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Review Paper On Application Of Deep Learning And Collaborative Filtering For Product Recommendation System

Miss. Dhanashri Dnyaneshwar Sagane[1], Dr. V. B. Kute[2]

[1]ME, Dept. of CSE, PRPCME, Amravati, Maharashtra, India
[2]Dept. of CSE, PRPCEM, Amravati, Maharashtra, India

Abstract

A product recommendation system is a software application designed to generate and offer suggestions for items or content that a particular user may wish to purchase or interact with. By employing machine learning methodologies and leveraging various data points related to both individual products and users, the system establishes a sophisticated network of intricate relationships between these products and users. This system is essential in numerous online shopping platforms, e-commerce services, and social networking applications. Collaborative filtering (CF) stands out as the most widely utilized method in recommendation systems. This technique is well-known for its extensive application; its fundamental principle is to forecast which items a user might find appealing based on their preferences. Recommendation systems that implement collaborative filtering can deliver precise predictions when sufficient data is available, as this method relies heavily on user preferences. User-based collaborative filtering has historically been effective in anticipating customer behavior, serving as a crucial component of recommendation systems. Nevertheless, the extensive application of this approach has uncovered significant challenges, such as data sparsity and scalability issues, particularly as the number of users and items continues to grow. To enhance both the execution time and accuracy of predictions, this paper introduces item-based collaborative filtering that incorporates dimensionality reduction within a recommendation system. The findings indicate that this proposed method can yield improved performance and execution time in addressing the existing challenges, as evaluated through Mean Absolute Error (MAE) metrics.

Keywords- E-commerce, Collaborative filtering, Online shopping, Product Recommendation.

I. INTRODUCTION

E-commerce markets have undergone significant transformation, evolving into new sectors centered around mobile commerce due to the rise of smart devices. This advancement has provided users with greater access to a wide array of information, resulting in a substantial increase in the volume of data that can be gathered. The rapid expansion of the World Wide Web has consequently led to challenges related to information overload, making it difficult for users to swiftly locate the information they seek amidst the vast amounts available. In recent years, customers have been empowered to actively share their reviews and receive discounts based on their participation in activities such as social surveys on e-commerce platforms. It has become crucial for e-commerce markets to leverage this data effectively by developing innovative marketing strategies informed by such insights. Furthermore, these markets have increasingly implemented automated personalization services to analyze customer behavior and patterns that influence purchasing decisions. E-commerce sites aim to gather a variety of user interests, including purchase history, items in the cart, product ratings, and reviews, to recommend relevant new products to customers. Collaborative filtering stands out as the predominant algorithm employed to create personalized recommendations on platforms such as Amazon, CDNOW, Epay, Movie Finder, and Netflix, extending beyond mere academic interest. This technology recommends items based on user similarity, and it can be categorized into two types: user-based collaborative filtering and item-based collaborative filtering. The user-based collaborative filtering algorithm effectively suggests relevant content to users by leveraging the principle that individuals are likely to favor items that similar users have preferred.Initially, the algorithm seeks to identify the user's neighbors by assessing user similarities. It subsequently integrates the rating scores of these neighboring users through supervised learning techniques, such as the k-nearest neighbors algorithm and Bayesian networks, or through unsupervised learning methods like the k-means algorithm. The item-based collaborative filtering algorithm operates on a similar principle to user-based collaborative filtering, utilizing the rating scores provided by users. However, rather than focusing on the nearest neighbors, it examines a collection of items that the target user has previously rated, calculating the similarity between these items and the item being recommended. Additionally, it incorporates the user's past preferences based on the identified item similarities. While collaborative filtering has proven effective across various domains, its extensive application has highlighted certain challenges, including issues related to rating data sparsity, cold-start scenarios, and data scalability. To address the challenges of sparsity and scalability within collaborative filtering, this paper proposes a user-based identification approach for product recommendations.

