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Fashion Recommendation System Using Images Features

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Abstract:

The fashion industry has rapidly evolved with the growth of e-commerce and the increasing demand for personalized shopping experiences. This project introduces a fashion recommendation system that helps users discover visually similar clothing items by simply uploading an image. Using machine learning and computer vision techniques, the system combines the power of the ResNet50 deep learning model to extract high-level features from images and LAB color space to analyze color similarities. Recommendations are generated by comparing the uploaded image with a dataset of fashion items. The system is implemented as a user- friendly web application using Flask, allowing users to upload images and receive personalized suggestions. Admins can manage users, respond to queries, and maintain FAQs, while users can interact with the system to explore fashion choices and get support. This project aims to enhance the online shopping experience by providing accurate, intelligent, and visually driven fashion recommendations.

Keywords: *Fashion Recommendation System, Machine Learning, Image Processing, ResNet50*

I.INTRODUCTION

In recent years, the fashion apparel industry has experienced tremendous expansion due to rising consumer demand for ease, variety, and customized shopping experiences. As e-commerce and online shopping have grown in popularity, customers are now more inclined to browse through enormous product catalogs and look for styles that suit their own tastes. Fashion recommendation systems are now vital tools for increasing user engagement and sales in this cutthroat market. By providing tailored, pertinent recommendations, these systems enhance the shopping experience for clients by assisting them in finding apparel items that suit their tastes and preferences. Effective fashion suggestion systems are therefore becoming more and more necessary in order for companies to provide individualized experiences that boost client happiness and loyalty while boosting conversion rates and revenue.

The goal of this paper is paper to use computer vision and machine learning techniques to create a sophisticated fashion suggestion system. The demand for individualized and user-friendly recommendation systems has grown in importance due to the explosive rise of e-commerce and online fashion purchasing. The goal of this work is to develop an intelligent fashion suggestion engine that, given an uploaded photograph, assists users in finding visually related clothing products. The method is intended to provide precise and pertinent recommendations by fusing conventional color-based features with deep learning-based image feature extraction.

The ResNet50 model, a pre-trained deep learning model at the heart of the system, captures crucial characteristics like texture, style, and patterns while extracting high-level features from garment photos. The LAB color space is also used to extract color information, which improves the visual resemblance between objects. The most similar items are shown as recommendations after the recommendations are created by calculating the similarities between the input image and the dataset photos. Because Flask is used to create this endeavor as a web application, users can interact with the recommendation system in an intuitive manner. When a user uploads a picture of fashion, the system will show them a number of related fashion goods. The project combines web development, machine learning, and computer vision to produce an advanced yet user- friendly fashion suggestion system that aims to enhance customers' buying experiences.

Both administrators and users have certain responsibilities in this fashion advice system to improve the user experience. The administrator can add or remove frequently asked questions (FAQs), manage registered users by viewing and removing them, log in, and respond to user inquiries promptly. In contrast, individuals can upload images to receive tailored fashion recommendations after registering with accurate information and logging in with their login credentials. Additionally, they can ask questions directly to the administrator and get answers to their questions by looking through the FAQ area for frequently asked questions. In addition to providing a seamless user experience when browsing fashion advice and receiving support, this framework guarantees easy communication between users and the administrator.

II. RELATED WORK

The aim of this paper is to develop an intelligent and personalized fashion recommendation system using advanced machine learning techniques. By integrating Convolutional Neural Networks (CNNs), specifically enhanced with the RESNET50 architecture, and combining them with the K-Nearest Neighbors (KNN) algorithm, the system seeks to analyze product images and user preferences to recommend visually and contextually similar fashion items. The paper focuses on leveraging deep learning for accurate image classification and retrieval, and employing similarity measures such as Euclidean distance and Cosine Similarity to enhance recommendation accuracy. The ultimate goal is to improve user experience in online fashion retail by offering tailored product suggestions that align with individual interests and past behaviors.[1]

The aim of this paper is to design and implement a personalized Fashion Recommendation System (FRS) using deep learning techniques to enhance the online shopping experience. The proposed system focuses on delivering accurate and tailored fashion suggestions by leveraging Convolutional Neural Networks (CNNs) for image analysis and feature extraction. Specifically, the ResNet50 architecture is employed to identify key visual features such as style, color, and texture from fashion item images. By combining this visual information with user interaction data and historical preferences, the system aims to generate recommendations that align closely with each user's unique fashion tastes. This approach not only improves user satisfaction by offering relevant suggestions but also helps fashion retailers boost customer engagement and increase sales through a more personalized and intelligent shopping experience[2].

