interactive way (Huq, Maskeliūnas, & Damaševičius, 2024).

Chatbots have been successfully integrated into leading e-commerce platforms, such as:

- **Amazon's Alexa[2]**: it is mainly recognized as a voice assistant, but it also enables users to conveniently repurchase items, monitor deliveries, and get personalized shopping suggestions within Amazon's shopping platform. Alexa's ability to process natural language allows it to comprehend intricate user requests, creating a smooth shopping experience

- **H&M's Virtual Stylist[3]**: H&M has introduced a chatbot as a virtual stylist on their website and mobile app. The chatbot queries users about their style choices and recommends clothing options that align with their preferences. This chatbot improves the shopping experience by providing personalized fashion advice in addition to aiding in product discovery.

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[2] Amazon Alexa

[3] You're invited to the metaverse! How H&M Group uses tech innovation for endless fashion opportunities - H&M Group (hmgroup.com)

- **Sephora's Facebook Messenger Bot[4]:** enables users to schedule make-up appointments, seek beauty tips, and experiment with products through augmented reality (AR). This interactive shopping experience connects online and offline methods, facilitating informed decision-making for users.

chatbot technology still has restrictions and areas that can be enhanced, such as:

- **Limited grasp of context**: Despite advancements in comprehending and analyzing natural language, chatbots still face challenges in maintaining context during prolonged conversations. This restriction may annoy users who have to restate information or explain their requests several times.
- **Managing Complicated Inquiries**: Chatbots are typically programmed to address particular tasks or respond to predetermined inquiries. When presented with complicated or subtle questions, they might struggle to offer precise or satisfactory answers. This can be especially difficult when users make very specific or rare requests.
- **Challenges in Personalization**: While chatbots can provide personalized suggestions, reaching a high level of personalization demands thorough data collection and processing. Privacy concerns regarding the collection and utilization of personal data can also affect the trust and acceptance of chatbot technology by users.
- **Incorporation with Human Agents**: Although chatbots are created for managing ordinary duties, there are instances where human involvement is required. Effective collaboration between chatbots and human customer service agents is crucial for a smooth transition when users require support beyond chatbot capabilities.
- **User Adoption and Trust**: Certain users may find it less natural or comfortable to interact with a chatbot compared to a human agent. Building trust with users in chatbots involves improving the user experience, ensuring answers are transparent, and providing simple options to transition to human support if needed.
- **Multilingual Assistance**: Due to the global reach of e-commerce platforms, chatbots need to communicate in various languages. Even though progress has been made in language processing, mastering fluency, and cultural significance in all languages supported still presents a difficulty.

4.3 Personalized Marketing

Personalized marketing approaches can emphasize a myriad of ideas and tools throughout the process of e-commerce. They can include not only the search engines, buyer behavior, recommendation systems, and intelligent agents but also many variables including customer registration and browsing activities. The customer's interaction with the website can serve as a source of information to aid evidence-based personalization (Babatunde, Odejide, Edunjobi, & Ogundipe, 2024). In addition to the customer's browsing patterns, frequent customer's browsing habits and actual purchases can contribute to a complete customer profile, promoting personalization by using membership data and incorporating push media. One marketing approach that can help influence consumer selection is individuals advertising, which includes customer behavioral interests and the visitor's previous search criteria. The acceptance of personalized ads is inextricably linked to the relevance of the advertisements provided by the website about the consumer. Associating profitable and personalized product offers is useful to both sides of the purchase interaction and can be a critical means for retailers and producers to develop specialized responses to different micro-market segments. As proposed by market niche segmentation or personal profile criteria, different mix strategies such as a personalized product, reasonable pricing, and a well-recognized sales point can be achieved (Okorie, et al., 2024).

Personalized marketing is adapting the content, strategy, and delivery to the preferences, interests, cognitive styles, and behavior of the person due to the use of profile, attitudinal, and behavioral attributes. Organizations can use various adaptive marketing strategies to infer how a consumer or segment of consumers is likely to use the website and the purchasing intention, which affords the ability to increase profitability and opportunities during the online shopping period (Houcheimi & Mezei, 2024, March). Many marketing experts believe that a personalized and relevant message will be an effective means of promoting products or services to individuals, which in turn will achieve customer dependable loyalty and acquisition benefits. Companies that can produce more relevant and targeted campaigns by using personalization techniques inside an

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[4] Sephora Bot — ChatbotGuide.org

integrated marketing approach will have a significant advantage. According to many researches and studies, creating a series of value-added relationships and loyalty between company and customer that includes personalized marketing strategy, person-to-person communication, relevant products and services, excellent customer support, individual flexibility, and congestion reduction, is its only complete savior (Karl, 2024).

