AI based Fashion Stylist Recommendation System

Sakshi Shete
Dept. of Information Technology
Vidyalankar Institute of Technology
Mumbai, India
sakshi.shete@vit.edu.in

Darshan HT
Dept. of Information Technology
Vidyalankar Institute of Technology
Mumbai, India
darshan.ht@vit.edu.in

Manish Thakare
Dept. of Information Technology
Vidyalankar Institute of Technology
Mumbai, India
manish.thakare@vit.edu.in

Kanchan Dhuri
Dept. of Information Technology
Vidyalankar Institute of Technology
Mumbai, India
kanchan.dhuri@vit.edu.in

Abstract — **This research paper outlines the design and implementation of an innovative AI Fashion Stylist system, integrating cutting-edge technologies to enhance the fashion experience for users. The project encompasses a comprehensive methodology, beginning with data collection and preprocessing, followed by the creation and real-time updating of user profiles. A sophisticated recommendation engine, incorporating collaborative filtering and content-based filtering, is employed for personalized outfit suggestions. The system integrates augmented reality for virtual try-ons, ensuring users can visualize clothing items in real- time. Real-time trend analysis, community engagement features, and seamless shopping assistance further contribute to the platform's depth and relevance. The research emphasizes user feedback mechanisms for continuous improvement, privacy and security considerations, and scalability for optimal performance. This paper offers a concise yet thorough overview of the project's design, demonstrating its commitment to delivering a user-centric, technologically advanced, and engaging AI Fashion Stylist system.**

Keywords—Artificial Intelligence (AI), Convolutional Neural Networks (CNN), Fashion Recommendation, Deep Learning, Machine Learning.

I. INTRODUCTION

In today's fast-paced and increasingly digital world, the fashion industry is undergoing a revolutionary transformation, and at the forefront of this evolution is the AI Fashion Stylist. This innovative concept combines the power of artificial intelligence with the creativity and personalization of fashion, promising to redefine the way we approach our wardrobes. An AI Fashion Stylist is not just a virtual assistant; it's a cutting-edge technology that understands your unique style preferences, suggests outfit combinations, tracks fashion trends, and helps you make more informed choices about your clothing, ensuring that you look and feel your best every day. As the fashion world continues to embrace the potential of AI, the AI Fashion Stylist is becoming an indispensable tool for both fashion enthusiasts and professionals, offering a glimpse into the future of personalized and sustainable fashion.

In this era of fashion innovation, the AI Fashion Stylist is your trusted companion on the journey to unlock your style potential and make fashion choices that truly reflect your personality and lifestyle. Artificial Intelligence (AI) is bringing about a significant revolution in the world of fashion. The notion and implications of an AI fashion stylist are examined in this research, an innovative technology that leverages machine learning algorithms and computer vision to revolutionize the way individuals engage with fashion. By analyzing user preferences, fashion trends, and clothing attributes, the AI Fashion Stylist offers tailored outfit recommendations, helping users discover their unique style and make informed wardrobe choices.

II. RELATED WORK

A unique dataset created by choosing appropriate ensembles from the fashion website Polyvore.com rather than clothing products. They suggested a model that employs a 2-layer MLP as a binary classifier and Res Net as a feature extractor. A high- performing model can assess if an outfit is good or terrible [1]. Shape signature features and the RGB color space mean are recovered, and a Bagged Decision Tree is used as the predictive model [2]. The Fashion Recommendation System provides a comprehensive experience for users by taking into account current fashion trends and personality trends. Their analysis of social media comments and activity provides them with social intelligence regarding the fashion context. The outcomes demonstrate that the mechanism performs better than the benchmark technique [3]. Style features are obtained by Deep Style by deducting categorical information from the visual attributes of things generated by CNN [4]. The suggested system demonstrates its ability to process the user's clothing from the photos, determine the type and colour of the outfit, and then, using the user's current wardrobe, suggest the best possible ensemble for the occasion. Users can save pictures of their own clothing in the wardrobe feature offered by the system. Every user has a wardrobe attached to them.

