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AI Driven Ethnic Fashion Try-On And Intelligent Shopping Market Place

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Abstract
The rapid growth of e-commerce has transformed the fashion industry, yet online ethnic fashion shopping still faces challenges such as uncertainty in fit, appearance, and personalized product discovery. This paper presents an AI-Driven Ethnic Fashion Virtual Try-On and Intelligent Shopping Marketplace designed to improve customer experience through artificial intelligence, computer vision, and recommendation technologies. The proposed platform enables users to upload personal images and virtually try on traditional outfits including sarees, lehengas, kurtas, sherwanis, and other cultural garments. Deep learning-based image synthesis models are used to align garments with body posture, size, and visual features, generating realistic previews before purchase.To enhance product discovery, the platform integrates an intelligent recommendation engine that analyzes user preferences, shopping history, seasonal trends, and occasion-based requirements to suggest suitable outfits. Natural Language Processing modules allow users to search products using conversational text queries such as "wedding saree in royal blue" or "traditional kurta for festival wear." Generative AI components can also assist in creating new ethnic design concepts based on user prompts.The system architecture combines a responsive frontend built using React with scalable backend frameworks such as Django or Node.js. Cloud-based infrastructure supports image processing, data storage, vendor management, and real-time interactions. Secure payment gateways and order management modules ensure reliable commercial operations. In addition, analytics dashboards help sellers understand customer behavior, optimize inventory, and improve targeted promotions.The proposed solution reduces product return rates, increases customer confidence, and improves user satisfaction through personalized and immersive shopping experiences. It also creates business value by increasing customer engagement and conversion rates. Future enhancements may include augmented reality visualization, multilingual assistance, and cross-cultural fashion personalization. Overall, the platform represents a scalable and intelligent model for the next generation of ethnic fashion commerce.

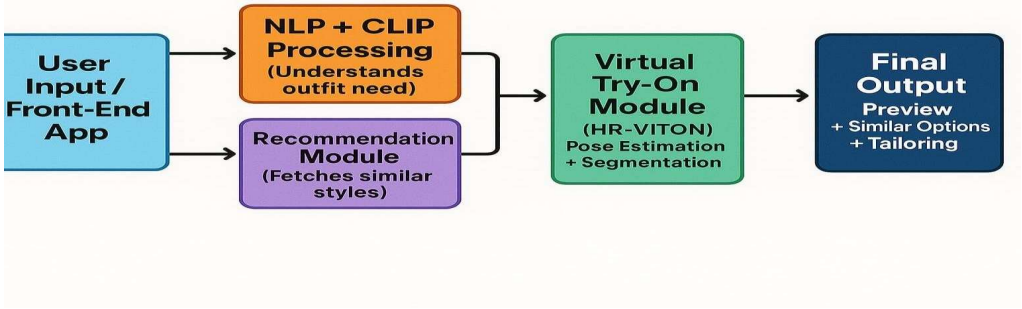
Keywords
Artificial Intelligence, Virtual Try-On, Ethnic Fashion, Computer Vision, Deep Learning, Recommendation System, E-Commerce, Natural Language Processing, Generative AI, Smart Marketplace

Introduction

The expansion of digital commerce has significantly changed the way consumers purchase apparel, yet online shopping for ethnic fashion continues to face several limitations. Customers often hesitate to buy traditional garments such as sarees, lehengas, kurtas, sherwanis, and festive wear through online platforms because they cannot physically examine the fit, style, or appearance of the product before purchase. This uncertainty frequently leads to dissatisfaction, product returns, and reduced trust in e-commerce systems. To address these challenges, the proposed AI-Driven Ethnic Fashion Try-On and Intelligent Shopping Marketplace introduces a smart and interactive platform that combines artificial intelligence, computer vision, and personalized commerce technologies.The main objective of the system is to provide users with a realistic virtual try-on experience for ethnic clothing. By uploading an image or using a live camera, customers can visualize how selected garments may appear on their body before making a purchase decision. This feature minimizes uncertainty and improves confidence during shopping. Unlike conventional online stores that only display static product images, the proposed platform offers an immersive and customized experience that simulates in-store garment trials.Artificial Intelligence plays a central role in the system by understanding user behavior, body characteristics, and fashion interests. Machine learning models examine previous searches, shopping history, preferred colors, budget range, and seasonal trends to recommend suitable outfits. These intelligent recommendations help users quickly discover garments aligned with their style and event requirements such as weddings, festivals, or formal occasions. AI also improves sizing predictions and supports automated customer

