

International Conference on Industry Sciences and Computer Science Innovation

ChatGPT based recommendation system for retail shops

Saroj Duwadi, Carlos Cautinho

Instituto Universitário de Lisboa (ISCTE-IUL), ISTAR, Lisboa, Portugal

Abstract

The rapid growth of e-commerce platforms has emphasized the significance of personalized recommendation systems in enhancing user engagement and satisfaction. This research paper presents the development and evaluation of an innovative Product Recommendation System that leverages advanced Artificial Intelligence (AI) techniques to provide tailored product suggestions. The primary objective is to create a user-centric experience by integrating an AI assistant, enabling natural and interactive interactions. Through a comprehensive survey conducted to understand customer behaviour while purchasing product using AI, the study aims to assess the system's effectiveness in delivering accurate recommendations and providing a seamless purchasing experience. The paper contributes to the field by showcasing the practical implementation of AI-driven recommendation systems, highlighting their potential to transform e-commerce interactions.

© 2024 The Authors. Published by ELSEVIER B.V.

This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0>)

Peer-review under responsibility of the scientific committee of the iSCSi – International Conference on Industry Sciences and Computer Science Innovation

Keywords: Artificial Intelligence (AI), AI assistant, Retail business, E-commerce, Personalized recommendation systems, Machine learning, ChatGPT

1. Introduction

In today's fast-paced world, retail shopping has become an integral part of daily life, but the rise of e-commerce and vast product options has led to challenges for consumers in finding suitable products. This has resulted in frustration and wasted time. To tackle this, there's a growing interest in using AI-driven recommendation systems to enhance the retail experience. This research addresses consumer struggles and business limitations in the retail industry. Consumers face difficulties in navigating numerous product options and making informed decisions, while businesses grapple with understanding individual preferences and providing tailored recommendations efficiently. Leveraging AI technologies offers a promising solution by developing conversational recommendation systems that save time,

provide personalized product suggestions, and potentially transform the retail landscape. This approach benefits both consumers by improving their shopping experience and businesses by optimizing operations and customer service.

1.1. Objective

The objective of this research is to enhance the retail shopping experience through an innovative solution that integrates a conversational AI model into an interactive kiosk with recommendation system placed in front of retail shops. Unlike existing AI tools in online marketplaces, this approach focuses on physical stores, allowing customers to engage in natural language conversations and receive personalized product recommendations. This helps human-like interaction and creates a user-friendly experience, fostering greater engagement. The system's recommendation algorithm generates tailored product suggestions based on individual profiles and retail shop data, ensuring relevant recommendations aligned with customer preferences.

The integration of the retail shop's data, including product catalogs and customer reviews, enhances the accuracy and relevance of recommendations, leveraging the specific offerings of the store. The system's continuous learning capabilities enable it to improve over time by adapting to user feedback and interactions. The implementation of the interactive kiosk combines the convenience of AI-powered recommendations with the sensory engagement of the physical retail environment, providing customers immediate access to personalized suggestions while in the store. This unique solution aims to revolutionize the retail shopping journey, offering a seamless blend of technology and tactile experience.

1.2. Methodology

The chosen methodology is a Systematic Literature Review (SLR) to analyse existing research on chatbot-based recommendation systems in retail [1]. This approach systematically explores the state of the art, key findings, and research gaps. The central research questions inquire about factors shaping system acceptance, adoption, and challenges in retail contexts. Hypotheses guide the investigation. The review identifies significant findings in AI's impact on retail, including automation and enhanced customer experiences [2]. Chatbot literature emphasizes factors affecting attitudes, trust, and emotional responses [3]. Research gaps include emotional responses across segments and decision-making influences [4].

The proposed recommendation system addresses these gaps by offering personalized suggestions, enhancing decision-making, and catering to diverse demographics [5]. The SLR methodology aids in understanding the potential of chatbot-based systems to reshape retail while guiding focused research.