They have experimented with a variety of deep learning and machine learning approaches to recognize the color and classify the type of clothing in photos. [5]. In [6], the topic of deep learning clothing classification was covered. In this system, convolutional neural networks (CNNs) were the method used. The Inception v-3 Deep Learning Technique was applied to several object detection tasks. The paper about 13 separate classes used a wide range of outfit choices. In paper [7], To determine the kind and color of the clothes, deep learning techniques were applied. The purpose of this paper was to develop a model for accurate clothing labeling. They concentrate on upper body and lower body apparel imagery in their work, along with images including human models. They scraped many e-commerce websites' websites to construct our own datasets. In this paper, they propose to use a convolutional neural network, ResNet-50, to develop a content-based recommendation system. [8]. In [9] They tackled the real-world issue of cross-scenario clothing retrieval given a regular human photo taken in an ordinary setting, like the street, and locating comparable apparel in online stores, where the images are taken with a clearer background and with a higher level of professionalism. Using a human detector that has been trained to identify 30 human components, they first suggest reducing the human pose discrepancy. They then suggested a two-step calculation based on part features to get more trustworthy one-to-many similarities between the query daily photo and online shopping photos. The article presented by Jianhua Liu et al [10], discussed the significance of form feature extraction in applications related to medical imaging. In their work, common shape feature extraction techniques and their features are presented in depth. Gülbaş et al. [11] used characteristics from several Deep Convolutional Neural Networks (CNN) that have already been trained, including the Alex Net, VGG Net, and Res Net models. Extreme Learning Machines (ELM) are then utilized for the classification of clothing. 60.42% accuracy percentage for the clothing classification system dataset has been achieved. In paper [12], they have put forth a Markov Network-based layout model that takes into account the blocking relationship in order to aim for a roughly ideal clothing arrangement for individuals in groups. Not only have dresses been suggested in this recommender system, but also accessories like handbags, heels, backpacks, and luggage. The user sees the top three costumes that have been rated [13]. In recent years, online shopping has surpassed all other channels. The growth of e-commerce sales has been greatly aided by recommendation systems' capacity to offer tailored recommendations and react fast to the choices made by the customer [14]. Various studies indicate that social media platforms like Facebook, Instagram, Snapchat, Pinterest, and Lookbook, as well as e-commerce sites like Amazon, eBay, and Shopstyle, are currently the most widely used sources of fashion tips and suggestions [15- 23].

III. PROPOSED METHODOLOGY

The goal of the proposed Fashion Stylist system is to revolutionize the fashion experience by providing a comprehensive and intuitive platform that leverages augmented reality, machine learning, and artificial intelligence. The system includes a robust user profiling feature that captures detailed user preferences, body measurements, style history, and past interactions. This data is used to fuel a sophisticated outfit recommendation engine that suggests personalized outfit combinations based on user profiles, taking into account factors such as current weather conditions, occasions, and fashion trends. To improve the accuracy of the outfit suggestions, content-based filtering, collaborative filtering, and hybrid recommendation algorithms are used as shown in "Fig. 1".

Additionally, the proposed system incorporates a virtual wardrobe management feature that allows users to upload, categorize, and manage their clothing items with ease. Users can also create and save curated outfit collections, making the outfit selection process more streamlined and efficient. One of the system's most notable features is the augmented reality (AR) try-on function, which lets users digitally try on apparel and accessories in real time and creates a realistic and engaging shopping experience.

A. Steps followed for Fashion Recommendation:

1) Problem Definition and User Research
Begin by clearly defining the problem you aim to solve with the fashion stylist, such as providing personalized outfit recommendations or promoting sustainable fashion. Conduct extensive user research to understand the target audience's fashion preferences, pain points, and expectations. Gather data through surveys, interviews, and user feedback.

2) Data Collection and Preprocessing
Collect a diverse dataset of fashion items, including images, product descriptions, and user reviews. Ensure the dataset represents various styles, brands, and price ranges. Annotate and preprocess the data, including image tagging for clothing attributes, such as color, pattern, style, and season.

3) AI Model Selection
Identify relevant deep learning or machine learning models for various tasks within the AI fashion stylist, such as image recognition, natural language processing (NLP) for product descriptions, and recommendation algorithms. Consider pre-trained models like convolutional neural networks (CNNs) for image recognition and transformer-based models for NLP tasks.