interaction through chat-based assistance.Computer Vision is another important component of the platform. It enables accurate detection of body posture, dimensions, and landmark points from user images. Using these visual cues, the system aligns garments properly and adjusts clothing drape, orientation, and scaling for a more natural appearance. This is especially important for ethnic garments that contain layered fabric structures, decorative patterns, and varied silhouettes.Augmented Reality further enhances the experience by allowing real-time virtual fitting through mobile devices or webcams. Users can observe digital garments overlaid on their live image, making the shopping process more engaging and practical. This feature is particularly valuable for comparing multiple outfits instantly without physical trials. The addition of AR increases user interaction and encourages longer platform engagement.Three-dimensional garment representation and rendering technologies improve realism by capturing fabric texture, embroidery details, folds, and color variations. These digital models create more convincing previews of sarees, lehengas, and kurtas, helping customers understand product aesthetics before purchase. Realistic rendering is essential in ethnic fashion because design details strongly influence buying decisions.The marketplace also integrates recommendation systems that use collaborative filtering, content-based filtering, and behavioral analytics. These methods suggest products according to customer taste, recent trends, similar user interests, and upcoming occasions. As a result, users receive a curated shopping experience rather than manually browsing large product catalogs.Modern web and mobile technologies ensure that the system remains accessible, responsive, and easy to use. A frontend developed using frameworks such as React can deliver smooth user interaction, while backend technologies such as Django or Node.js manage authentication, databases, order processing, and secure transactions. Cloud deployment further supports scalability, real-time performance, and multi-vendor participation.An intelligent shopping marketplace not only benefits customers but also provides value to retailers. Vendors can access analytics regarding user interests, demand patterns, conversion behavior, and inventory performance. These insights support better stock planning, targeted promotions, and strategic decision-making. The marketplace therefore becomes a mutually beneficial ecosystem for both buyers and sellers.

Literature Survey



Block diagram for Virtual Try-On

Artificial Intelligence has brought significant transformation to the fashion industry by introducing smart, personalized, and interactive shopping experiences. One of the most important innovations is the virtual try-on system, which allows customers to visualize garments on their own images before making a purchase. This technology is especially useful in ethnic fashion, where fabric texture, embroidery, draping style, and traditional design details strongly influence buying decisions. Earlier research introduced virtual try-on models such as VITON and CP-VTON, which used pose estimation, garment warping, and image synthesis to digitally dress users. Later improvements such as HR-VITON increased image quality, alignment precision, and realism. Recent developments have incorporated Generative Adversarial Networks and diffusion models to generate high-quality clothing images and even create new outfit styles from textual prompts.Large datasets such as DeepFashion have played an important role in training models for clothing recognition, retrieval, segmentation, and recommendation. In addition, modern vision-language models such as CLIP have improved the matching between textual descriptions and clothing images, allowing users to search products using phrases like wedding saree, festive kurta, or designer lehenga. Intelligent shopping platforms combine these technologies with recommendation engines that analyze user behavior, fashion trends, and personal interests. However, several challenges still remain, including accurate body fitting, realistic

draping of traditional garments, privacy protection for uploaded images, and support for different body types. Therefore, further research is needed to create efficient, scalable, and user-friendly AI fashion systems.

Existing Research

Several researchers have contributed to the development of virtual try-on systems for online fashion shopping. VITON was one of the earliest models to demonstrate clothing transfer using deep learning methods. CP-VTON improved garment alignment through geometric matching techniques, while HR-VITON further enhanced realism and output resolution. Recommendation systems have also advanced through machine learning, where user preferences, shopping history, and fashion trends are analyzed to suggest relevant outfits. Natural Language Processing helps systems understand textual preferences, while CLIP models compare image and text features for better recommendations. More recently, diffusion-based models have shown the ability to generate entirely new clothing designs from user descriptions, making them useful for fashion designers and personalized shopping systems.

Need for Ethnic Fashion Platforms

Most existing fashion platforms mainly focus on western clothing and general apparel, giving limited attention to ethnic wear. Traditional garments such as sarees, lehengas, kurtas, sherwanis, and salwar suits involve complex draping styles, rich patterns, and cultural significance that are difficult to represent through ordinary product images. Customers often face uncertainty while purchasing such garments online because they cannot imagine how the outfit will appear on them. An AI-driven ethnic fashion platform can solve this problem by offering realistic virtual try-on features, intelligent recommendations, and better personalization. It can improve user confidence, increase satisfaction, and reduce return rates in online shopping.