2. State of the art

2.1. Systematic review

The systematic review methodology is employed to comprehensively analyze the literature on recommendation systems in retail, aiming to understand the state of the art and identify research gaps. The review process involves a structured analysis of relevant studies, with the objective of informing the development of the proposed system and offering an unbiased synthesis of existing research.

Key articles explored AI's impact in the retail industry, highlighting its potential to automate tasks, reduce costs, and enhance operational efficiency [2]. AI applications at the point of sale include self-checkout systems, sales assistance robots, chatbots, and AI-based security systems, all aimed at improving customer experiences and operational efficiency [6].

Previous research recognizes chatbots' benefits in customer engagement, influencing attitudes, trust, and satisfaction [3]. However, gaps exist in understanding emotional responses, decision-making influences, and variations across age groups [7]. The proposed recommendation system aims to address these gaps by providing personalized suggestions, involving customers in decision-making, and delivering to diverse demographics.

Research reveals limitations of existing chatbots, such as limited functionalities and reliance on human intervention, highlighting the potential for personalized recommendation systems to overcome these limitations and offer a more versatile shopping experience [5].

2.2. Related works

The design of chatbots encompasses rule-based, retrieval-based, and generative-based models for generating responses based on user input [5]. Retrieval-based chatbots offer predefined responses suitable for basic queries, while generative-based models, like ChatGPT, excel in natural language generation through extensive training on large datasets [8]. ChatGPT's human-like responses have led to its application in customer service, including platforms like Mercari, Zalando, and Shopify, enhancing interactions and engagement [9]. Zalando's fashion assistant, Mercari's shopping assistant, and Shopify's AI-powered shopping assistant exemplify the use of ChatGPT in providing personalized product recommendations and aiding users in finding items [10]. Klarna's collaboration with OpenAI integrates ChatGPT to offer curated shopping experiences [10].

The proposed recommendation system for retail shops introduces interactive kiosks that facilitate real-time conversations with customers, enhancing their shopping journey [10]. These kiosks, as showcased by Zalando, Mercari, and Klarna, bridge the physical and digital realms, enabling customers to engage with ChatGPT, seek product advice, and receive tailored recommendations [9]. This integration offers an immersive and convenient means for customers to explore, visualize, and purchase products while benefiting from AI-powered assistance. The system's innovative approach capitalizes on ChatGPT's advanced language capabilities to redefine the retail shopping experience through interactive and personalized interactions [9].

3. Requirement analysis

3.1. Survey findings and analysis

The survey conducted among retail shop owners and customers highlights the evolving landscape of AI-powered technology and chatbots within the retail industry. While a notable percentage of shop owners currently do not employ AI-powered solutions, a substantial portion is already using or considering adopting these technologies to enhance their businesses. The challenges faced by shop owners in providing personalized recommendations encompass issues related to staff resources, training, and suitable technology. These findings underscore the demand for user-friendly and adaptable AI-powered recommendation systems that can effectively assist staff and enhance customer experiences.

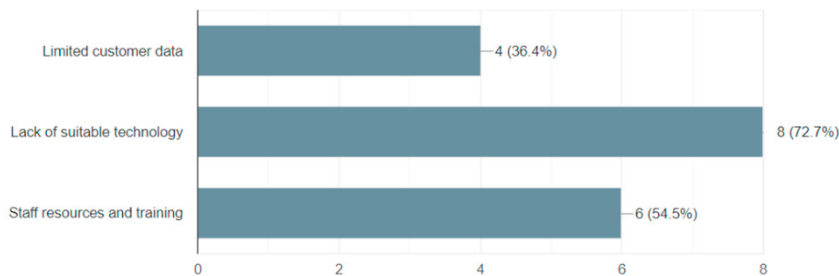


Figure 1 Challenges faced by retail shops.

The survey sheds light on customers' preferences and expectations for a recommendation system. Most potential users fall within the age range of 25-35, with significant representation from other age groups as well. Personalized recommendations are highly valued, emphasizing the importance of a system that can leverage machine learning algorithms to continuously improve accuracy. Customers desire accurate and efficient responses, detailed product information, complementary suggestions, and timely recommendations based on seasons. Privacy and data security

concerns also emerged, indicating the need for robust security measures and transparent data practices to build trust among users.