The recommender system's main objective is to provide product recommendations that are similar to the query image. Sorting related objects from a large data set can be challenging. Online shopping systems are investigating how to suggest products based on customer preferences. To collect comparable items, several statistical methods and similarity metrics were used in the past, which led to less exact and reliable product recommendations. An effective Deep CNN model is suggested for the product's classification. The results of the evaluation of the suggested model employing a data set of fashion products are satisfactory. With an accuracy rate of 89.02%, this enables the products to be accurately and consistently recommended. When it comes to categorization metrics, the suggested model performs better than other models already in use[3].

The aim of this paper is to develop a personalized outfit recommendation system that generates modified outfit images based on the individual fashion preferences of each user. Unlike previous methods that focus mainly on generating diverse and compatible outfits, this system emphasizes tailoring outfit modifications to reflect personal style choices. By extracting and updating features such as color, texture, and shape from the input outfit image and its segmentation mask, the system can generate variations that align with the user's preferred fashion style. To accurately learn user preferences, the system creates a personalized dataset by asking users to classify a set of images into four distinct styles. Through this approach, the system can classify and recommend fashion items that reflect individual tastes. Evaluation results confirm that the system successfully recommends different styles for different users based on the same input image, effectively capturing user-specific fashion preferences. The paper also highlights challenges such as dataset bias and model limitations, suggesting that further improvements can lead to even greater recommendation accuracy[4].

Recently, convolutional neural network (CNN) - based fashion recommendation techniques, which automatically recommend the matching clothes to

the consumer, have been widely researched. In general, the feature vector of a fashion item, i.e. clothes vector, obtained by CNN conveys two types of information: style and category, where the style indicates the distinctive characteristic of the clothes and the category represents the common properties of the clothes in the same class. Due to the mixed information of style and category, however, the clothes vector often recommends the unmatching clothes. To solve this problem, we propose a style feature extraction (SFE) layer, which effectively decomposes the clothes vector into style and category. Based on the characteristics that the category information has small variations in the same class while being distinguished from other classes, we extract and remove the category information from the clothes vector to obtain more accurate style information. Experimental results show that the proposed method achieves state-of-the-art results in terms of link prediction, which is a performance measure of a stylish match. In addition, as a simple CNN layer, it is expected that the proposed SFE layer is compatible with all popular CNN architectures[5].

This paper is to develop an advanced fashion recommendation system that improves online shopping by giving personalized clothing suggestions. The system uses machine learning techniques, especially the Random Forest algorithm, to make accurate and efficient recommendations. Users can select their preferred style and fit through an easy-to-use interface, helping the system understand their individual preferences. It also uses context-based filtering by considering factors like fashion trends, occasions, body type, and personal taste to make better suggestions. Over time, the system becomes smarter and more accurate by learning from user choices. The results show that combining different machine learning techniques with user and product data can provide helpful, personalized fashion recommendations[6].

This paper is to design and develop an intelligent AI Fashion Stylist system that provides a smarter and more engaging fashion experience for users. The system combines advanced technologies like collaborative and content-based filtering to give personalized outfit suggestions. It includes features such as virtual try-ons using augmented reality, real-time trend analysis, and shopping assistance to help users make better fashion choices. The platform also focuses on user interaction and feedback to improve suggestions over time. Additionally, the system is designed with privacy, security, and scalability in mind to ensure smooth and safe use. Overall, the goal is to create a user-friendly, innovative, and highly personalized fashion recommendation system using artificial intelligence[7].

This paper is to develop a smart and secure fashion trend prediction system by using advanced technologies such as artificial intelligence, sentiment analysis, augmented and virtual reality, and blockchain. The proposed model focuses on identifying and analyzing fashion trends based on people's interests, which are captured through sentiment analysis on social media and other digital platforms. The system allows users to explore trending clothing styles and designs in an interactive way, using AR/VR for virtual try-ons and personalized recommendations. It also ensures data safety and secure online transactions through blockchain technology. Overall, the goal is to provide a modern, reliable, and user-friendly platform for understanding and following fashion trends in the digital age[8].

