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Intelligent System for E-commerce

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Abstract - ***Using image analysis, the suggested e-commerce recommendation system makes product recommendations based on visual similarity. It analyzes product photos using the ResNet50 model to give customers recommendations based on their visual preferences. Our goal is to increase user engagement by providing image-based, tailored recommendations. Through the presentation of visually appealing and pertinent product options, this system seeks to enhance the shopping experience for users.***

I. Introduction

The e-commerce sector is expanding remarkably in the modern day and is increasingly pervasive in our daily lives. A growing number of goods and services are offered online, and traversing large product catalogs can be difficult for consumers. A less-than-ideal buying experience and choice fatigue may result from this overabundance of options. In order to overcome this difficulty, recommendation systems have become essential. They offer tailored product recommendations that boost user engagement, boost revenue, and raise customer happiness. Recommendation systems, sometimes referred to as recommender systems, make recommendations to users about goods, services, or content based on their past usage patterns, preferences, and contextual data using data-driven methods and algorithms.
E-commerce platforms have helped us to realize about the immense value in recommendation systems, as they not only assist users in discovering relevant items but also contribute significantly to the success of the business by driving conversions and fostering customer loyalty.

II. Related work

The intention of this document of research is to make the online e-commerce environment more user-friendly and at the same time managing overload efficiently using an improved version of Apriori algorithm.

This paper introduces a time-efficient collaborative filtering method. Initially, we construct a time-weighted score matrix to capture users' evolving interests. Using differential equations, we group correlated users and items into cohesive communities. Users with stable state values indicate shared interests, simplifying community assignment. Finally, real-time predictions are derived through dynamic similarity assessments. We have worked with an approach to derive results while comparing several other methods to test the efficiency of our algorithm.

In this document, the proposed idea unfolds in two step process of recommendation process by retaining diverse advantages of the recommender algorithm. In this first step association rules are used to classify existing customers and further gain potential customers. Once we complete the first step we move on to applying CF methods to realize obtained recommendations [3].

The proposed product recommendation system addresses the challenge of users navigating numerous e-commerce websites to find suitable products. It operates independently of website structure, utilizing rules and regular expressions to match specifications with website text. The system visualizes results graphically to facilitate user for decision-making, by providing realistic recommendations. Some Key features include visualization, rule-based matching, and independence from website structure [4].

The personalized recommendation model for e-commerce products proposed here to take a leap towards integrating BERT and BiLSTM to enhance recommendation accuracy. By leveraging BERT's bidirectional language model and BiLSTM's contextual semantic information, the model outperforms other benchmark models, achieving a low RMSE value of 0.82. This indicates the feasibility and effectiveness of the proposed approach for personalized e-commerce recommendations [5].

The primary aim of this paper is to introduce an innovative strategy for refining personalized recommendations of e-commerce products. By amalgamating BERT and BiLSTM models. The principal goal is to showcase the feasibility and effectiveness of approach in delivering more precise and customized product suggestions consumers within e-commerce [6].

In this paper, the researchers examined customer behavior and applied techniques to refine personalized recommendations within e-commerce. They seamlessly incorporated the recommendation system into the platform and assessed its performance using metrics such as precision, mean absolute error (MAE), and root mean square error (RMSE). These evaluations underscored the system's capacity to deliver precise product suggestions customized to individual preferences [7].

In this paper, the use of deep learning is explained for music emotion recognition. It proposed a model that combines CNN

and LSTM networks for feature extraction and capturing temporal dependencies in music data [8].

In this paper, an investigation is done on the use of artificial intelligence techniques in collaborative filtering recommender systems. It aims at enhancing user experience by reducing choice overload using personalized recommendations [9].

In this paper, the main objective is to develop a fashion recommendation system that answers the queries related to fashion shopping. First, it identifies the fashion type of given input image. If the given fashion image is valid then similar products will be recommended. And then it will retrieve the similar products from various e-commerce websites. Three main steps are executes: Image Preprocessing, Recommendation Engine, and Web App. For Image Preprocessing [10].