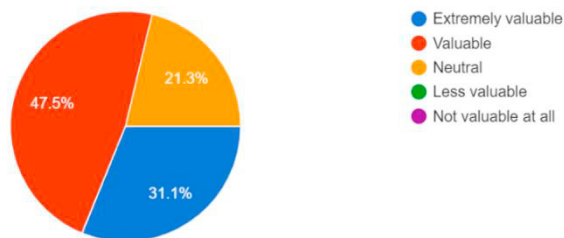


Figure 2 Value of personalised recommendations system

3.2. Use case

After analyzing the data from survey, the use case for the recommendation system is designed to accommodate customers. The system provides personalized features for registered users, such as the ability to view their order history. The use case diagram illustrates the flow of interactions between the customers, the retail shop owner, and the recommendation system. The customers can easily interact with the system through a user-friendly GUI, engaging in natural language conversations to receive product recommendations. Additionally, customers have the option to search for specific products and provide valuable feedback on the recommended items. The retail shop owner can update product details and view customer feedback and ratings to further enhance the system's performance.



Figure 3 Use case diagram of system

4. System architecture

The language model is a critical component that allows the chatbot to understand user queries, generate responses, and provide recommendations. The specific language model we use for the system is "ChatGPT." ChatGPT is a variant of the GPT (Generative Pre-trained Transformer) series developed by OpenAI. GPT models are built on a deep learning architecture called transformers, which have proven to be highly effective in natural language processing tasks. Transformer is a neural network architecture that was proposed in 2017 by Vaswani et al. It revolutionized the field of natural language processing (NLP) and has been widely used in various NLP tasks. The Transformer architecture relies on attention mechanism and does not use recurrent structures like Recurrent Neural Network (RNNs). It is known for its ability to capture long-range dependencies in sentences and its parallelizability, which makes training faster. As shown in figure 4, transformer-based models, such as GPT, BERT, and others, have outperformed previous state-of-the-art networks in NLP tasks[11].

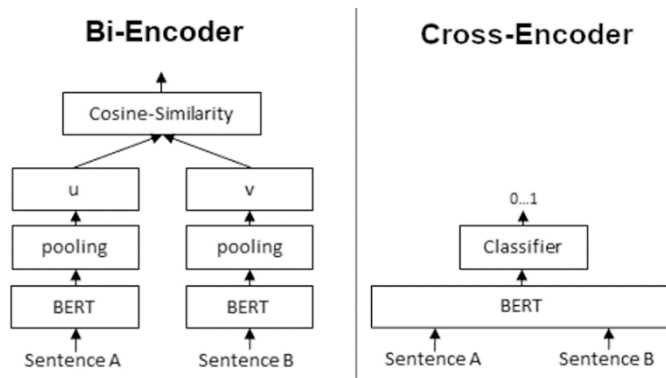


Figure 4 General architecture of a Bi-Encoder (left) and a Cross-Encoder (right), using BERT as the language model.

Moving into the system architecture, it is carefully designed to create a seamless and efficient product recommendation experience. Each component serves a vital purpose in ensuring user-friendliness, accurate recommendations, and smooth interactions. The architecture includes a User Interface (UI) for easy navigation and natural language interactions, an Authentication and User Management module to handle registrations and profiles, an NLP Module for interpreting queries and generating natural language responses using the ChatGPT language model, and a Recommendation Engine at the core that delivers personalized product suggestions. The architecture also encompasses a Product Database, Feedback and Rating System, External Data Sources, ChatGPT Integration, APIs and Services, and Analytics and Monitoring to track user interactions, recommendation effectiveness, and system performance [12].