4.4 Fraud Detection and Security

To enhance money laundering detection in e-commerce from data, a hybrid approach based on the data mining tool of Apriori algorithm and a linear phase model of probabilistic agent is employed to automatically assess the expected grade of a transaction (Islam, Haque, & Karim, 2024). Agent technology has been applied as well. A multi-agent system is developed and deployed to support business intelligence and decision making in financial institutions for detecting fraud and money laundering. The system is capable of deciding whether a customer is sincere or a crook by making queries to human and non-human agents. A secondary agent with an integrated adaptive and executable decision support system has been developed to support the primary agent in detecting money laundering (Mutemi & Bacao, 2024).

Today, with the wider public acceptance of e-commerce, merchants have to deal with growing fraudulent activity in the e-commerce domain. Machine learning and agent technology have shown great promise to disentangle fraud from genuine transactions. Machine learning methods have been thoroughly applied for fraud detection and have proven very effective (Xu, Zhou, Zheng, Zhu, & Xin, 2024). Fraud detection involves creating a statistical profile for each customer by taking into account many factors, including the customer's location, the time and date of the transaction, the behavior and purchase history of the customer, and examining unusual patterns. In practice, the analysis of a huge number of parameters with many-tuple cases can be achieved efficiently through the use of data mining and decision trees, which can determine logically the connections and dependencies between variables, in the case of disjunctive rules (Mutemi & Bacao, 2024).

5   Enhancing the Online Shopping Experience

To provide various product exploration paths that lead customers to their items of interest, fuzzy association rules are constructed based on customer transaction data. This uses a transaction record to build a transaction database and then uses the fuzzy concept to perform a fuzzy partition of database records (rohidin, Samsudin, & Matderis, 2024). A rule is supposed to be used to describe that relationship. Mining these constructive rules will be completed to discover the different relationships between records. The first product could be recommended by using the most probative record based on fuzzy matching, and then extracting the rest of the product order from sorted record sets. After the peer list has been generated, a priority weighting method can be used to rank and suggest different orders based on customer behavior until several orders with the highest likelihood of purchasing are placed in front of the list (Mutemi & Bacao, 2024).

Besides personalization, AI applications are also essential in enhancing the online shopping experience as it has a special and intimate role in the interactive, actionable, and customized system throughout the online shopping process. In the following sections, a brief survey of essential AI for enhancing the online shopping experience is presented.

5.1 User Interface Design

Additionally, it is important to give users transparent and helpful feedback as they navigate through the site. Users want to know immediately whether the system has understood them and responded to their needs or not. The feedback needs to be brief and located where the user looks for it, such as a cue on the screen or a continuously updated list of items in the shopping cart.

Each page should include tabs or buttons that move users to other important website sections. For example, the product catalog, shopping cart, customer service, etc. The links should be grouped so that the user can find what they are looking for quickly, but the group should not be too long to avoid confusing the user (Sutresno, et al., 2024).

The most important parts of website pages should be eye-catching and easily accessible. An attractive appearance brings a good impression and can capture users' attention. Maintaining a standardized layout throughout the site could reduce user confusion (Akin, 2024).It would also help improve the usability of the website.

Users have encountered and visited many websites during their surfing. Many users will try to look for some basic information before making a purchase. Basic information such as product prices, features, availability, delivery charges and time, etc., will attract many customers to buy. Therefore, it is crucial to first present this information on the website.

For customer-focused applications, developing the user interface and offering an efficient navigation process is very important to ensure that the user interface design is user-friendly and the choices for users can be understood easily. User-friendly designs enable a website user to customize the site to his or her needs. An efficient navigation process helps customers find what they are looking for as quickly and as easily as possible (Raji, et al., 2024). The design of the navigation also affects people's impression of the online store. Here are some ideas.