The aim of this paper is to design a Fashion Recommendation System that suggests products according to consumer's personal taste, preference and previous activity. They have mainly used the testing methods: Resnet50 and Cosine Similarity. The primary objectives are Pre-processing the Data, Converting the images to an Array format, and Use a pre-trained model to make recommendations, Get the photos embedded, Calculate the cosine similarity of the photos, and lastly Recommend things that are comparable [11].

III.Objectives and scope:

Enhance User Experience: The foremost objective of the model is to enhance the user experience on the e-commerce website by providing visually similar product recommendations. Users should find it easier to discover products they might like, leading to higher user engagement.

Increase Conversion Rates: The recommender system should aim to boost conversion rates by suggesting visually appealing products that align with users' preferences. The objective is to influence users to make more purchases and increase the website's sales.

Improve Product Discovery: The system should facilitate improved product discovery, especially for visually-driven shopping experiences. Users should be able to find products that match their visual preferences and style.

Image-Based Product Recommendations: The primary objective of the model is to provide image-based product recommendations. It will focus on suggesting visually similar items to users based on the images they interact with or express interest in.

Visual Search Integration: Integrate a visual search feature that allows users to upload or capture images of products they like, and the system will recommend visually similar products from the catalog. This feature extends the scope of image-based recommendations.

Real-Time Recommendations: The system should provide real-time or near-real-time recommendations to users as they browse the website, ensuring that users receive up-to-date suggestions during their current shopping session.

Integration of Deep Learning Models: Incorporate CNN and other deep learning models for image feature extraction and similarity analysis, enabling accurate image-based recommendation.

IV. Proposed methodology

This section contains a brief description about Resnet50,K-Nearest neighbor algorithm followed by our proposed methodology for intelligent system for ecommerce

A. Resnet50

Resnet50, a widely employed convolutional neural network (CNN), is prominent in image classification tasks. It facilitates the use of a pre-trained model which is trained on the extensive ImageNet database, which comprises over a million images. This model is crucial and serves as the foundation for classifying ,suggesting images for our model.

B. K-Nearest neighbor algorithm

K-Nearest Neighbor (KNN) stands as a supervised learning algorithm that is adept at both classification and regression tasks. Its functionality revolves around predicting the optimal class for test data by assessing the distance between the test data and all the training points. Following this, it identifies the K nearest points to the test data and makes accurate predictions.

V.Actual Execution and Results

A] Input Dataset and preprocessing:

We have used amazon product sales dataset from 2023 from Kaggle. This dataset contains a total of 140 csv files each containing different types of products for example air conditioning.csv, Grocery.csv, etc. It has a total of nine features:

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name	description
name	The name of the product
main_category	The main category of the product belong
sub_category	The main category of the product belong
image	The image of the product look like
link	The amazon website reference link of the product
ratings	The ratings given by amazon customers of the product
no of ratings	The number of ratings given to this product in amazon shopping
discount_price	The discount prices of the product
actual_price	The actual MRP of the product

First, we combined all 140 csv files into one single csv file. After that we removed some features and only retained features such as name, image and actual_price.

Further, we removed all the duplicate records which occurred more than once in the csv file. The records which had null features were also removed.

B] Intelligent system for ecommerce

We have proposed a method for recommending products to users based on the image of product. Our system will recommend products to users that look similar.