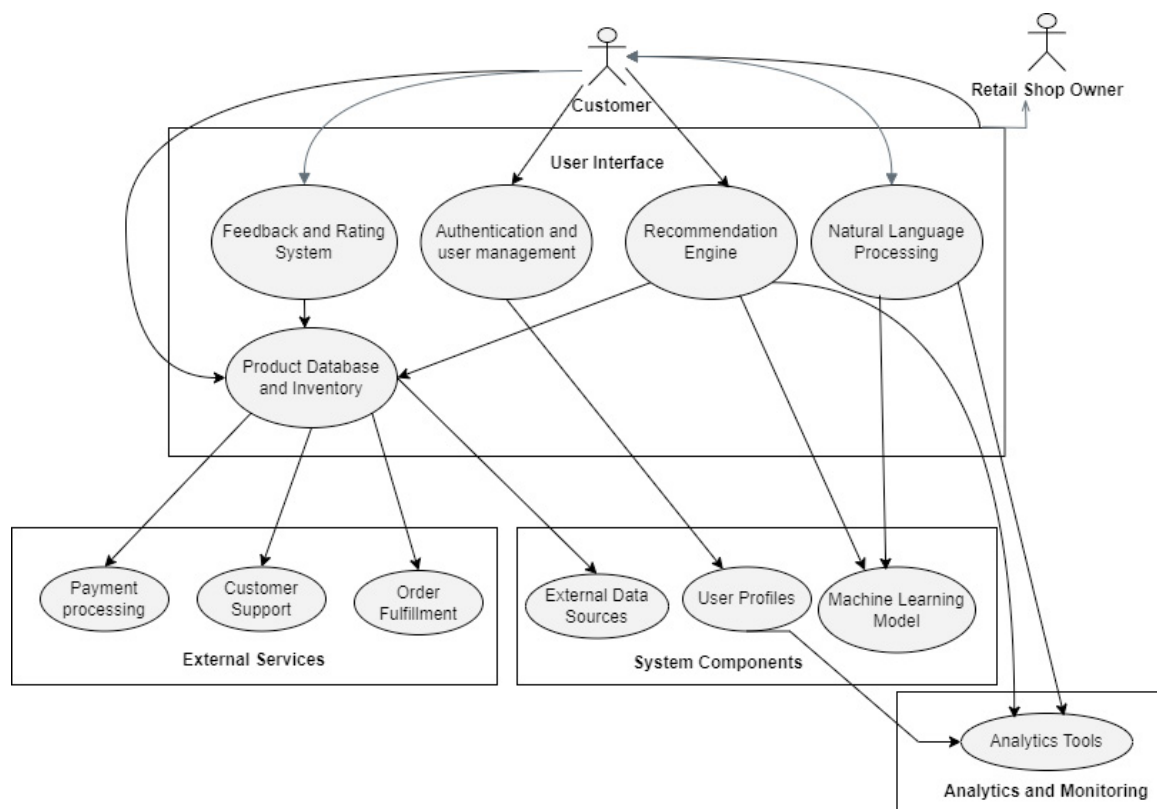


Figure 5 System architecture

5. Implementation

The system has been designed which employs a language model, to enhance online shopping. Through a user-friendly interface built with HTML, CSS, and JavaScript, users engage with the system effortlessly, receiving personalized product suggestions. The AI-powered chat model, driven by ChatGPT, facilitates dynamic conversations and smooth interactions between users and the recommendation engine. A dedicated checkout page integrates seamlessly, offering real-time order summaries and convenient payment options. On the backend, a Flask application orchestrates user interactions, ensuring efficient communication with language model and optimizing performance for repeated queries.

The system leverages language model capabilities to create a user-centric online shopping experience. The combination of intuitive design, real-time interaction, and AI-driven recommendations results in a cohesive and efficient platform that enhances the way users shop in retail stores.

