ARTIFICIAL INTELLIGENCE (AI) BASED ANALYSIS OF CUSTOMER BEHAVIOUR ON E-COMMERCE PRODUCT

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ABSTRACT

The rapid growth of e-commerce has led to an overwhelming volume of data generated from customer interactions with online platforms. To gain a competitive edge, businesses are increasingly turning to artificial intelligence (AI) for analyzing customer behavior and making data-driven decisions. Various implications of AI-driven insights on enhancing customer experience and engagement within the e-commerce domain is studied. This includes the implementation of personalized product recommendations, targeted marketing strategies, and efficient customer service through AI-powered chatbots. This paper presents a comprehensive study on the application of AI in analyzing customer behavior on e-commerce products.

KEYWORDS— Customer, Artificial Intelligence, Data Mining, E-commerce.

INTRODUCTION

Experienced customers' earlier evaluations may be helpful for novice consumers since inexperienced consumers may have significant uncertainty while purchasing experiential items that need technical knowledge and abilities to work well. However, information shown about individual purchasers is restricted in one-sided review systems (such as Amazon) since users may only leave reviews as buyers and there is no feedback from the seller's side. The purchasing and selling of products and services through the internet is referred to as "e-commerce," which is short for "electronic commerce." It comprises making purchases and sales through the internet as well as the transfer of data, monetary value, and other types of information between buyers and sellers. E-commerce has brought about a sea change in the manner in which companies function as well as in the manner in which customers purchase by delivering ease of use, an extensive variety of alternatives, and access to goods and services all over the world.

The following is a list of important characteristics of online commerce:

1. Online storefronts: E-commerce makes it possible for companies to establish virtual storefronts on the internet, where consumers can shop for and buy goods and services. Individuals, small enterprises, or even major organizations might own one of these shops if they want to do so online.

2. Electronic Payments: E-commerce makes it possible to conduct safe online transactions by using a variety of electronic payment methods, including credit cards,

digital wallets, bank transfers, and even cryptocurrencies like bitcoin. Because of this, there is no longer a need for actual cash or cheques.

3. Ability to Serve a Global Market Because it eliminates physical boundaries, e-commerce enables enterprises to serve clients located all over the globe. Customers are able to shop from any location, and retailers may increase the geographic scope of their customer base outside their immediate vicinity.

4. Customer Support E-commerce platforms often include customer support services, which may be accessed by consumers through online chat, email, or the phone. These services can assist customers with a variety of difficulties, including enquiries, order tracking, and return requests.

The traditional model of brick-and-mortar retail has been upended by the rise of online commerce, which has opened up new avenues of expansion for companies while also enabling customers to purchase from the convenience of their own homes. It will continue to develop as new technologies come out, such as artificial intelligence, augmented reality, and voice commerce, all of which will have an impact on the future of online buying.

Figure 1.1: Machine Learning in E-commerce

Machine learning plays a significant role in the e-commerce industry, enabling businesses to enhance various aspects of their operations and improve customer experiences. Here are some key applications of machine learning in e-commerce:

1. Personalized Recommendations: Machine learning algorithms analyze customer behavior, purchase history, and preferences to provide personalized product recommendations. These recommendations help increase user engagement, conversion rates, and customer satisfaction.

2. Customer Segmentation: Machine learning models can segment customers based on their behavior, demographics, and preferences. This enables businesses to target specific customer groups with tailored marketing campaigns and promotions.

3. Fraud Detection: Machine learning can be employed to identify fraudulent activities and transactions, helping e-commerce platforms detect and prevent fraud, thereby safeguarding customers and merchants alike.

4. Price Optimization: E-commerce companies can use machine learning algorithms to dynamically adjust product prices based on factors like demand, competition, and customer behavior, maximizing revenue and profitability.

5. Inventory Management: Machine learning can predict demand patterns and help businesses optimize their inventory levels, reducing excess stock and stockouts, and improving overall supply chain efficiency.

6. Customer Service and Chatbots: Chatbots powered by natural language processing (NLP) and machine learning enable e-commerce platforms to provide instant customer support, answer queries, and assist customers throughout their shopping journey.

7. Image and Voice Search: Machine learning algorithms can facilitate accurate image and voice search functionalities, making it easier for customers to find products they are looking for using visual or voice queries.

8. Sentiment Analysis: Machine learning models can analyze customer reviews and feedback to gauge customer satisfaction and sentiment, allowing businesses to make data-driven improvements to their products and services.

LITERATURE SURVEY

K. Mensah et al., [1] As social media are more quickly integrated into the conventional e-commerce ecosystem, the classic idea of e-commerce is increasingly shifting to social commerce. Practitioners and academics alike need knowledge of the factors and causes that account for the public's embrace of social commerce in order to effectively use social media methods designed to increase social commerce purchases. Trusting beliefs, such confidence in social networks, the integrity of the seller, and the kindness of the seller, were shown to be important predictors of the willingness to participate in social commerce. In social commerce, however, buyer intent was not significantly affected by the seller's expertise. Other findings indicated that consumer social commerce contact history significantly predicted social network trust, seller honesty, seller competence, and seller kindness.