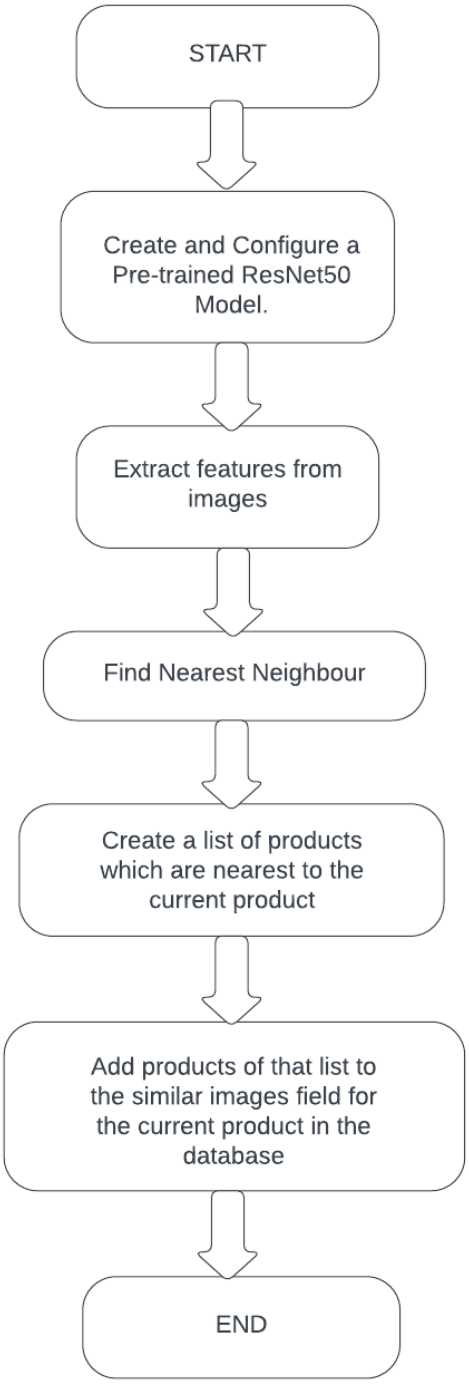

Figure 1. Flowchart of the system

First,we create and configure the resnet50 model. This model is already pretrained on the imagenet database. After that the features are extracted from the image using this resnet50 model. These features are then used to find most similar looking images using the KNN algorithm.

Now,to store the results obtained from the algorithm we use a Many-to-Many field in the database for each image.

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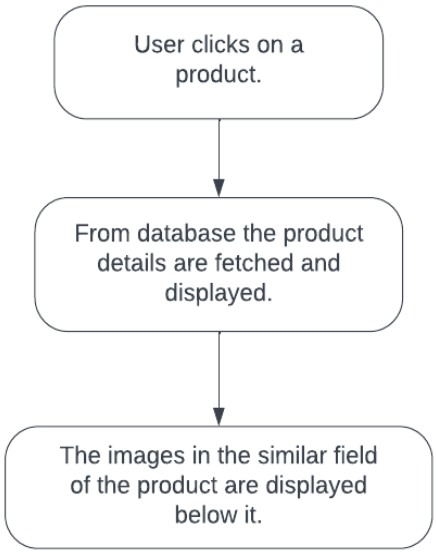

Figure 2 Flowchart for user

Whenever a user clicks on a product the product details will be fetched from the database and displayed. The similar products we earlier stored in the many to many field will also get displayed thus achieving the desired goal of recommending visually similar products**.**

VI. Results and Conclusion

ResNet50, pre-trained on millions of images from the ImageNet database, achieves high accuracy rates of over 80.4%. Leveraging this model, our proposed e-commerce recommendation system uses image analysis to suggest products based on visual similarities, enhancing user experience by offering personalized, image-driven recommendations.

A robust product recommendation system significantly improves customer engagement by suggesting relevant products they search for or browse. This approach benefits various stakeholders—sellers, distributors, and agencies—by providing real-time, appropriate recommendations across multiple marketplaces. As part of an e-commerce personalization strategy, dynamic product recommendations play a crucial role in boosting product sales on websites.

Our enhanced recommendation system evaluates several mechanisms using key metrics, including response time, scalability, accuracy, data source (implicit/explicit), and independence. Our findings reveal that recent research focuses predominantly on improving recommendation accuracy through innovative methods such as data and web mining algorithms and neural network-based approaches.

Using the ResNet50 model to analyze product images, we provide users with suggestions that match their visual preferences, overcoming limitations found in other algorithms. This approach reduces computational complexity and enhances recommendation accuracy. Our research presents qualitative results, demonstrating the effectiveness of the ResNet50 and CNN-based intelligent system in delivering accurate and visually appealing product recommendations.

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