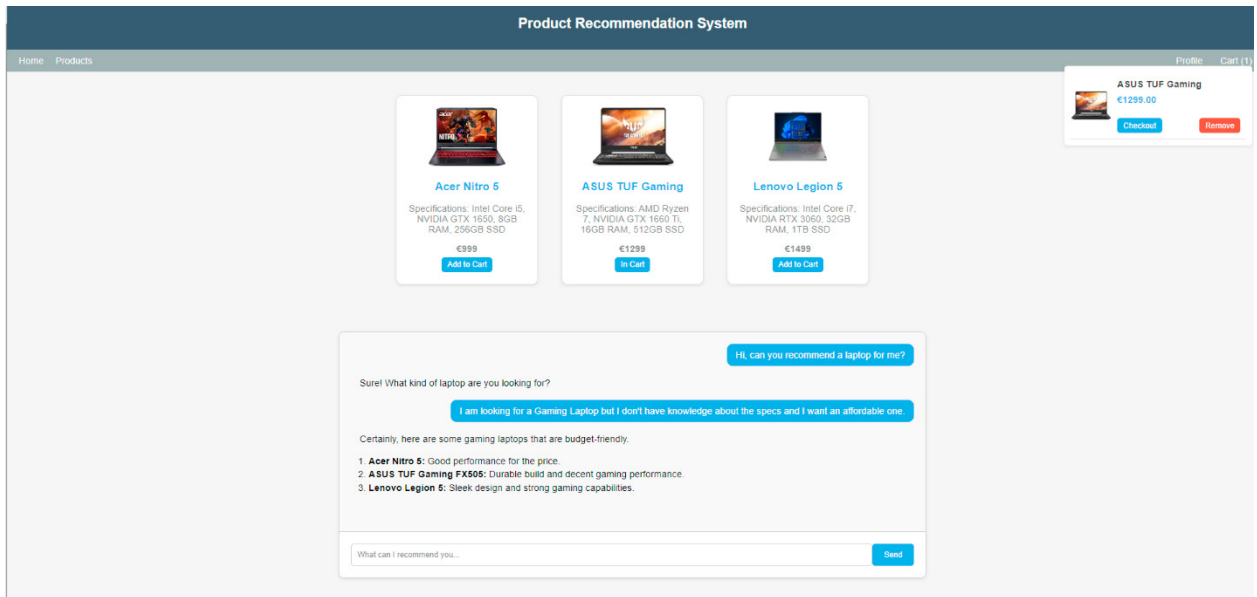


Figure 6 Screenshot of the system

6. Result discussion

6.1. System Testing

The usability test involving eight participants produced significant insights into the developed system, highlighting its importance in modern e-commerce. Users unanimously praised the system's easy navigation, emphasizing the role of a user-friendly interface in enhancing engagement. The AI-driven chat interaction received high marks for its intuitiveness, showcasing AI's potential to bridge the user-technology gap. Clear and organized product listings underscored the importance of presentation in aiding decision-making. High ratings for recommendation accuracy validated the system's ability to understand user preferences.

As shown in figure 7, positive alignment between recommended products and user needs emphasized personalization's essence. Overall satisfaction affirmed the success of AI-driven recommendations. The feedback underlines recommendation systems' pivotal role in modern e-commerce, meeting user expectations for personalization, accuracy, and relevance. The system's success indicates its potential to reshape digital shopping experiences.

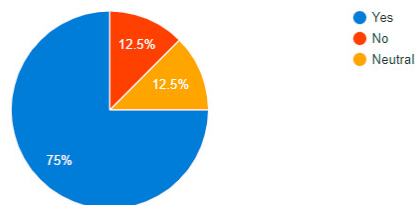


Figure 7 Recommended products aligned with preferences and needs of customer

7. Conclusion and future work

In this research paper, we presented the development and evaluation of a novel product recommendation system empowered by advanced AI techniques. The system's integration of an AI assistant facilitated natural interactions, enriching user experiences. Usability testing revealed the system's efficacy in delivering tailored recommendations, offering valuable insights into user preferences, and enhancing engagement. The positive feedback on navigation, chat interaction, recommendation accuracy, and user satisfaction highlight the significance of AI-driven recommendation systems in modern e-commerce.