4) Model Training
Train the selected models on the prepared dataset, fine-tuning them for specific fashion-related tasks. Implement techniques like transfer learning to leverage pre-trained models.

5) User Profiling and Preferences
Create user profiles by collecting data on user style preferences, sizes, and past fashion choices. Implement algorithms to update these profiles based on user interactions.

6) Outfit Recommendation Engine
Develop a recommendation engine that considers user profiles, current weather, occasion, and fashion trends to

suggest personalized outfit combinations. To improve outfit recommendations, make use of collaborative filtering, content- based filtering, or hybrid recommendation systems.

7) Real-time Trend Analysis

Implement algorithms that continuously monitor fashion trends by analyzing social media, fashion blogs, and online magazines. Use natural language processing and image analysis to extract trend-related information.

8) Augmented Reality (AR) Integration

Integrate AR technology to enable users to virtually try on suggested outfits and accessories, enhancing the user experience.

9) User Interface (UI) Design

Design an interface that is simple to use and intuitive for the AI fashion stylist, available through web or mobile applications.
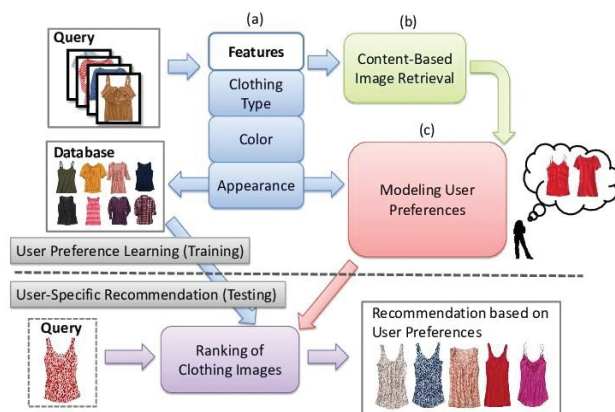

Fig. 1. Workflow of System

The above figure clearly explains the workflow of the project being into two parts which begins with the providing a query and then the features n other characteristics are extracted like type of clothing, color and appearance etc. and then using content based image retrieval the selected model learns varied user preferences and based upon that the recommendation system comes into picture which ranks the outfits based on the query being presented and then provided the recommended outfits similar to the query.

IV. IMPLEMENTATION AND RESULTS

In the implementation phase of our research, Convolutional Neural Networks (CNNs) have been employed for the crucial task of image classification, specifically to categorize various clothing items into distinct classes such as top wear, bottom wear, and footwear. Although CNNs are known for their capacity to identify complex patterns in picture data, it is interesting to note that the original model had difficulties correctly classifying entire costumes. Despite these initial classification discrepancies, it is essential to highlight our ongoing commitment to refining and optimizing the model's performance. Through a comprehensive approach, we are actively engaged in fine-tuning parameters, expanding the

training dataset, and exploring advanced CNN architectures to bolster the accuracy of outfit classification. This optimization process aims not only to rectify current classification inconsistencies but also to enhance the model's overall efficacy in accurately categorizing diverse and intricate fashion ensembles. This iterative refinement underscores our dedication to continually improving the AI Fashion Stylist system, ensuring it delivers reliable and precise results in outfit classification for an enriched user experience.

Incorporating augmented reality (AR) into our AI Fashion Stylist system marks a transformative feature, empowering users to virtually try on their outfits for a personalized and immersive experience. Presently, the AR functionality is adept at analyzing and rendering virtual try-ons exclusively for male attire. However, recognizing the importance of inclusivity, our team is actively engaged in refining and expanding this capability to seamlessly accommodate and enhance the virtual try-on experience for female clothing items.

Additionally, our platform is on the brink of unveiling the Trend Analysis section, a dynamic feature designed to keep users abreast of the latest fashion trends. This section serves as a valuable resource, alerting users to prevailing trends and styles, thereby aiding them in making informed decisions about their wardrobe choices. As we strive for continuous improvement, these advancements underscore our commitment to delivering a cutting-edge AI Fashion Stylist system that not only embraces technological innovation but also prioritizes user inclusivity and trend-conscious styling recommendations.