5.2. Search and Navigation Optimization

An important and very beneficial application of AI techniques in online stores and e-commerce is in the optimization of search and category navigation. Many online stores contain a large number of products that belong to a large number of categories. For human-operated e-commerce sites, navigation through category hierarchies is adequate for browsing but can become inconvenient or even result in not finding what one is looking for. Search engines and product filters are provided to compensate for the increasing complexity of category navigation and product search. However, traditional search engines are database query programs that only retrieve results based on matching keywords (Zhang S. , 2024). Keyword search engines can produce unpredictable and unexpected output because of polysemy and synonymy, and the difficulty of requiring keywords to be in specified attribute fields. Furthermore, because the contents of most databases are opaque, search engines can also retrieve Amazon or other web pages that list products but do not have the option to purchase the product.

5.3 Personalization Strategies

User-to-user collaborative filtering algorithms such as Amazon.com, Digimark, Egain, Electric Friends, and Firefly were advocating social networking between unknown users. But in order to provide good recommendations, site owners needed first to have a trusted community of users exchanging advice and recommendations. Content-based recommender systems evade a critical mass of similar users. It is the nature of today's long-standing commerce websites that it is difficult for new entrants to beat the incumbents. To a large extent, neither prevalent type of recommender system engaged in the discourse that was taking place on the web about company products or services recommender systems used other visitor transaction data to calculate the proximity (similarity) of products.

Personalization strategies form the gamut of strategies useful in delivering personalized content and services such as recommendations (products, services, etc.), communication (feedback, e.g., purchase reviews), bundles, and targeted promotions (Devineni, 2024). The space of recommendations is divided by authors such as (Resnick & Varian, 1997) or used by web content authors, such as (Eftimov, 2024), or used by product specialists, such as (Sharp, 2024).The most common distinction is into representatives based on evaluators based on competence-based. The formers supply additional information about junction objects, whilst the evaluators need features of objects and feature access. The last type of recommendation is related to recommender agents that need both object features and user feedback of objects, which learn from web log data. They propose to use reinforcement learning and noted that the traditional methods focused on modeling web pages and the utilities of links and sometimes page summaries, and that these sources of training were not ideal for fine-tuning which pages to link to.

6   Case Studies and Best Practices

Given this foundation, the system should expect greater knowledge of the employment of techniques and tools concerning device learning, in general, concerning network learning, and approach learning. Therefore, when introducing AI into the decision-making process, it requires comparing a modest spectrum of rules for method determination. As they say, the more rules a system can produce, the greater the customer's degree of fulfillment. In terms of supervision and regulation, AI-integrated e-stores run the risk of encountering particularly susceptible phenomena, for example, what they call AI-related misdirection's (Thomas, et al., 2022).

We also know that manager awareness and support are the main drivers for creating an AI-sustained context for decision-making. We need to make them aware of the advantages and clear prospects by reaching a wider audience to reduce their general gap or ambiguity. This interest falls into the use of case studies that propose practical, forward-looking, and strategic modifications. AI has undoubtedly promised system enhancements to reinforce e-commerce combinations and activities. Offering some strategic tuning calls for the formation of advanced system supervision, as reflected by the Highway. Since the e-commerce system is founded on complex tasks related to handling a broad spectrum of issues, from general New Product Development (NPD) by direct clients to the promotion of management to providers, we affirm that the most benefit may be received by infusing AI decision support techniques in the context of the widest human Artificial Complexity (Manoharan, Durai, Rajesh, & Ashtikar, 2024).

Case studies and research that merge AI with e-commerce suggest taxonomies and guidelines to support decision-making and lessen the gap between researchers and practitioners. They categorize the most significant AI applications in e-commerce technique enhancement. The defense of these AI-empowered approaches relates to the perspectives given by e-commerce research, for example, how social presence may improve the interaction process and the promotion of dialogue with the community. The development of robust AI-driven tools, techniques, and decision support models consistently entices the need to test them in the real world and validate them as complete, accepted, and promising outlooks.

6.1 Amazon: A Leader in AI-driven E-Commerce

Other applications of AI in e-commerce include emotion analysis, personalized email marketing, intelligent text message alerts, the Internet of things, shoppable landing pages, fraud detection, and reviewing historical customer queries to automate the generation of the substantial training data required for existing models (Al-Kabi, Al-Qudah, Alsmadi, Dabour, & Wahsheh, (2013, April)). Amazon employs machine learning algorithms, logistics strategies, robotics, cloud computing, and mathematical models to deliver billions of items to customers all over the world, explicitly knowing the value of the dollar and the requirements of the customer. By considering user satisfaction, correctness, and speed, Amazon constantly improves its results with rigorous algorithms, research, and science.