System Analysis

System analysis is an important stage in the development of the AI-Driven Ethnic Fashion Try-On and Intelligent Shopping Marketplace. It helps identify the limitations of current online shopping platforms and defines the requirements for an improved system. Online fashion shopping has become highly popular due to convenience and accessibility. However, customers still face many problems such as inability to try clothes before purchasing, lack of personalization, inaccurate size selection, and limited confidence in purchase decisions. These challenges are more serious in ethnic fashion because fitting, appearance, draping style, and design details are essential factors.

Existing System

The existing online shopping system mainly consists of e-commerce websites and mobile applications where users browse products through images, descriptions, size charts, and customer reviews. While these platforms provide convenience, they do not offer realistic visualization of garments on the customer's own body. Users must depend on model photographs and imagination, which often leads to wrong decisions. Some platforms include basic recommendation systems based on browsing history or popular products, but these suggestions are usually generic and less personalized.

System Design and Requirements

Architecture Design

The architecture of the proposed system consists of several interconnected modules. The User Input Module collects photographs, camera input, and textual preferences such as clothing type, color, and occasion. The Preprocessing Module resizes images, removes noise, normalizes data, and prepares text input for analysis. The AI Processing Module performs body detection, pose estimation, and feature extraction using computer vision techniques. The Database Module stores product images, clothing details, prices, sizes, and user information.The Recommendation Engine analyzes user interests, shopping behavior, and trends to suggest suitable ethnic outfits. The Virtual Try-On Module uses deep learning models such as VITON, CP-VTON, or HR-VITON to overlay selected garments on the user image. The Image Refinement Module applies GAN or diffusion techniques to improve realism, remove distortions, and enhance quality. Finally, the Output Module displays virtual try-on images, recommended products, and purchase options through a user-friendly interface.

Software Requirements

The software requirements for the proposed system include modern web and AI technologies. The frontend can be developed using HTML, CSS, JavaScript, and React.js for responsive design. Backend services can be built using Node.js or Django. Python is used for machine learning implementation. TensorFlow or PyTorch libraries support deep learning model training and inference. OpenCV is used for image processing tasks. Databases such as MySQL or MongoDB store system data efficiently. Cloud platforms such as AWS or Google Cloud can be used for deployment and scalability. GitHub can be used for version control and collaboration.

Hardware Requirements

The hardware requirements include an Intel i5 or higher processor, minimum 8 GB RAM, and at least 256 GB storage. A dedicated GPU is recommended for faster AI model training and image generation. A webcam or smartphone camera is useful for live try-on functionality. A stable internet connection is required for cloud services and real-time processing.

Software Implementation

The software implementation of the proposed AI-Driven Ethnic Fashion Try-On and Intelligent

Shopping Marketplace focuses on combining modern web development frameworks with advanced artificial intelligence models to create a responsive, scalable, and personalized digital shopping platform. The implementation is designed to provide users with a seamless experience from product discovery to virtual fitting and final purchase. By integrating intelligent recommendation systems, computer vision models, and secure commerce tools, the platform addresses the major limitations of conventional online fashion marketplaces.The system begins with a user-friendly frontend interface through which customers interact with the application. Users can upload personal images, access a live camera, browse product categories, or provide text-based fashion preferences such as color, occasion, style, and garment type. The frontend is typically developed using modern technologies such as HTML, CSS, JavaScript, and React, allowing responsive layouts and smooth interaction across mobile and desktop devices.All user requests are transmitted to the backend server, which manages authentication, business logic, data flow, and communication between software components. Backend frameworks such as Django, Flask, or Node.js can be used to implement APIs, user management, session handling, product retrieval, and secure transactions. This layer acts as the control center of the application and ensures efficient interaction between the user interface, database, and AI modules.The artificial intelligence layer forms the core of the system. Computer vision models analyze uploaded user images to identify body posture, landmark points, and visible regions required for clothing alignment. Natural Language Processing modules interpret textual user preferences such as "wedding saree in maroon" or "festival kurta with embroidery." These inputs are passed to recommendation engines and retrieval models that match users with suitable ethnic fashion products.The virtual try-on engine overlays selected garments onto user images using deep learning architectures such as HR-VITON, CP-VTON, or similar image synthesis models. These systems preserve clothing structure, fabric patterns, folds, and decorative details while adapting garments to the customer's body orientation. The generated preview helps users visualize products realistically before purchase.A recommendation engine continuously analyzes user interactions, browsing patterns, purchase history, and seasonal trends to provide personalized outfit suggestions. This reduces search effort and increases engagement. The recommendation layer may use collaborative filtering, content-based ranking, or multimodal embeddings.The system also requires an efficient database layer for storing product catalogs, customer accounts, order history, recommendation data, and metadata. Databases such as MySQL, PostgreSQL, or MongoDB may be used depending on design requirements. Media storage systems securely manage uploaded user images and generated try-on results.