Presently, our outfit recommendation engine relies on a predefined rule-based system for assessing the suitability of different outfit pairings. Acknowledging the need for a more nuanced and personalized approach, we are actively exploring the integration of content-based filtering techniques. This strategic shift aims to enhance the accuracy and relevance of outfit recommendations by leveraging user-specific preferences, style histories, and item attributes. As part of our ongoing commitment to optimization, we are diligently working towards refining and fine-tuning the content-based filtering model, ensuring it aligns seamlessly with individual user tastes and preferences.

Furthermore, the development of our user profiling system is underway, promising a transformative experience for every user. This system is poised to empower users to curate and save their personalized recommendations, effectively creating a digital wardrobe that aligns with their unique style. As we embark on these advancements, our focus remains steadfast on delivering a sophisticated and tailored AI Fashion Stylist system that not only embraces evolving technologies but also prioritizes user-centric personalization and convenience.

The UI serves as the gateway to a world where technology seamlessly intertwines with fashion, offering users a visually appealing and user-friendly platform. The design principles prioritize simplicity, ensuring that users can effortlessly navigate through various features such as personalized outfit recommendations, virtual try-ons, and wardrobe management. The User Interface (UI) of our AI Fashion Stylist system has

been meticulously designed to provide an intuitive and engaging experience for users seeking personalized fashion recommendations and styling assistance. A glimpse of our user interface is shown below.
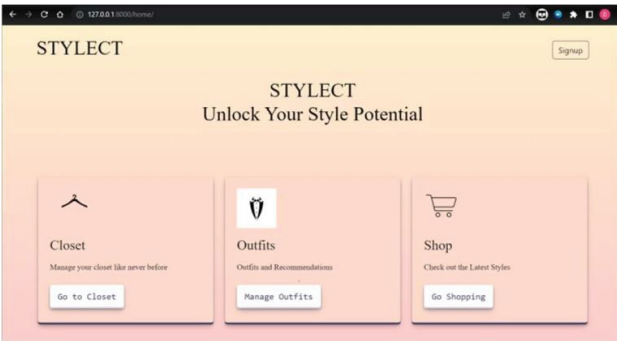

Fig. 2. Home Page

The Home Page serves as the central hub of our AI Fashion Stylist system, offering users a seamless and personalized journey through three distinct sections namely The Closet, Outfits and Recommendations and Shopping Arena as shown in "Fig. 2".
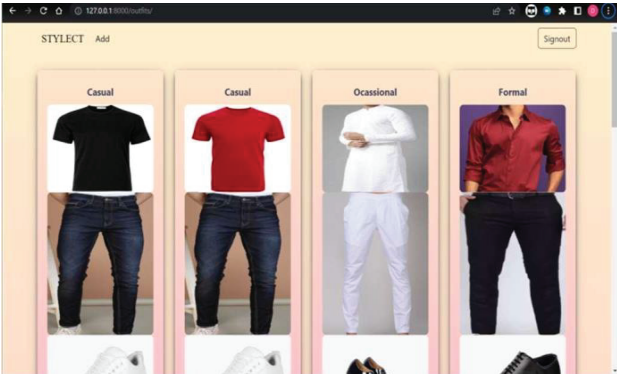

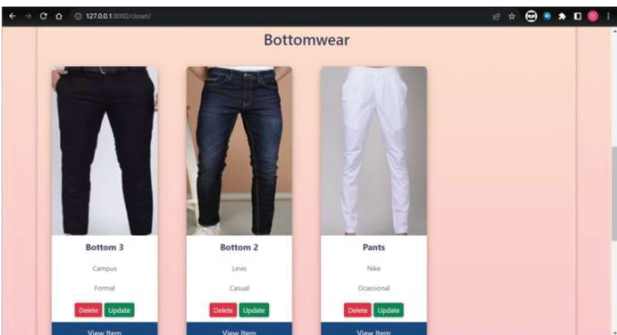
Fig. 3. Closet Section showcasing Top wear