Amazon is a global leader in using artificial intelligence and machine learning techniques to transform e-commerce[5]. AI techniques have been employed in almost every aspect of Amazon's e-commerce business, such as search results ranking, product recommendations, demand forecasting, product and deal discovery, public data generation, and warehouse management. Also, the company continuously improves its AI technologies to understand the latest fashion trends and detect images that appeal to customers, predict and identify the types of products according to numerous variations in raw data collected for millions of physical products, ensure the accuracy of product sales forecasts and seasonal data patterns regardless of constantly changing influences, and update its popular natural language understanding models to better understand the ambiguity, informality, and variability of customer communications (Chen, 2012).

Nevertheless, even though Amazon has been successful, there are various challenges and expenses associated with integrating AI technologies, such as:

- **Financial Expenses:** The large sum of money required for AI technologies, such as infrastructure, research, and hiring talent, can be considerable. Amazon can leverage its large resources to scale these investments, something that smaller companies may lack.
- **Resistance from employees towards implementing AI:** It can arise due to concerns about job loss or the complexity of new systems. Having efficient strategies for managing change is crucial to address these worries and guarantee a seamless transition.
- **Integration complexity:** Successfully incorporating AI into current processes and systems necessitates a thorough grasp of both AI tools and the specific industry. Misalignment may result in inefficiencies and AI capabilities being underutilized (Eftimov, 2024).

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[5] https://www.amazon.com/

6.2 Alibaba: Innovations in Personalization

The personalization methodology based on the analysis of user actions and interests is described in detail in this article. The concept of the personalization system used by Alibaba Group features five main components: a scenario engine, activity data analysis, life-cycle customer management, personalization service, and a central serving platform. To improve personalization, two main principles combine AI technologies about individual data: sharpness and diversity. To these principles, the company decided to create and use technical clusters that combine different AI techniques[6].

The text presents the innovations and personalization methodology of the Alibaba group of companies in electronic commerce. The principles of Alibaba's use of online behavior, marketing, and information platform strategy, innovative services for win-win participation, and the creation of conditions for interacting with all retail chain partners in the modern retail digital economy are discussed. These innovations and services make all Alibaba platforms leaders in the field of personalization. The methodology of personalization is in detail described in this document: preparation and user data collection, data aggregation, data model design, generation of personalized predictions, and building a recommendation service. The article presents examples in which Alibaba uses different AI technologies and various data in the area of personalization. The details of scoring for clustering and the recognition model are presented (Cao, 2013).

Despite Alibaba's successful AI implementation, it encounters comparable hurdles, such as:

- **Depends on complex AI models:** Alibaba's personalized experience relies on complex AI models that require ongoing updates and refinement. This complication may present difficulties, especially in preserving model precision with increasing data volume.
- **The price of customization:** Alibaba's level of customization requires a cost, in terms of both computational resources and data management. Smaller e-commerce platforms may find these costs unaffordable.

6.3 Small E-commerce Platforms

Even though Amazon and Alibaba are leading examples in AI-powered online shopping, smaller firms and local websites show the possibilities and difficulties of incorporating AI as well, such as:

- **Shopify**[7] is a tool utilized by small to medium-sized companies globally, integrating artificial intelligence for suggesting products and managing inventory. Nevertheless, the difficulties involve managing the expenses of incorporating AI with the advantages for small businesses that may have restricted budgets.
- **Lazada**[8], a main platform in Southeast Asia, uses AI to provide personalized shopping experiences tailored to the preferences of each region. Despite achieving success, Lazada encounters obstacles in gathering data from various markets and the expensive upkeep of AI infrastructure.

6.4 Effect and Measurements

- Implementing AI has shown to enhance income streams by heightening customer engagement and improving change rates. AOV, CLV, and ROI are frequently employed to evaluate the financial consequences of implementing AI in the e-commerce sector.
- AI-powered personalization leads to increased customer satisfaction, as indicated by customer satisfaction and net promoter scores. These measurements demonstrate how effective AI has been in enhancing the personalized shopping journey.
- AI boosts operational efficiency by automating tasks like inventory management and demand forecasting, cutting down on errors, and optimizing resource allocation. Measuring order processing speed and inventory cycling rates can show the increased efficiency resulting from implementing AI technology (Kalmykov & Kalmykov, 2024).

6.5 Challenges in the Execution of Artificial Intelligence

- Privacy issues to ensure that AI systems comply with regulations and address concerns about data protection due to the vast amount of data needed.

