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# E-commerce platform based on Machine Learning Recommendation System

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***Abstract*—Information overload is one of the potential setbacks to many e-commerce platform users. It is very important to filter the media and the choices that are overwhelming for internet users while making buying decisions using online stores. To solve this problem, recommendation systems are used widely. A recommender system helps users find a product of their own choice by filtering and prioritizing and effectively generating the relevant information to its users. The purpose of a recommender system is to save time and hassle of searching through the World Wide Web, instead it generates specific and relevant content that promotes online transaction and bring satisfaction to the users of e-commerce platforms. The proposed system is an e-commerce platform based on an apparel recommendation system that recommends products on the foundation of the user's preferences.**

***Index Terms*—Apparel recommender system, Content-based apparel recommendation, Machine Learning, User preferences**

## I. Introduction

In recent years, e-commerce has been discovered to have a strong link to consumer pleasure, and success is always founded on customer trust. As the use of the internet for shopping became more prevalent, customers are confronted with the difficult task of sifting through a large number of product possibilities to discover the one they require [1]. Artificial intelligence (AI), specifically computational intelligence and machine learning methods and algorithms, have been used to increase prediction accuracy and tackle data sparsity and cold start difficulties in the creation of recommender systems [2]. In the field of e-commerce, the impact of machine learning and deep learning is expanding [3]. These domains' algorithms aid in increasing sales and optimizing different parts of e-commerce operations, from product selection to effective product ordering. Recommendation system has recently attracted a lot of interest and is being used in a variety of industries [4]. The exponential growth of the e-commerce business has highlighted the need for effective recommendation systems in today's world [5]. Recommendation systems are data-filtering systems that attempt to anticipate a user's preferences for one thing over another. Movies, books, research articles, search queries, social tags, products, financial services, restaurants, jobs, universities, friends, and other applications all use recommendation algorithms. The basic purpose of a recommendation system is to boost product sales by providing a relevant item to the customer and so improving total profit, which encompasses the functional goals of recommendation systems including relevancy, serendipity and diversity [6]. A recommendation system can help clients quickly find a wide range of things that they are interested in. The popularity of this effective suggestion system is growing by the day because it is simple and reliable for a client to purchase online and find the best selections for them.

The Recommender system aims to provide users with product, service and information recommendations based on their interests, taking into account their needs and preferences. A user would undoubtedly prefer a website that suggests something beneficial to him over one that forces him to browse through the site to find the products they require. A recommender system's fundamental function is to predict a user's preferences by comparing them to those of another group of users [6]. The recommendation systems are used in different aspects of uses for example what clothes to buy, types of friends to make, or what kind of online news content to consume. They also provide suggestions from the data extracted from a given user profile or the ratings given for an item. Artificial intelligence, machine learning, deep learning, and computer vision are among the primary technologies supporting the development of intelligent garment recommendation systems and smart shopping gadgets. Apparel suggestions serve a unique purpose that they not only promote similar products to match users' current dressing styles, but also provide personalized styling tips to help users gain a better understanding of personalized styling [7].

Smart apparel recommendation systems, inspired by traditional styling services aim to recommend appropriate apparel to specific people based on concepts obtained from design knowledge and professionals' expertise with computer intelligence technology [8]. The recommendation system of apparel depends on the suggestion which was carried out manually. To help the customer to get the product with customization they wished for, the system puts on some good recommendations for the customer to increase the satisfaction of customer and salesperson gets benefit with more of his products sold [9].

This paper proposes an e-commerce platform based on an apparel recommendation system. The application collects the data from the users and then constructs an apparel recommendation system using machine learning algorithms, as shown in

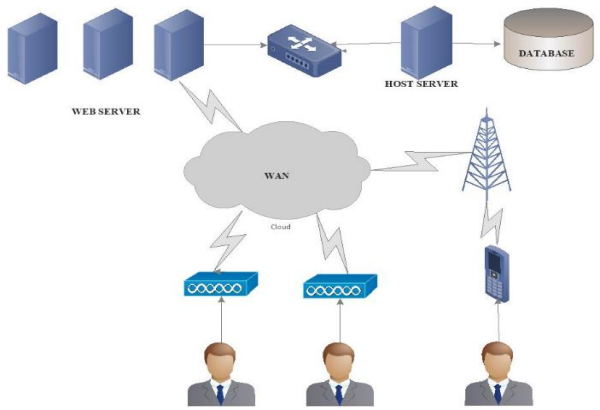


Fig. 1. System Diagram of the Recommender System

Fig 1. above. The recommendation system provides users with quality things, saving them time.

