Machine Learning Based Fashion Recommendation System

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Abstract
The main objective of a recommender system is to give its user a number of item recommendations related to a subject. Numerous fields employ deep learning to address challenging and complex problems using vast amounts of data. Referral systems can also make advantage of deep learning. In order to boost sales, online shopping platforms are currently searching for a way to suggest products based on customer interests and preferences. Systems for selling clothing provide a list of suggestions depending on the users' requirements and preferences. Nowadays, almost every work is completed online. We suggest a deep neural network-based content-based apparel recommender system since people like to utilize it online. Product traits are necessary in content-based systems in order to predict ratings of unseen items. Our suggested solution uses a deep neural network to provide the necessary features in a big and useful volume, thereby obtaining the cloth category and eliminating the requirement for manual product feature extraction. This system's advantage is that it displays the findings to the user after using the same network to designate gender as a feature in the suggestion-making process. Various machine learning algorithms are examined and tested both with and without demographic data, including gender. The experimental findings demonstrate that our suggested approach solves the cold start issue for new products and has a smaller loss than other similar systems. Additionally, our suggested system suggests new, pertinent, and surprising products.

Keywords: Clothing, Recommender System, Deep learning, Demographic, Feature Extraction, Cold start, Content, Coronavirus

1. INTRODUCTION

The fashion and e-commerce industries are changing quickly, and customers are looking for customized apparel options that suit their own tastes. Users may become overwhelmed by the sheer number of options, though, and find it difficult to identify particular products or fashions that genuinely suit their preferences. Furthermore, this issue is made worse by the lack of physical trial rooms in the online buying setting, which leaves customers unsure of how clothes will fit and appear on them. For online sellers, this gap between the physical texture of apparel and the digital shopping experience has become a major obstacle. We suggest a sophisticated Fashion Recommender System in conjunction with a state-of-the-art Virtual Trial Room feature to close this gap and improve customer happiness. In order to empower consumers, our research solution makes use of machine learning, computer vision, and picture recognition technologies.

2. LITERATURE SURVEY

Cairong Yan, Yizhou Chen, And Lingjie Zhou., This paper presents a recommendation framework for fashion e-commerce, using the Amazon dataset. It incorporates a data augmentation algorithm, a user-item knowledge graph, and differentiated recommendation strategies for active and inactive users. The approach improves recommendation accuracy and addresses the cold start problem [1].

Aitor Goti, Leire Querejeta-Lomas, Aitor Almeida., This research examines the impact of AI in fashion e-commerce through a systematic review of 219 publications from Web of Science and Scopus. The articles were categorized by AI techniques, revealing research gaps and opportunities for further exploration in the field [2].

Junxia Ma, Qilin Liu, Zhifeng Zhang.,This study introduces the TRRDLMF method for teaching resource recommendations, using deep learning and probabilistic matrix decomposition to enhance accuracy and personalization. Empirical tests on four datasets show up to 73.12% accuracy and 97.89% recall. The system effectively tracks learners' knowledge and preferences, offering

personalized recommendations to improve learning efficiency [3].

Erugu Krishna,Dr.M.Bal Raju ,B.Pannalal., This study proposes a CNN-based recommendation system for fashion, considering user and designer preferences, as well as color compatibility. The model was trained and evaluated using a custom dataset of 12,000 images, demonstrating the effectiveness of the approach in recommending textile designs [4].

XinweiRen, Wei Yang, Xianliang Jiang., This study proposes a deep course recommendation model using LSTM and Attention mechanisms, integrating multimodal features like video, audio, title, and introduction. It also incorporates user demographic and feedback data. Experiments on real datasets show an AUC score of 79.89%, outperforming similar algorithms and providing more accurate course recommendations [5].

Wenhui Yu,Xu Chen., This study presents a clothing recommendation model that integrates aesthetic features, crucial for matching user preferences. Using a pre-trained neural network for aesthetic assessment and a tensor factorization model for personalization, the system outperforms traditional methods in aligning recommendations with users' visual tastes, as shown by real-world dataset tests [6].