II. LITERATURE REVIEW

1] Antonio Hernando, Jesús Bobadilla, Fernando Ortega, and Jorge Tejedor (2021), In this paper the author has presented the idea of using a reliability measure associated with the predictions made by a recommender system. In this manner, we will provide a user with a pair of values when recommending an item: a prediction of how much he will like this item; and the reliability measure of this prediction. Using these two values, users could balance between the prediction made by the recommender system and the reliability of this prediction to make their decision.

2] Nitika Kadam, and Shraddha Kumar, The author in order to improve the working and quality of the recommender system, presented a Hybrid approach by combining content-based filtering and collaborative filtering, which includes Memory (K-Nearest Neighbour) and Model-based (clustering and rule-based techniques), in the proposed methodology. Using the Hybrid approach, we get advantages from each other while the drawbacks of both methods won't be taken into account.

3] Krishna Patidar, Recommendation systems are a powerful new technology for extracting additional value for a business from its user databases. These systems help users find items they want to buy from a business. Recommender systems benefit users by enabling them to find items they like. Conversely, they help the business by generating more sales. Recommender systems are rapidly becoming a crucial tool in E-commerce on the Web. Recommender systems are being stressed by the huge volume of user data in existing corporate databases and will be stressed even more by the increasing volume of user data available on the Web. New technologies are needed that can dramatically improve the quality and scalability of recommender systems.

4] Winnie Nguyen, The literature review discussed how collaborative filtering models are used for personalised recommenders in ecommerce. First, the author explained the typical qualifications for datasets and mentioned specific datasets used in research papers. Second, the author explained the matrix factorization algorithms researchers used for predicting users' preferences.

5] Nirav Raval, et al. This paper represents the overview of Approaches and techniques generated in the Collaborative Filtering based recommendation system. The recommendation system derived into Collaborative Filtering, Content-based, and hybrid-based approaches. This paper classifies collaborative filtering using various approaches like matrix factorization, user-based recommendation, item-based recommendation. This survey also tells the road map for research in this area.

6] Harsh Mishra, et al. In this paper, the author stated that Recommender systems are systems based on Machine learning algorithms that help users discover new products and services. Recommender systems are very essential in this era of the internet where services are mostly handled on the web rather than on a person to person basis.

7] Banerjee, Anurag & Basu, Tanmay, In this paper, a weighting technique is proposed in spirit of the term weighting scheme of the text retrieval system for item based collaborative recommender system. The proposed scheme has been used for effective movie recommendation. The empirical analysis on the benchmark MovieLens 100K dataset has shown improvement over state of the art recommender system algorithms.