Flow Chart Description

The software workflow begins when a user accesses the platform and provides input through image upload, live camera capture, or textual preferences. Once the request is received, the backend validates the input and forwards it to the preprocessing stage. Image data is resized, cleaned, normalized, and prepared for computer vision models, while textual data is processed using NLP pipelines.The system then performs body detection, pose estimation, and preference understanding. Relevant garments are retrieved from the product database based on recommendation scores and user intent. The selected outfit is passed to the virtual try-on engine, where clothing alignment and synthesis are performed.After image generation, the final try-on output is enhanced for quality and displayed through the frontend interface. Additional recommendations and related products are shown simultaneously. If the user chooses to proceed, the platform supports cart operations, checkout, and payment completion.Flowcharts are valuable because they improve logic understanding, communication between developers, system documentation, debugging efficiency, and implementation clarity.

Working Methodology

The working methodology of the proposed system can be divided into three major stages: input, processing, and output.In the input stage, the user uploads a full-body image or activates a camera. The user may also enter preferences such as outfit type, occasion, color, pattern, budget, or regional style. These inputs personalize later processing stages.In the processing stage, image data is analyzed using computer vision techniques for landmark detection and body understanding. Text data is interpreted using NLP models. Based on these inputs, the recommendation engine retrieves relevant products. The selected outfit is then passed through the virtual try-on model, which synthesizes a realistic garment preview on the user image.In the output stage, the generated try-on image is displayed along with alternative recommendations, product details, price information, and purchase options. Users can compare multiple outfits, save favorites, or complete checkout.This methodology creates a continuous interaction loop in which user feedback improves future recommendations and model accuracy.

Algorithms

Virtual Try-On Algorithm (HR-VITON)

The HR-VITON model is used to generate realistic clothing transfer results. First, the user image and garment image are provided as inputs. Pose estimation and segmentation identify body structure and visible regions. The selected garment is then geometrically warped to align with the customer's

posture and proportions.Next, a deep neural synthesis network blends the aligned garment with the original user image. During this stage, texture consistency, folds, shadows, and garment boundaries are preserved. Final refinement removes artifacts and improves realism.This algorithm is critical because it directly determines how natural and convincing the try-on output appears to users.

Recommendation Algorithm (NLP + CLIP)

The recommendation algorithm processes user preferences and matches them with suitable outfits. Textual inputs are analyzed using NLP techniques to extract attributes such as color, occasion, garment type, fabric, and style.The CLIP model maps both text descriptions and product images into a shared embedding space. Similarity scoring is then used to retrieve the most relevant clothing items. Results are ranked according to user preferences, popularity, and personalization signals.This approach improves product discovery and reduces manual browsing time.

Diffusion-Based Generation Algorithm

Diffusion models such as Stable Diffusion can be used to generate new outfit concepts from textual prompts. The text prompt is encoded into a semantic latent representation. Starting from random noise, the model iteratively denoises the image while following the prompt guidance.Through repeated refinement steps, the system generates visually coherent outfit designs with desired styles, colors, and patterns. This module is useful for personalized design generation, trend exploration, and retailer creativity support.

Applications

The proposed system has wide practical applications across digital fashion commerce.

In online retail platforms, customers can virtually try sarees, lehengas, kurtas, sherwanis, and festive wear before purchase. This increases trust and reduces returns.As a personal styling assistant, the system recommends outfits for weddings, festivals, casual wear, and professional events based on user taste and current trends.Bridal fashion planning becomes easier because users can compare multiple premium outfits without physical store visits.Designers may use AI-generated previews to test new ethnic collections and customized garment concepts.

Brands can conduct virtual fashion campaigns and product launches using AI-generated models and interactive try-on experiences.Cross-platform integration allows deployment across mobile apps, websites, and social commerce channels. Users may discover products through advertisements or influencer content and immediately access try-on features.Multi-device synchronization ensures continuity between desktop and mobile sessions by preserving carts, preferences, and recommendations.