Samit Chakraborty, Md. Saiful Hoque., This review paper examines state-of-the-art image-based fashion recommendation systems (FRSs) in fast fashion, addressing the need for efficient sorting and personalization on e-commerce platforms. It is the first comprehensive review of FRSs and filtering techniques, providing insights and future model directions for researchers and practitioners in AI, computer vision, and fashion retail [7].

LuyaoLiu,Xingzhong Du Lei Zhu., This paper introduces Discrete Supervised Fashion Coordinates Hashing, a model that improves fashion recommendations by learning compact binary hash codes for clothing items, guided by a clothing matching matrix. This approach reduces memory usage and speeds up recommendations, outperforming traditional models in efficiency and accuracy [8].

Kanchan, Ashish Hooda., This article explores methods to make clothing more adaptable to various body types, emphasizing the importance of fit and comfort for customer satisfaction and brand loyalty. It discusses challenges in designing inclusive fashion and methods for creating precise patterns that flatter all body shapes, enhancing comfort and appeal [9].

Prof.Meera Sawalkar1, Bindu Udar., This study proposes a content-based clothing recommender system using deep neural networks to automatically extract product features and suggest items based on user preferences. By incorporating demographic factors like gender, the system achieves lower loss, addresses the cold start problem, and offers novel and relevant recommendations [11].

Qingyi Lu, Shuaishuai Huang., This study proposes a multimodal clothing recommendation model that combines text and image data, leveraging a pre-trained language model to understand user and product nuances. A variational encoder addresses the cold start problem, and experiments demonstrate the model's strong performance compared to other methods, offering valuable insights for recommendation system optimization [12].

Buradagunta Suvarnaand Sivadi Balakrishna., This study presents a deep ensemble classifier for fashion recommendation, combining predictions from five pre-trained models (MobileNet, DenseNet, Xception, and two VGG variants) to enhance accuracy and reliability. Using cosine similarity, the model achieves 96% accuracy on benchmark datasets, highlighting the benefits of transfer learning and ensemble techniques for fashion recommendations [13].

Yashar Deldjoo, Fatemeh Nazary., Fashion recommender systems use user data and computer vision to suggest items, overcoming challenges like sparse data and lack of detailed product info. By combining visual insights with user preferences, they provide personalized outfit recommendations [14].

Narges Yarahmadi Gharaei.,Chitra Dadkhah., This paper proposes a content-based clothing recommender system using deep neural networks, eliminating manual feature extraction. It improves recommendation accuracy, handles cold start issues, and suggests relevant, unexpected items while incorporating demographic features like gender [15].

Ronak Bediya,Krishnanand Mishra., This study explores deep learning techniques for fashion recommendations using the Myntra Fashion Dataset, comparing VGG16 and MobileNet models. It finds that while individual models (VGG16 and MobileNet) perform well, their hybrid ensemble is

less efficient, highlighting the need for further optimization in ensemble models for better accuracy and efficiency in e-commerce recommendations [16].

Han Yang RuimaoZhang, Xiaobao Guo., The study introduces the Adaptive Content Generating and Preserving Network (ACGPN) for photo-realistic clothing try-ons. It improves visual try-on by predicting and adjusting the semantic layout of the reference person, preserving or generating content as needed. ACGPN uses semantic segmentation, clothing warping, and content fusion to enhance image realism, outperforming existing methods in perceptual quality [17].

ChongjianGe,Yibing Song., The Disentangled Cycle-consistency Try-On Network (DCTON) improves virtual try-on by separating key components like clothes warping, skin synthesis, and image composition. It uses cycle consistency learning for self-supervised training, producing highly realistic try-on images. Extensive experiments validate its effectiveness on challenging benchmarks [18].

Han Yang,Xinrui Yu.,The Recurrent Tri-Level Transform (RT-VTON) framework enables full-range virtual try-on for both standard and non-standard clothes. It uses gradual feature transformation across three levels: clothes code, pose code, and parsing code, addressing the limitations of existing methods for complex clothing styles [19].