The aim of this paper is to develop an event-based clothing recommendation system that improves the accuracy and relevance of fashion suggestions for users. Unlike traditional text-based methods, this system uses advanced visual processing techniques and deep neural networks to analyze clothing images. The model is trained to detect specific types of events—such as weddings, conferences, and parties—and match them with appropriate outfits from a wide range of 53 clothing categories. By using object detection, the system accurately identifies clothes suitable for different scenarios and recommends similar items to the user using the nearest neighbors approach. The proposed system achieves a high mean Average Precision (mAP) of 84.01, showing strong performance in detecting relevant fashion items and offering context-aware recommendations that suit the user's needs for various occasions[9].

This paper is to develop an Intelligent Personalized Fashion Recommendation System that helps users find the most suitable fashion choices from a large amount of online fashion content. The system uses advanced multimedia mining techniques to analyze and recommend fashion trends based on personal preferences. It includes three key models: (1) an interaction and recommender model that connects user preferences with current fashion trends, (2) an evolutionary hierarchical multimedia mining model

that efficiently filters key fashion elements from online content, and (3) a color tone analysis model that matches clothing colors with skin tones and improves visual understanding using refined contour extraction. Together, these models create a powerful recommendation system that can analyze fashion trends from complex multimedia content and provide users with personalized, diverse, and accurate fashion suggestions[10].

III. METHODOLOGY

The development of the fashion recommendation system fig 1, shows the proposed methodology involves several key stages that integrate computer vision, machine learning, and web development to deliver personalized clothing suggestions based on user-uploaded images.

1.

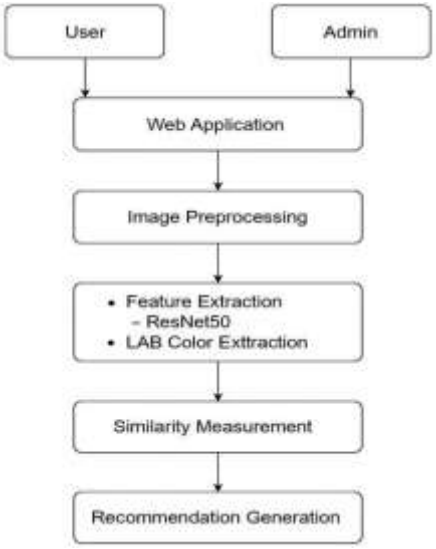

Fig 3.1.1. Proposed Methodology

The methodology is structured as follows:

1. **Data Collection and Preprocessing**: A dataset of fashion item images is collected from online sources or fashion catalogs. Each image is resized to a uniform dimension and preprocessed to ensure consistent input to the deep learning model. Noise is reduced, and images are normalized to prepare them for feature extraction.

2. **Feature Extraction Using ResNet50:** A pre- trained ResNet50 model is used to extract high-level visual features from each image. This deep learning model captures important attributes such as texture, style, and patterns. The model is fine-tuned to improve accuracy on fashion-specific images.

3. **Color Feature Extraction:** In addition to deep features, color features are extracted using the LAB color space. LAB is preferred because it aligns closely with human perception of color differences. These features help improve the accuracy of visual similarity matching.

4. **Similarity Measurement**: For every image uploaded by a user, the system extracts its features (deep and color) and compares them with the features of all images in the dataset. Cosine similarity or Euclidean distance is used to calculate how close each item is to the uploaded image in terms of appearance.

5. **Recommendation Generation**: The most visually similar fashion items are ranked based on their similarity scores. The top matches are selected and presented to the user as personalized fashion recommendations.

6. **Web Application Interface (Flask):** A web application is built using Flask to provide an interactive interface. Users can upload images and view recommended fashion items. Admins have their own interface to manage user accounts, FAQs, and respond to user queries.

- User and Admin Module Functions: User Module: Users can register, log in, upload fashion images, and receive recommendations. They can also view FAQs and communicate with the admin.
- Admin Module: Admins can manage user accounts, add or delete FAQs, and respond to user-submitted questions to support a smooth user experience.