## II. Literature Survey

The authors in [10] developed an improved collaborative filtering recommendation algorithm and recommendation strategy. naive Bayes and K-means played a pivotal role in the creation on this algorithm. The results proved it an efficient recommender system. The system proposed in [11] comprises of an interactive environment in which a user interacts with many modules that perform tasks such as data collection from internet sources, knowledge extraction, clustering, and trend/product suggestion. The Clustering Module integrates multiple grouping algorithms and provides a consensus for data clustering. At the same time, the Product Recommender and Feedback module collects feedback from designers on various fashion items and suggests more relevant goods based on their preferences.

[12] performed experiments on the selected trusted data to make the best recommendations. The similarity was calculated between the users so that better recommendations can be made. Then, this similarity is added to the weight factor of the improved slope one algorithm. The authors of [13] investigated the k-means-singular value decomposition (k-means-SVD) for dimensionality reduction and clustering approaches based on the algorithm of created collaborative filtering recommendation. In [14], the suggested system will be based on user evaluations, and it will determine the sentiment score, the most important features, and their associated values for each item using natural language processing algorithms. The text mining results will be utilized to inform the recommendation process. In [15], Advanced data-analysis techniques were used to analyze the product data sets in this article, and the results were positive. The product quality has been accelerated by extracting product features, product quality, and several other components of the user evaluation. Based on customer reviews, a product recommendation has been made to assist the customer in selecting the best product during the search process. The Naive Bayesian FrameWork was utilized in [16] to effectively segment clients who purchased clothes products. The primary goal of this research is to identify the various probable associations of customers in terms of brand, product, and price based on their purchasing behaviours. The results show that the clusters created by the algorithm based on K-Means are similar, and that the results are acceptable based on feedback from existing customers, and that the algorithm satisfies the customers' requirements based on the amount of money (price range) they want to spend while doing online shopping. Unlike traditional systems that rely on a user's previous purchases and history, this project in [17] tries to generate recommendations based on an image of a product provided by the user, because many times individuals see something they like and look for things that are similar to it.

## III. Methodology

In this paper, we aim to put forward a method to construct an apparel recommendation system. We have defined the modeling and construction phases of an e-commerce apparel recommendation system. The prediction will be made based on content-based filtering. The most popular sort of filtering system is content-based filtering. These systems rely on a user's rating while constructing a profile to obtain preliminary information about a user in order to avoid not knowing a new user. Two sorts of information are primarily emphasized while creating a user profile: the user's preferences and the user's engagement with the recommendation system. It merely suggests items based on a comparison of the item's content and the user's profile. These systems' engines compare a user's positively rated item with an item that user has not yet rated. Users will be recommended the things that have the most similarities. As shown in Fig 2. The user B and user D both gave ratings to the cell phone and cell phone case. Since user A also likes the cell phone, the system will recommend to the user, a cell phone case also.

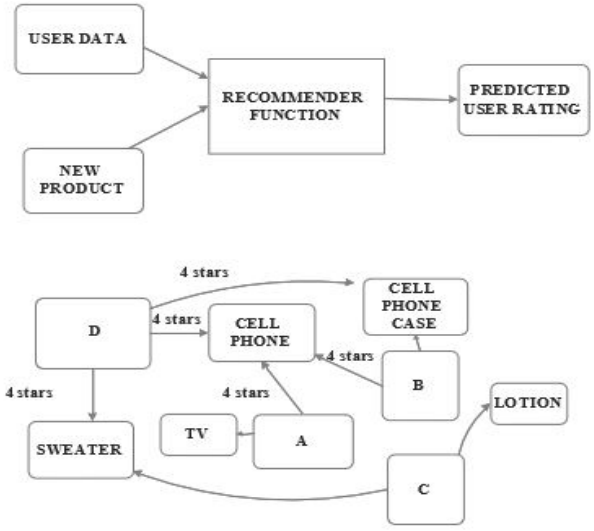


Fig. 2. Methodology of Recommender System

### A. Modelling Preferences of User

We look at user selections to gather data based on user interests. This is where the activity log of a specific user has analyzed through the type of content that a user is interested in. This is a user-centered approach for data collection relevant to user interests.

*1) Prediction:* To create an apparel recommendation list, data that is relevant to user interests are sorted and further used for making predictions. These predictions are based on the probability calculated with the help of similarity functions.

### B. Nearest Neighbor Algorithm

Among non-parametric classifiers, one of the most popular non-parametric techniques in the group of the Nearest Neighbor (NN) [18]. Based on the supplied image, the closest neighbor algorithm is utilized to locate the most relevant products, and suggestions are provided [19]. Classifier is usually utilized in exercise for the ones including the foundation of the sample-to-sample span. It mainly utilized the distance function to find out the parallelism within two different samples to intent the nearest neighbor for testing a data or point of any query [20].