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[6] Alibaba.com: Manufacturers, Suppliers, Exporters & Importers from the world's largest online B2B marketplace
[7] Create your online store today with Shopify Malaysia
[8] Lazada Malaysia | Fast & Free Shipping

- Shortage of skills: Integrating AI necessitates knowledge in AI technologies and the business sector, leading to a need for proficient individuals that may be challenging to find, particularly for smaller firms
- Cost-Benefit Analysis: It is important for smaller businesses to carefully evaluate the expenses associated with implementing AI compared to the projected advantages, which may pose difficulties due to limited resources.

7   Ethical and Privacy Considerations

Laws and regulations to solve business problems are simple. You can obey non-governmental public governance, such as self-regulation, certification, advice, guidance, and supervision. Many powerful technical problems that have to be revised can be solved (Grindal, Mueller, & Srivastava). Interests, including the interests of sellers and consumers, technologies of various artificial intelligence are mainly for the purpose of neural network analysis or recommendation systems. These are the core. Morals also include Yu-Morals and Yan-Morals. In the era of artificial intelligence, interest structure, trust, accountability, interests, responsibility, fairness, and freedom are special because the moral status of algorithms is still controversial in the literature war. The moral practice of artificial intelligence in e-commerce has commercial promotion value, and the whole model of the ultimate moral standards should be carefully considered in the context of specific algorithms (Bonnefon, Rahwan, & Shariff, 2024).

Many e-commerce advancements will lead to new applications, such as mobile social applications, mobile cloud computing, big data analysis, networking, artificial intelligence, and cloud software architecture evolution. Specifically, e-commerce provides a large platform for the application of artificial intelligence (Akin, 2024). All of this is realized by solving actual problems in reality, not by technical optimization. The core is "big data" and "data science", and the relationship between people and data. That's semantics. The new capitalism with large-scale, data-driven authorities includes laws, interests, morals, sellers' privacy, consumer privacy, and consumer protection in e-commerce. The ideal state is an era of honesty and trust (Babatunde, Odejide, Edunjobi, & Ogundipe, 2024).

7.1 Data Privacy Regulations

The GDPR[9] requires data controllers to accurately record how they handle personal data. They are required to keep a detailed record of the processing activities they are responsible for. Particular rules under GDPR govern the processing of certain types of personal data as well as information about criminal convictions and offenses. Without an adequate decision, personal data can be freely transferred between EEA members and to other nations. However, the transfer of personal data to countries outside the EEA with low levels of data protection requires an assessment of adequacy or a mechanism to ensure appropriate safeguards depending on other suitable guarantees (Esteves & Rodríguez-Doncel, 2024).

Before the General Data Protection Regulation (GDPR), there were privacy breach notification obligations in the previous regime, but there was no legal obligation for businesses to report every single breach of data protection to the Information Commissioner's Office. There was a duty to notify the Information Commissioner's Office of breaches of the seventh principle, but the Data Protection Act 2018 extends this obligation to every breach of data protection. Because of the GDPR, if there is a breach that is likely to result in a risk to an individual's rights and freedoms, the individual must be informed directly, whilst if there is the potential to cause large numbers of individuals to suffer significant material or non-material damage, the business involved must inform the local supervisory authority [10].

7.2 Bias and Fairness in AI Algorithms

Over the years, recommender system research has paid increasing attention to predictive accuracy and the problem of pervasive side effects of optimization on other important aspects of real-world systems, escalating the importance of bias and fairness in the personalization field. It is also recognized that the process of modeling in personalization and recommender systems, when human entities are the subject of prediction, brings about unique problems that stem from social and cultural biases (Caton & Haas, 2024). This body of study calls for

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[9] What is GDPR, the EU's new data protection law? - GDPR.eu
[10] GDPR vs UK Data Protection Act 2018: What's the difference? | CSO Online

measures of bias and fairness with dual purposes: to ensure the elimination of bias that could be detrimental to social justice (bias-mitigating), and to the evaluation and accountability of the produced predictions (bias-auditing). These facets are particularly important in domains like personalization, where the human entity is the most immediate consumer of the model's output (Deldjoo, Jannach, Bellogin, Difonzo, & Zanzonelli, 2024). In recent years, "artificial intelligence" (AI) has been continuously attracting a great deal of attention. The word artificial intelligence can include robotic neural networks, expert systems, and real learning patterns (Zhang S. , 2024). With the development of the Internet and the rapid growth of electronic commerce, the integration of artificial intelligence techniques in e-commerce has academically attracted considerable attention. Online vendors attempt to explore effective and efficient personalization technologies to provide customers with services that better conform to their needs and preferences. The study investigates the crucial problems encountered in the construction of effective personalization systems and describes the potential benefits of the integration of AI personalization technologies to e-commerce interests (Thomas, et al., 2022).