IV. TECHNOLOGIES USED

1. Python

Python is a high-level, interpreted programming language that has gained immense popularity in recent years, particularly in the fields of data science, machine learning, and artificial intelligence. Its clean and readable syntax makes it easy to learn and use, even for beginners, while its powerful libraries and extensive community support make it highly suitable for complex application

development. In this study, Python serves as the core development language for building the fashion recommendation system. It facilitates seamless integration of various tasks such as data preprocessing, image processing, model training, evaluation, and visualization. Libraries like TensorFlow and Keras are used within Python to construct and train deep learning models such as Convolutional Neural Networks (CNNs), including the RESNET50 architecture. Additionally, Python libraries such as NumPy and Pandas are employed for numerical computations and dataset manipulation, while OpenCV and Pillow assist with image handling and transformation. Visualization tools like Matplotlib are used to graphically

Convolutional Neural Network (CNN) model, particularly the RESNET50 architecture, which enhances image classification performance. TensorFlow provides powerful APIs for defining neural networks and optimizing them through backpropagation and gradient descent, making it ideal for processing large-scale image datasets efficiently.

NumPy: NumPy (Numerical Python) is a fundamental library for numerical computing in Python. It is used for handling multi-dimensional arrays and matrices, performing mathematical operations, and preparing data before feeding it into machine learning models. In this project, NumPy is used for data preprocessing, manipulating image arrays, and calculating similarity metrics such as Euclidean distance and Cosine similarity for the KNN algorithm.

OpenCV: OpenCV (Open Source Computer Vision Library) is used for real-time image processing tasks. In the context of this recommendation system, OpenCV helps with image reading, resizing, converting color spaces, and feature extraction. It plays a crucial role in the initial stages of image handling and transformation before the data is passed to deep learning models.

Pillow (PIL): Pillow is a Python Imaging Library (PIL) used for opening, manipulating, and saving images in various formats. It is useful for basic image operations such as resizing, cropping, rotating, and converting images to arrays. Pillow is often used alongside OpenCV and NumPy to

Matplotlib: Matplotlib is a data visualization

represent training results and system outputs. Python's ability to work across platforms and integrate with other frameworks also makes it an ideal choice for deploying the trained model into real-time applications. Its flexibility, efficiency, and rich ecosystem of tools make Python a foundational technology in the implementation of intelligent and personalized fashion recommendation systems.

2. Python Libraries are

TensorFlow: TensorFlow is an open-source deep learning framework developed by Google. It is used in this system to build and train the enhance preprocessing efficiency and maintain compatibility with different image types.

library used to plot graphs and visualize model performance. In this system, it is utilized to visualize:

- Training and validation accuracy/loss over epochs.
- Sample images and their predicted similar items.
- Feature maps from CNN layers for better understanding of how the model interprets visual data.

V. RESULT

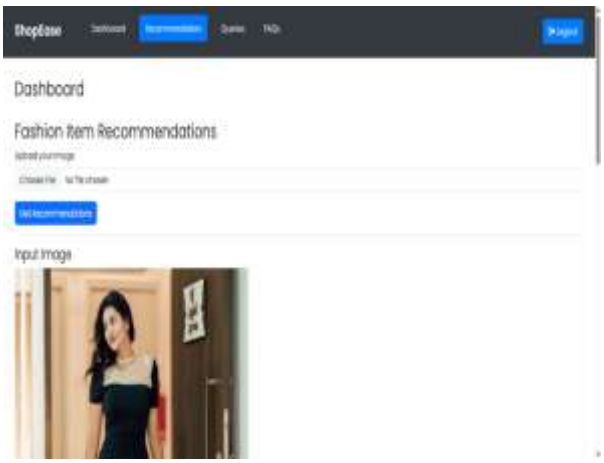

FIG 5.1

This is a fashion recommendation web application called ShopEase that helps users discover visually similar clothing items by uploading an image. The system uses deep learning (ResNet50) and color analysis (LAB color space) to find matching fashion items. Users can easily upload images, get

recommendations, and explore fashion choices. The platform also includes admin features to manage users, respond to queries, and maintain FAQs. It enhances the online shopping experience by providing intelligent, personalized fashion suggestions.

VI. CONCLUSION

In conclusion, this project presents an effective fashion recommendation system that leverages deep learning and computer vision techniques to provide personalized and visually similar clothing suggestions based on user-uploaded images. By combining the power of the ResNet50 model for feature extraction and LAB color space for color analysis, the system delivers accurate and relevant fashion recommendations. The user-friendly Flask-based web interface ensures easy interaction for both users and admins, enhancing the overall shopping experience. This solution not only supports users in discovering products that match their style but also helps fashion businesses improve customer engagement, satisfaction, and sales in the competitive e-commerce environment.

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