M. Abdulqader et al., [2] Customers base their purchases in part on what they read in online reviews. Existing methods for detecting fraudulent internet reviews are ineffective at stopping the proliferation of phony reviews, and recognizing them automatically remains a challenging subject. There is a dearth of a high-performance, theory-based model in the literature for detecting fake reviews that allows us to comprehend the phenomena from a psychology standpoint and assess reviews based on user-generated material and customer behavior. These theories included: the leakage theory, the four-factor theory, interpersonal deception theory, self-presentational theory, reality monitoring theory, criteria-based content analysis, scientific content analysis, the verifiability approach, the truth-default theory, and information manipulation theory. Specificity, quantity, delay, emotion, ambiguity, informality, consistency, credibility of source, and outlier behavior are all examples of such concepts.

N. S. Bhati et al. [3] The proliferation of the internet and other forms of digital communication has made widespread use of these services inevitable. As a result, e-services have exploded in popularity and become a critical factor in the success of online businesses.

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As a result, gauging and evaluating E-Service Quality is crucial since it influences consumers' propensity to make online purchases. As an extension of the Theory of Planned Behavior, the present research looks at how consumers' perceptions of sellers' E-SQ influence their desire to buy online. A total of 449 internet shoppers from the Indian state of Rajasthan were involved in the research. Confirmatory Factor Analysis using SPSS 24.0 and AMOS 24.0 was used to conduct reliability testing and confirm the measurement model's constructs. In addition, the causal relationships between the measurement model's components were validated and experimentally tested using Structural Equation Modelling.

A. Mashatan et al. [4] work delves into how consumers' views on crypto-payment's privacy and security shape their confidence in the technology, a crucial factor in shaping consumers' long-term goals and relational exchanges. Based on responses from 327 people, the study concludes that consumers' perceptions of information privacy risk, anonymity, and transaction traceability significantly affect their trust in crypto-payment, while consumers' perceptions of information security fraud risk have no significant effect. It also lent credence to the idea that customers' level of confidence in the technology has a role in whether or not they'll use crypto-payments. The results provide light on what has to be done to solve consumer concerns related to information privacy and possible security vulnerabilities in crypto-payment, as well as the need of raising consumers' knowledge of these issues. This research contributes new understanding to the factors that influence customers' views of privacy and security in the realm of crypto-payment services.

F. Sun et al., [5] Designers build new goods and markets based on the products of previous dynasties, and this is the exclusive emphasis of the conventional product categorization process. This method is time-consuming and inefficient, and it has become a barrier to progress in these businesses' efforts to raise productivity standards and control output. Product categorization is only one area where AI has been put to use in recent years. The three components of MdmNet are as follows: a way for modeling prospective customers using deep learning technologies a weighted fusion module and a consumer information deduction technique based on the MDM that creates a consumer feature closed loop and outputs the classification result from the consumers' point of view.

Experiments conducted on gold-standard data Vehicles are used to showcase the superior functionality of the planned MdmNet. This work is the first to try to include consumer motivation research into the standard machine learning approach.

S. Li et al., [6] It is crucial to increase user happiness by making individualized product integration improvements based on consumer assessment behavior. However, consumers of varying ages make judgments about their level of pleasure based on different criteria. Traditional models and theories of consumer behavior in product assessment fail to account for the nonlinear impact of product qualities and customer personality, and they fail to provide a detailed depiction of the careful deliberation that goes into such decisions. To address these knowledge gaps, develop a Planned Behavior Model for Consumer Evaluation grounded in the theory of planned behavior, which breaks down the evaluation process into three stages: the formation of an attitude toward the product, the formation of an intention to evaluate the product, and the generation of an evaluation of the product.

S. Elphick et al. [7] As a result of high levels of distributed generation, several energy network service providers are facing difficulties in maintaining a safe and stable voltage in their networks. Although lowering supply voltage magnitudes would be preferable in this setting, many network operators are unwilling to do so because of worries about appliance performance at lower magnitudes. Providers of networks are responsible for maintaining voltages within the parameters set out in the relevant standards. This research analyzes the effect of different voltage levels on home appliances by comparing how well they function when supplied with power at different levels. Energy consumption, equipment functioning, and actuator status were tracked throughout a range of applied voltages. There were no reported equipment failures, however there was noticeable variation in appliance behavior depending on the amount of the applied voltage. The voltage reduction factors for individual appliances aimed at conserving energy have also been determined.

H. Jiang et al., [8] The link between a product design characteristic and a consumer's desire might be nonlinear and fuzzy when modeled using online feedback. But tastes change throughout time and are not constant among consumers. Few methods have been offered in previous research to simulate the nuances of customer preferences as expressed in online reviews. However, due to black box issues and the fact that explicit models cannot be demonstrated, the generated models are difficult to understand by humans; this has given birth to the field of study known as explainable artificial intelligence. Therefore, it is critical to create models that accurately reflect customer preferences and are easy to grasp. To model the variational consumer choice from online comments, a nonlinear time series fuzzy regression approach is given; this method may provide a fuzzy dynamic consumer preference model with interactive terms, second-order, and/or higher-order terms. Sentiment analysis is initially applied to online comments in order to extract the datasets.