8   Future Directions and Emerging Trends

The latest developments in the field of online trade have become the subject of research under the title of Advanced Technologies in electronic commerce. These technologies enable offering the customer more advanced sales environments and attracting the customer. With the increasing competition in the field of electronic commerce and with the continued advancement of technology, online sales companies need to offer the best quality service to their customers (Eftimov, 2024). Research and development studies are being carried out in this field, and it can be said that this is a promising and difficult work. In this study, some of the work done is film-shown on globalization, online shopping malls, benefits and threats of e-commerce, and electronic commerce applications. The art of artificial intelligence, which normal people confuse with their theory and science, is the subject of a separate section. In the next section, the essence of the study subject is summarized. Then, in a wider frame and from different aspects of the business world, the literature studies related to artificial intelligence in electronic commerce are examined. In the end, the discussion of the study is located, and it has been finalized in the language (Lazić, Milić, & Vukmirović, 2024).

The novels of the authors in the fields of computer science, engineering, and management science are increasingly turning into ongoing projects. Advanced technologies take an increasing role in all sectors and cause a revolution, especially in trade. Online sales have become one of the most important elements in the trade arena. Despite all the accelerated developments online, what is known as very comfortable shopping can sometimes lead to unpleasant results or even questions about whether technology has real advantages at the highest level. However, in recent years, advanced technology components, the most important of which is artificial intelligence, have been added to the electronic commerce environment to offer very advanced services and bring customer satisfaction to the highest level, which should have been done (Manoharan, Durai, Rajesh, & Ashtikar, 2024).

8.1 Predictive Analytics and AI

The intelligent agent can also use the user's profile, how many words are in the abstract, how many words cover the query, and where the query words appeared in the abstract. Using this information, Enigma's basic artificial intelligence server, Enigma Expert, hypothesizes the users that fall into the preferences that are the intersection of the groups of likely readers [11]. These group preferences are then traced to the specific preprocessed subdirectories that satisfy the group's requirements. Then it discards the information that the group will not be interested in. If there is a time delay, the action of the user may convert the glance to the offered presentation and Enigma to give the brief to the non-suspecting audience that would otherwise be available. In either case, the audience maximally visible specific presentation of the relevant news. The intelligent agent would then modify the information, exploring lateral and vertical relations within the essays (Frasnetti, et al., 2024).

Enigma has developed a product that enables 'zero-click buys' through predictive analytics. When a user logs on to Enigma.com[12], the user is 'personally greeted.' Individualized news is delivered to the visitor based on preferences. The system makes the statement, "If you have a news source in New York, then you are likely,

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[11] How we cracked the Enigma code using Artificial Intelligence (linkedin.com)
[12] https://www.enigma.com.my

because of your interest in e-commerce, to be interested in a series on the impact of e-commerce on New York." Then it asks, "Would you like to view the news?" If the visitor responds, "No," the system asks, "Would you like us to show the news?" If the visitor responds, "Yes," the information is presented. In this fashion, the user can then view information from other sources (Zhang, Millan, Money, & Guo, 2024).

Predictive analytics (PA) is another powerful AI tool. Box.com[13] uses predictive analytics in selecting content that is interesting to you. If you ask for information about mayonnaise, for example, the latest information on mayonnaise from the mayonnaise issue is automatically displayed. If you have asked for information on a wide range of subjects and search on the site without logging on, you receive the most popular items at the top of your search (Eftimov, 2024).

8.2 Voice Commerce and AI Integration

With the assistance of a natural language comprehension neural network, Alex can understand better natural language and thus integrate search and product identification functions with voice interactions seamlessly. This conversational AI-first selects the most relevant text template to interpret the user voice input and then uses an AI model to understand the user's search behavior. The conversational AI model transfers the user's voice to a synthesized Q&A and strategy, which eventually replies to the consumer. Before transferring the voice inputs into actual text conversions, the ASR was transcribing the user inquiry into raw text. After a separate process for error correction, the intent was identified upon utterance significance understanding. The dialog flow then responds to the user's capability through their intentions about shopping and query. The responses are then communicated to the user in an audio nature through TTS (Mari, Mandelli, & Algesheimer, 2024).