*1) Content-based Apparel Recommendation System:* Content-Based Filtering recommender systems allow users to filter information based on a collection of procedures that perform analysis to predict what the user could be interested in or what is relevant to the user [21]. Content-based recommender systems are designed to suggest goods that, are comparable to those that have previously piqued a user's interest. Content-based recommendation systems can be used to propose web pages, news articles, restaurants, television shows and objects for sale, among other things [22]. In this research, Grab Now E-Commerce platform is considered as a run time environment for application and evaluation of an apparel recommendation system. In order to design an apparel recommendation system, we use profiles of apparel information (such as type and colors of apparels) viewed by different users. Every single interest shows a group of similar apparels with regard to its type and colors. The prediction module is used for providing a recommendation list to the users of Grab Now E-Commerce platform.

This mechanism executed algorithms based on two different similarities. The system relied on item-to-item Nearest Neighborhood algorithm that, is for user purchase history followed by recommendation of similar products and similar color in item. Either in the database or the item selected by the user, these two different degrees of similarities are computed under the function of recommendation. Same database is used for showing more accuracy in either of the one which is already tested for selecting items considering selecting neighbor.

### C. Naïve-Bayesian Frame Work

Naïve-Bayes is one of the most dominant frameworks used for prediction based on probability [19]. It collects observations regarding an item and calculates its value. This classification tool is derived from Bayes' Theorem. It is mostly used as a part of predictive modeling in machine learning and data mining [23].

## IV. Results

Considering the mechanism, it can produce the results by applying different recommendation functions to generate a desired recommendation. We separated our dataset into training data and test data. 80% of the data formed the training data and the rest 20% was made the test data. The training dataset contains 50 users, 100 ratings and 25 items. Hence results are exclusively segregated into two major courses: First of all, the quality of results for every single recommendation function as well as the best performance recommendation function. While color similarity extract from content base filtering and recommendation over user purchase history also filtered on the basis of content, as shown in Fig 3.

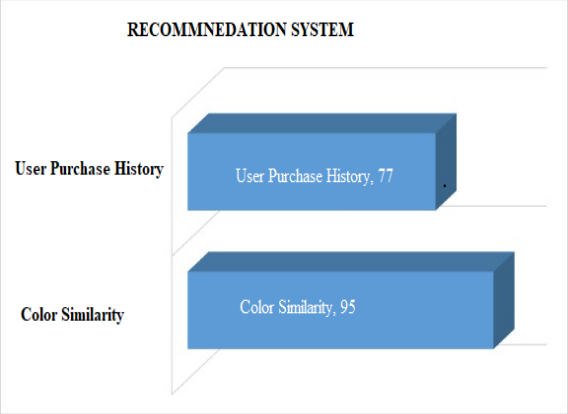


Fig. 3. Results of the Recommender System

The overall evaluation can be summarized considering the sensitivity and significance of few parameters. Content-based filtering approaches the algorithms utilizing nearest neighbor algorithm. It is accomplished by using the results from users' experiments, gathered from database. Three major steps can be used for required evaluation. Every single algorithm out of evaluation table in database gets created which contained the categories, item ID's, item colors and importantly item name. Considering the previous step every item from created list, by using the proposed parameters producing evaluation, from which neighbor item list can be created. Above process can replicate by every single selection each time made by user interference. User selection basically opt the recommendation while the prediction is aligned on identical item attributes which users selected by its own.

We also experience the two different similarities, item color and recommendation of product through purchase history of any user, where item to item similarity measures in Nearest Neighbor algorithm one has far better advantage over another, that is color similarity is much more on a higher side of recommendation instead of user purchase history then importantly the edge goes with the color similarity note.

## V. Conclusion

With the expansion of e-commerce platforms and Internet transactions, intelligent e-commerce personalized recommendation systems have made significant progress in recent years. Faced with such vast amounts of user data, establishing an intelligent recommendation system based on user interests is critical for making human lives easier. With an abundance of already existing information and data on the web it is extremely difficult for the users to find relevant data. This issue is solved by recommending new and not-yet applied options to users based on their current requirements and wants. To provide clear suggestions, recommendation systems use various types of information based on user preferences, lists of items accessible and the history of previous searches between the user and the systems used.

## References


[1] S. E. Küçükbay and N. K. Turhan, "Supervised learning based apparel recommendation system for online shopping," *ISC2019*, 2019.

[2] Q. Zhang, J. Lu, and Y. Jin, "Artificial intelligence in recommender systems," *Complex & Intelligent Systems*, vol. 7, no. 1, pp. 439–457, 2021.

[3] M. Naumov, D. Mudigere, H.-J. M. Shi, J. Huang, N. Sundaraman, J. Park, X. Wang, U. Gupta, C.-J. Wu, A. G. Azzolini *et al.*, "Deep learning recommendation model for personalization and recommendation systems," *arXiv preprint arXiv:1906.00091*, 2019.

[4] T. Ebesu, B. Shen, and Y. Fang, "Collaborative memory network for recommendation systems," in *The 41st international ACM SIGIR conference on research & development in information retrieval*, 2018, pp. 515–524.