Y. An et al. [9] The online shopping website's recommendation algorithm relies heavily on knowing the shopper's gender. The inability of gender estimate findings to fulfill the requirements of the product recommendation system is a common issue with gender data due to customers' reluctance to voluntarily reveal personal information. From the dataset given by Vietnam FPT Group, analyze the customers' online buying activity, specifically the goods seen throughout the shopping session, in order to learn the customers' genders. The number of female samples is three times higher than the number of male samples, making the dataset very unbalanced. solve this problem by training a two-layer classifier model to predict clients' genders, and by dividing the female data into three groups.

Cheng, G., et al., [10] This research uses theories of moral identity, community participation, emotional attachment, and brand loyalty to examine the motivations and dimensions of oppositional loyalty (such as cost-benefit analysis, referral networks, schadenfreude, and trash-talking). The 533 users who made more than three monthly postings in Xiaomi's mobile online communities made up our sample. To examine direct impacts, used structural equation modeling, and to validate the moderating link, turned to hierarchical regression. The results suggest that both community involvement and brand attachment positively promote oppositional loyalty, with the latter somewhat mediating the effect of the former. In addition, moral identity cushions the blow of brand loyalty and community involvement on negative word-of-mouth.

J. Jeong et al.[11] This work presented novel methods for doing the following: (1) predicting an individual consumer's sentiment before they make a purchase or write a review; (2) extracting product-specific PCDs from review text data; (3) identifying unobserved consumer characteristics and preferences through analysis of the DFs of the target consumers and other prior reviewers; (4) classifying consumers' sentiment toward a specific PCD through the use of context-based word embedding and deep learning models.

E. Cuevas-Molano et al., [12] presented businesses to establish customer-centric marketing strategies for a variety of products throughout a given industry since it is generalizable, scalable, and easy to comprehend. Social media is used by businesses to develop lasting connections with their clientele. Businesses may achieve this in a variety of ways, one of which is through encouraging online discussion about their brand via dedicated fan pages. Customers are given the tools they need to become brand champions on these digital hubs.

CHALLENGES

Analyzing customer behavior on e-commerce platforms using Artificial Intelligence (AI) presents several challenges. While AI has the potential to provide valuable insights and improve customer experiences, it also faces some hurdles. Here are some of the key challenges:

1. Data Privacy and Security: E-commerce platforms collect vast amounts of customer data, including personal information, purchase history, and browsing behavior. Ensuring the privacy and security of this data is crucial to gain customer trust. AI systems need to be designed with robust security measures to protect sensitive information from potential breaches or unauthorized access.

2. Interpretability and Explainability: AI models used for customer behavior analysis often involve complex algorithms such as deep learning and neural networks. These models may lack transparency and make it challenging to interpret why certain decisions or recommendations are made. Explainable AI techniques are essential to ensure that the results are understandable and acceptable to both customers and stakeholders.

3. Adaptability and Rapid Change: Customer behavior can change rapidly, influenced by various factors such as trends, events, or economic conditions. AI systems need to be adaptable and capable of detecting and responding to these changes quickly. Continuous learning and updating of models become essential to stay relevant and accurate.

4. User Engagement: Understanding customer behavior is one thing, but effectively engaging customers based on the analysis is another challenge. AI can identify patterns and preferences, but turning those insights into personalized and compelling recommendations requires careful design and user experience considerations.

5. Ethical Considerations: The application of AI in e-commerce requires ethical considerations to avoid manipulative practices or invading customers' privacy. Striking the right balance between providing personalized recommendations and maintaining customer autonomy is critical.

6. Integration with Existing Systems: Implementing AI-based analysis into existing e-commerce platforms can be complex. Integration with legacy systems and workflows may require significant effort and coordination to ensure smooth functioning.

7. Cost and Resource Constraints: Developing, maintaining, and running AI systems can be costly, especially for smaller e-commerce businesses. Additionally, accessing high-quality data and hiring AI expertise can be challenging for some companies.

Despite these challenges, AI-based analysis of customer behavior on e-commerce platforms offers immense potential to enhance customer experiences, boost sales, and optimize marketing strategies. Addressing these challenges requires a multidisciplinary approach involving technology, data governance, ethics, and domain expertise.

CONCLUSION

The integration of AI into the analysis of customer behavior in e-commerce offers substantial benefits for businesses seeking to optimize their operations and meet evolving customer expectations. The findings of various previous research contribute valuable insights to academia and industry professionals, promoting a deeper understanding of the potential and challenges of AI in e-commerce and fostering the development of more effective AI-driven solutions for the sector. The future scope of using Artificial Intelligence (AI) for analyzing customer behavior on e-commerce platforms is incredibly promising and is expected to witness significant advancements and innovations.

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