Fig. 4. Closet Section showcasing Bottom wear

Each area has been painstakingly created to meet the various needs of visitors, offering a thorough and engaging fashion experience. By strategically combining these three sections on the Home Page, our AI Fashion Stylist system aims to create a unified and immersive environment, where users can effortlessly manage their wardrobe, explore outfit pairings, and receive intelligent shopping recommendations.
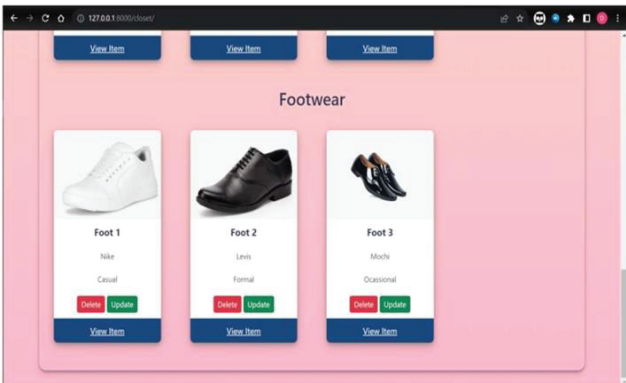

Fig. 5. Closet Section showcasing FootwearCloset Section:

The "Closet" section represents the heart of the user's fashion ecosystem, a virtual wardrobe where every apparel item is meticulously organized and easily accessible. Users can effortlessly browse through their collection of top wear, bottom wear, and footwear, gaining quick access to their entire ensemble. This section serves as a dynamic reflection of the user's personal style evolution, ensuring that every fashion choice is archived for future reference as shown in "Fig 3a, 3b, 3c".
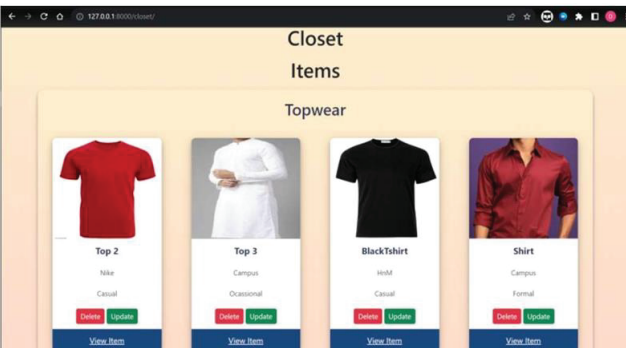

Fig. 6. Outfits Recommended based upon Occasion

V. OUTFITS AND RECOMMENDATIONS SECTION

In the "Outfits and Recommendations" section, users embark on a personalized styling journey. The system curates and displays outfits tailored to various occasions such as casual, formal, or special events. Here, users can effortlessly manage their outfits, explore pairing options, and receive intelligent recommendations based on their unique preferences. The section seamlessly integrates outfit management with real-time AI-driven suggestions, empowering users to make informed and stylish choices as shown in "Fig. 4a, 4b".

VI. Shopping Section

The "Shopping" section, currently under development, is poised to revolutionize the fashion retail experience. Based on individual user preferences, this section will provide curated shopping recommendations, offering a tailored selection of clothing items that align with the user's style, preferences, and ongoing fashion trends. This feature will not only enhance the user's shopping experience but also contribute to the platform's mission of seamlessly integrating fashion and technology.

VII. Conclusion

In conclusion, AI fashion stylists represent a transformative force in the fashion industry. They offer personalized outfit recommendations, real-time trend insights, and sustainability awareness. With the integration of Augmented Reality (AR), they provide immersive virtual try-on experiences and foster global fashion communities. The future of AI fashion stylists holds promise, not only for elevating personal style but also for promoting conscious fashion choices and a more connected fashion world. As technology continues to advance, AI fashion stylists will play an increasingly pivotal role in shaping the future of fashion.

The future scope of the Fashion Stylist would be:

- The system will offer a real-time trend analysis feature that monitors and analyzes fashion trends using data from social media, fashion blogs, and trend databases.

- The shopping assistance feature provides real-time product recommendations and price comparisons based on user preferences and shopping behavior, with seamless integration with e-commerce platforms for a smooth shopping experience.

- A community and social integration feature, creating a fashion community platform where users can share their outfits, receive feedback, and engage with fashion experts and influencers.

- The system generates personalized fashion content, including blogs, newsletters, and style guides, based on user preferences and fashion trends. Users can also explore customization options for AI-generated fashion designs and accessories.

- The system incorporates a feedback loop that collects user ratings and comments on outfit recommendations and platform features.

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