[5] P. Meel, P. Chawla, S. Jain, and U. Rai, "Hybrid apparel recommendation system based on weighted similarity of brand and colour," in *International Conference on Innovative Computing and Communications*. Springer, 2021, pp. 427–437.

[6] M. Vivek, N. Manju, and M. Vijay, "Machine learning based food recipe recommendation system," in *Proceedings of international conference on cognition and recognition*. Springer, 2018, pp. 11–19.

[7] N. Nikzad-Khasmakhi, M. Balafar, and M. R. Feizi-Derakhshi, "The state-of-the-art in expert recommendation systems," *Engineering Applications of Artificial Intelligence*, vol. 82, pp. 126–147, 2019.

[8] Y. Lu, Y. Duan, and R. Saga, "Double deep features for apparel recommendation system," in *Proceedings of the 53rd Hawaii International Conference on System Sciences*, 2020.

[9] C. Guan, S. Qin, and Y. Long, "Apparel-based deep learning system design for apparel style recommendation," *International Journal of Clothing Science and Technology*, 2019.

[10] X. Li and D. Li, "An improved collaborative filtering recommendation algorithm and recommendation strategy," *Mobile Information Systems*, vol. 2019, 2019.

[11] S.-F. Tsarouchis, A. S. Vartholomaios, I.-P. Bountouridis, A. Karafyllis, A. C. Chrysopoulos, and P. A. Mitkas, "Science4fashion: An autonomous recommendation system for fashion designers," in *IFIP International Conference on Artificial Intelligence Applications and Innovations*. Springer, 2021, pp. 729–742.

[12] L. Jiang, Y. Cheng, L. Yang, J. Li, H. Yan, and X. Wang, "A trust-based collaborative filtering algorithm for e-commerce recommendation system," *Journal of Ambient Intelligence and Humanized Computing*, vol. 10, no. 8, pp. 3023–3034, 2019.

[13] R. R. Gudur, A. Blackler, V. Popovic, and D. Mahar, "Methodological issues with older users as research participants," in *Proceedings of the 6th IASDR (The International Association of Societies of Design Research Congress*. IASDR (The International Association of Societies of Design Research), 2015, pp. 851–867.

[14] H. Zarzour, Z. Al-Sharif, M. Al-Ayyoub, and Y. Jararweh, "A new collaborative filtering recommendation algorithm based on dimensionality reduction and clustering techniques," in *2018 9th international conference on information and communication systems (ICICS)*. IEEE, 2018, pp. 102–106.

[15] G. N. Kottage, D. K. Jayathilake, K. C. Chankuma, G. U. Ganegoda, and T. Sandanayake, "Preference based recommendation system for apparel e-commerce sites," in *2018 IEEE/ACIS 17th international conference on computer and information science (ICIS)*. IEEE, 2018, pp. 122–127.

[16] S. Bandyopadhyay, S. Thakur, and J. Mandal, "Product recommendation for e-commerce business by applying principal component analysis (pca) and k-means clustering: benefit for the society," *Innovations in Systems and Software Engineering*, vol. 17, no. 1, pp. 45–52, 2021.

[17] J. S. Mohan, H. S. Vedantham, V. C. Vanam, and N. P. Challa, "Product recommendation systems based on customer reviews using machine learning techniques," in *Data Intelligence and Cognitive Informatics*. Springer, 2021, pp. 267–286.

[18] Y. Zeng, Y. Gong, and X. Zeng, "Controllable digital restoration of ancient paintings using convolutional neural network and nearest neighbor," *Pattern Recognition Letters*, vol. 133, pp. 158–164, 2020.

[19] M. Sridevi, N. ManikyaArun, M. Sheshikala, and E. Sudarshan, "Personalized fashion recommender system with image based neural networks," in *IOP Conference Series: Materials Science and Engineering*, vol. 981, no. 2. IOP Publishing, 2020, p. 022073.

[20] E. P. Frady, G. Orchard, D. Florey, N. Imam, R. Liu, J. Mishra, J. Tse, A. Wild, F. T. Sommer, and M. Davies, "Neuromorphic nearest neighbor search using intel's pohoiki springs," in *Proceedings of the Neuro-inspired Computational Elements Workshop*, 2020, pp. 1–10.

[21] B. Hrnjica, D. Music, and S. Softic, "Model-based recommender systems," *Trends in Cloud-based IoT*, pp. 125–146, 2020.

[22] M. J. Pazzani, D. Billsus *et al.*, "The adaptive web," *Berlin, Heidelberg: Springer-Verlag*, pp. 325–341, 2007.

[23] H. Zhang, L. Jiang, and L. Yu, "Attribute and instance weighted naive bayes," *Pattern Recognition*, vol. 111, p. 107674, 2021.