In recent years, another form of virtual sales assistant that integrates voice commerce (VC) with AI has surfaced. This technology combines the AI model (for user intent prediction and Q&A generation) and the voice model (referring to TTS (text-to-speech) and ASR (automatic speech recognition) for speech input/output). As a result, it significantly improves VC's capability for conversational-style shopping assistance and product information provision. Although the technology has just emerged, it has been deployed in many intelligent voice assistant platforms, such as Amazon Alexa and Tencent Xiaowei. Alexa, for example, uses AI models trained with a large body of product knowledge. Also, its conversational voice AI can accommodate a large number of user intents associated with placing an order, providing information, or scheduling products based on spoken inquiries[14].

9   Conclusion and Implications

Conclusion and Implications Research in the past has limited papers on the integration of Artificial Intelligence (AI) techniques in e-commerce—hence there is a need for a more comprehensive review and in-depth examination of the past and present status of this integration. In addition, this paper has identified the gaps and deficiencies of the previous intervention, such as attempts on AI for personalized recommender—probably due to the scarcity of papers published on this topic. Researchers and practitioners alike could make reference to the development on AI techniques in e-commerce and are made aware of its limitations and deficiencies. Indeed, there are opportunities for directions in future research that this paper pointed out, such as assessing the longitudinal impacts of AI-based techniques on business performance. More specifically, future researchers could use both qualitative and quantitative findings for more detailed studies to uncover the reasons and rationales of why and when the AI techniques should be implemented by online retailers to improve the online shopping experience, personalization, and subsequently customer satisfaction with e-commerce.

Abstract The ever-increasing demanding nature of the online consumer has led to the increased adoption of e-commerce. The manifest success and increasing number of e-commerce websites have rendered extremely fierce competition among these websites, and the key to success has now shifted from mere presence to providing exceptional online shopping experience and personalization to consumers. This has indirectly led to the integration of artificial intelligence techniques into the e-commerce domain. The purpose of this study is to provide a systematic and comprehensive review of the integration of specific artificial intelligence techniques

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[13] Secure, AI-Powered Content Management, Workflow & Collaboration (box.com)
[14] Alex - LayerAi (cryptogpt.org)

in e-commerce and its implications to both practitioners and academicians. This study has also identified the various shortcomings and makes numerous suggestions for future research.

9.1 Summary of Key Findings

The research conducted in this study presents the areas of e-commerce where AI has been utilized, under the application of AI tools such as machine learning and natural language processing, for personalization, chatbots, and virtual assistants. These are different techniques under the broad application of AI in e-commerce, following the use of the various applications in e-commerce platforms. We did a review of papers on AI applications in e-commerce to ascertain the various techniques and to identify ways AI has been used, business concepts applied, problems solved, challenges, and the limitations under which various techniques of AI have been used. The learning covers the mechanics, applications, advantages, benefits, opportunities of AI, and problems that were resolved by firms in e-commerce.

The study begins with an introduction of artificial intelligence as it relates to e-commerce, along with the research questions, objectives, and an overview of the study's significance and contribution. The comprehensive explanation of each AI technique's structures, along with a description of its possible applications for e-commerce and an examination of its benefits and drawbacks, come next. This leads to a summary table of the integration of AI techniques into e-commerce.

9.2 Practical Implications for E-Commerce Businesses

Explainable AI techniques can increase the trust of shoppers towards provided recommendations by making them more understandable. Additionally, customer relationship management can be improved and a business network can be extended using social media mining techniques. E-commerce businesses can collect and analyze personal data of potential clients and, in turn, create personalized marketing campaigns. Moreover, the usage of differential pricing techniques can earn a business higher profits. Finally, it was presented that AI techniques aid in the detection of frauds in online transactions and also can offer quick and personalized customer support. This chapter presented the main AI techniques that have been utilized in e-commerce environments. Consequently, there is now much more competition among e-commerce companies. Because of this, companies have an ongoing obligation to provide their clients with the greatest possible purchasing experience. Inefficient shops can lose clients and damage their reputation. E-commerce companies may boost personalization and the online purchasing experience by utilizing cutting-edge AI techniques. Online shoppers can make better, more educated judgments about what to buy by using recommender systems, which can generate accurate, individualized recommendations. Additionally, chatbots can communicate with prospective customers directly and respond to their inquiries as needed.

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