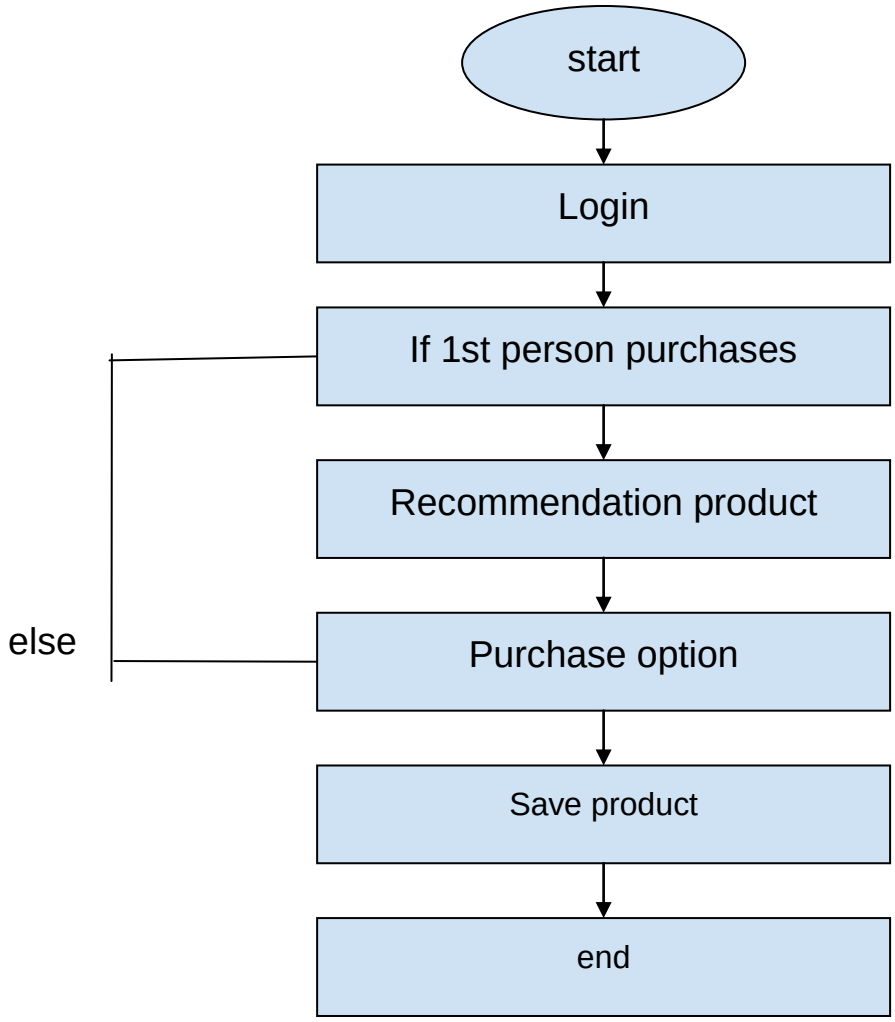
8] E. Adomavicius, A. Tuzhilin, (2020) This paper presents an overview of the field of recommender systems and describes the current generation of recommendation methods that are usually classified into the following three main categories: content-based, collaborative, and hybrid recommendation approaches. This paper also describes various limitations of current recommendation methods and discusses possible extensions that can improve recommendation capabilities and make recommender systems applicable to an even broader range of applications.

9] F. Kong, X. Sun, S. ye, (2020) In this paper, we compare the performance results of four collaborative filtering algorithms applied in the start up stage of recommendation. We evaluate these algorithms using three publicly available datasets. Our experiment results show that Pearson and STIN1 methods perform better than latent class model (LCM) and singular value decomposition (SVD) methods during the start up stage.

III. METHODOLOGY

The proposed methodology entails the creation of a Python-based system that consists of four primary components: 1) Data Collection and Processing, which involves the acquisition and preparation of pertinent information from various datasets; 2) User Interface (UI) Design and Implementation, facilitating customer engagement through responsive, name-based interactions; 3) Development of a recommendation engine utilizing deep learning and collaborative filtering methods to produce product suggestions, with the ability to display all recommendations and establish connections to the respective products; and 4) In-depth analysis of product parameters through dataset examination. This strategy guarantees a smooth user experience, tailored responses, and insightful product recommendations, all while harnessing data-driven insights to improve system efficacy. This initiative presents a recommendation system that prioritizes user engagement. Upon logging in, users are greeted with a dedicated interface that offers options for product purchases and displays personalized recommendations tailored to the preferences of the logged-in user and their associated contacts. This cutting-edge system promotes a reciprocal recommendation framework, enabling users to discover and acquire products based on suggestions from individuals within their contact network, thereby fostering a dynamic and interactive environment for informed purchasing decisions.

FLOWCHART OF PROPOSED SYSTEM:



IV. SYSTEM REQUIREMENT SOFTWARE REQUIREMENT

1] Python Software

MODULES

1. Tkinter
2. OS
3. Pandas
4. PI

V. CONCLUSION

This study presents a practical framework for product recommendation systems that integrates deep learning and collaborative filtering techniques. The proposed methodology consists of a Python-based system with four primary components: data collection and processing, user interface design and implementation, the development of a recommendation engine, and an in-depth analysis of product parameters. This framework is designed to provide a smooth user experience, tailored responses, and insightful product recommendations, all while utilizing data-driven insights to enhance overall system performance. The principal conclusions indicate that this methodology is effective in generating personalized product recommendations, harnessing

data-driven insights, and optimizing system performance. Future considerations may include exploring the potential applications of this methodology in sectors such as e-commerce, marketing, and customer service.

VI. REFERENCE

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