While this research successfully demonstrated the potential of AI-based recommendation systems, there are opportunities for further exploration and enhancement. Future work could focus on refining the recommendation algorithm to accommodate dynamic user preferences and evolving trends. Additionally, integrating sentiment analysis and user feedback could fine-tune recommendations. This paper opens doors for continuous innovation and advancement in the realm of AI-driven recommendation systems, contributing to the ongoing transformation of the e-commerce landscape.

Acknowledgement

This work was supported by Fundação para a Ciência e a Tecnologia, I.P. (FCT) [ISTAR Projects: UIDB/04466/2020 and UIDP/04466/2020].

References

- [1] C. Okoli, "A guide to conducting a standalone systematic literature review," *Communications of the Association for Information Systems*, vol. 37, no. 1, pp. 879–910, 2015, doi: 10.17705/1cais.03743.
- [2] F. D. Weber and R. Schütte, "State-of-the-art and adoption of artificial intelligence in retailing," *Digital Policy, Regulation and Governance*, vol. 21, no. 3, pp. 264–279, 2019, doi: 10.1108/DPRG-09-2018-0050.
- [3] D. L. Kasilingam, "Understanding the attitude and intention to use smartphone chatbots for shopping," *Technol Soc*, vol. 62, no. May, p. 101280, 2020, doi: 10.1016/j.techsoc.2020.101280.
- [4] A. D. Tran, J. I. Pallant, and L. W. Johnson, "Exploring the impact of chatbots on consumer sentiment and expectations in retail," *Journal of Retailing and Consumer Services*, vol. 63, no. August, p. 102718, 2021, doi: 10.1016/j.jretconser.2021.102718.
- [5] S. Mohamad Suhaili, N. Salim, and M. N. Jambli, "Service chatbots: A systematic review," *Expert Syst Appl*, vol. 184, no. June, p. 115461, 2021, doi: 10.1016/j.eswa.2021.115461.
- [6] M. Blut, C. Wang, N. V. Wunderlich, and C. Brock, "Understanding anthropomorphism in service provision: a meta-analysis of physical robots, chatbots, and other AI," *J Acad Mark Sci*, vol. 49, no. 4, pp. 632–658, 2021, doi: 10.1007/s11747-020-00762-y.
- [7] M. Chung, E. Ko, H. Joung, and S. J. Kim, "Chatbot e-service and customer satisfaction regarding luxury brands," *J Bus Res*, vol. 117, no. November 2018, pp. 587–595, 2020, doi: 10.1016/j.jbusres.2018.10.004.
- [8] D. Kalla, D. Candidate, N. Carolina, N. Smith, and D. Candidate, "Study and Analysis of Chat GPT and its Impact on Different Fields of Study," vol. 8, no. 3, pp. 827–833, 2023.
- [9] Maria Monteros, "Retailers are using ChatGPT to help people pick what to buy," 2023, [Online]. Available: <https://www.modernretail.co/technology/retailers-are-using-chatgpt-to-help-people-pick-what-to-buy/#:~:text=Retailers are using ChatGPT to both help shoppers find specific,plugin from ChatGPT's plugin store.>
- [10] "Shopify Adds ChatGPT Assistant To Shop App & Web." Accessed: Jul. 04, 2023. [Online]. Available: <https://www.valueaddedresource.net/shopify-adds-chatgpt-assistant-shop-app/>
- [11] J. Coelho et al., "Transformer-based Language Models for Semantic Search and Mobile Applications Retrieval," *International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management, IC3K - Proceedings*, vol. 1, no. Ic3k, pp. 225–232, 2021, doi: 10.5220/0010657300003064.
- [12] B. Paula et al., "Collaborative Filtering for Mobile Application Recommendation with Implicit Feedback," *2022 IEEE 28th International Conference on Engineering, Technology and Innovation, ICE/ITMC 2022 and 31st International Association for Management of Technology, IAMOT 2022 Joint Conference - Proceedings*, 2022, doi: 10.1109/ICE/ITMC-IAMOT55089.2022.10033307.