Nagendra Panini Challa, Abbaraju Sai Sathwik.,FashionNet is an intelligent system that provides personalized fashion recommendations based on user preferences, body shape, and style. It uses deep networks with a matching network for compatibility and a feature network for extraction, employing a two-stage training method to personalize recommendations [20].

Prof. Mrs. Rohini S. Jadhav, Aditya Shahare., This paper introduces a personalized fashion recommender system combining OpenCV and TensorFlow, enabling virtual try-ons to enhance the online shopping experience. Using real-time clothing mapping and tailored recommendations, it eliminates physical trials, improving convenience and customer satisfaction. Built with Python, PyCharm, and machine learning techniques, this system aims to reshape fashion retail dynamics [21].

Paper	Accuracy More than 80%	Using Machine Learning	Dataset Used	Model Used
[1]	✗	✗	✗	✗
[2]	✗	✓	✓	✓
[3]	✓	✗	✓	✓
[4]	✗	✗	✗	✓
[5]	✓	✗	✓	✗

Chart 1 comparison table

EXISTING ISSUE

The effectiveness of current garment recommender systems may be impacted by a number of issues. The cold start problem, in which new users or things do not have enough data to create reliable suggestions, is one of the main problems. Lack of user context, such as failing to take occasion or weather into account, is another problem that can result in suggestions that aren't relevant. Furthermore, overfitting or underfitting might impact algorithms like K-NN's capacity to generalize user preferences. Another issue is scalability, since it can become computationally costly to maintain performance as the system gets larger. Inaccurate or out-of-date user profiles and bias in suggestions resulting from demographic factors might lessen relevance and personalization. As more private user data is saved, data security and privacy become more crucial. Additionally, representation is frequently restricted to basic elements, missing the complexity of clothes, and fashion trends change quickly, making it challenging for systems to remain current. Clothing recommender systems can be made more effective and user-friendly by addressing these problems with solutions including hybrid approaches, contextual awareness, ongoing profile learning, and improved data integration.

GAP ANALYSIS

The gap analysis identifies a number of areas where current apparel recommender systems might be enhanced to increase system performance and user experience. One of the main problems is the cold

start issue, which occurs when there is not enough data to provide new users or things with proper recommendations. Another gap is user personalization, since existing methods frequently fall short in capturing subtle preferences like fit, materials, and style. Irrelevant recommendations result from a frequent disregard for contextual awareness, which includes elements like occasion and weather.

Furthermore, product representation typically ignores deeper visual and textual elements that can better convey apparel specifics in favor of simple criteria like color and brand. Other crucial limitations are scalability and real-time processing, since many systems find it difficult to manage big datasets effectively or offer prompt, dynamic recommendations. Another issue is bias in suggestions, since current methods may inadvertently favor particular goods or groups of people, so restricting variety and equity. Finally, to ensure safe data practices and encourage ongoing user feedback for better tailored recommendations, data privacy and user engagement are areas that require development. Clothes recommender systems will become more efficient, customized, and scalable if these deficiencies are filled.

CONCLUSION

By allowing merchants to provide customers personalized recommendations based on data obtained from the Internet, recommendation systems may open up new business options. They assist customers in quickly locating goods and services that closely correspond with their preferences. Furthermore, many state-of-the-art algorithms have been created to provide product recommendations depending on how individuals interact with their social networks. As a result, studies on integrating social media photos into fashion suggestion systems have become increasingly popular recently.

Based on scholarly works on the subject, this report reviewed fashion recommendation systems, algorithmic models, and filtering strategies. Future scholars will be better able to comprehend fashion recommender systems because of the thorough discussion of the technical features, advantages, and disadvantages of the filtering algorithms. However, as erroneous suggestions might have a detrimental effect on a client, the suggested prototypes should be tested in commercial applications to determine their viability and accuracy in the retail market.

Furthermore, in order to create an efficient recommendation system, future research should focus on incorporating time series analysis and precise product picture classification based on color, trend, and clothing style variance. The suggested methodology will guarantee highly curated and customized offerings for consumers by adhering to brand-specific customization initiatives. Therefore, this study will be very helpful to academics who want to create recommendation systems with augmented and virtual reality elements.

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