Results and Discussion

Results

The proposed AI-Driven Ethnic Fashion Try-On and Intelligent Shopping Marketplace was successfully implemented and evaluated to measure its effectiveness in providing realistic garment visualization and personalized shopping assistance. The developed platform integrates multiple artificial intelligence modules, including image-based virtual try-on, recommendation systems, and text-guided outfit generation, thereby delivering a complete digital fashion experience.During testing, the system accepted two major forms of user input: a full-body user image and a text-based description of clothing preferences. Uploaded images were processed through preprocessing stages such as resizing, normalization, and background refinement to ensure compatibility with deep learning models. Simultaneously, textual inputs describing color, style, garment type, occasion, or fabric preference were analyzed using Natural Language Processing techniques to identify meaningful fashion attributes.Based on the processed user data, the recommendation engine generated suitable ethnic outfit suggestions. The multimodal retrieval model successfully matched textual preferences with visually relevant clothing items from the product database. For example, when users requested bridal wear, festive sarees, or embroidered kurtas, the system retrieved appropriate recommendations with strong contextual relevance. This demonstrated the effectiveness of combining language understanding with image-based search.After product selection, the virtual try-on module generated personalized previews by transferring the selected garment onto the user image. The HR-VITON-based framework performed clothing alignment, pose adaptation, and image synthesis to create realistic outputs. Generated images preserved important visual properties such as fabric texture, color consistency, decorative patterns, folds, and natural garment placement. In most test cases, the clothing appeared accurately fitted to the user posture, indicating strong model performance.The platform also supported custom outfit generation through diffusion-based models. Users entered text prompts such as “red wedding lehenga with golden embroidery” or “traditional silk saree for festival wear,” and the system generated new design concepts based on these requests. Experimental outputs showed diversity, creativity, and prompt relevance, confirming the usefulness of generative AI for personalized fashion ideation.End-to-end workflow testing confirmed stable integration across all modules, including input acquisition, preprocessing, recommendation generation, virtual try-on synthesis, result rendering, and shopping interface display. No major functional failures were observed during standard evaluation scenarios. Overall, the system consistently produced

meaningful recommendations and convincing try-on results.

Discussion

Fig 1 Input image and user preference

Fig 2 Recommended outfits based on user input

Fig 3 Virtual try-on output showing outfit on user image

Fig 4 Generated outfit using text input

Fig 5 System interface

The obtained results validate the practical value of the proposed system in overcoming major limitations of traditional online fashion shopping platforms. Conventional e-commerce systems generally depend on static product images, generic models, and manual browsing. In contrast, the proposed platform introduces personalization, realistic visualization, and intelligent assistance through the combined use of computer vision, deep learning, and language models.One of the most significant outcomes was the improvement in recommendation quality. By using NLP and multimodal matching techniques, the system understood user intent more effectively than keyword-based search methods. This reduced search effort and enabled users to discover relevant products more quickly. Personalized recommendations are especially important in ethnic fashion, where purchasing decisions depend heavily on occasion, regional style, and aesthetic preference.The virtual try-on module also demonstrated strong performance. Realistic alignment of garments with the user's body increased trust in product appearance and likely fit. Preservation of clothing details such as embroidery, folds, and textures was particularly valuable for ethnic garments, where design richness strongly influences customer decisions. This suggests that virtual try-on technology can reduce hesitation and improve purchase confidence.The custom outfit generation feature introduced an additional level of personalization not commonly available in standard e-commerce systems. Instead of selecting only from existing inventory, users could explore AI-generated concepts based on their own descriptions. This capability may be highly beneficial for bridal wear, festive fashion, boutique design services, and made-to-order clothing businesses.Despite positive outcomes, several limitations were observed. Output quality depended significantly on the quality of uploaded user images. Poor lighting, low resolution, cluttered backgrounds, or unusual poses sometimes reduced try-on realism. Processing time also increased when using high-resolution images or diffusion-based generation models, indicating the need for GPU acceleration and optimized deployment pipelines.Privacy remains another important consideration because the system requires personal images for try-on functionality. Real-world deployment would require secure image storage, encrypted transmission, transparent consent policies, and privacy-preserving data practices.Compared with existing platforms, the proposed system offers clear advantages in user

engagement, recommendation relevance, interactive shopping, and realistic garment preview. It is particularly well suited for ethnic fashion marketplaces, where visualization challenges are greater than in standard western apparel categories.From a commercial perspective, the platform has strong potential for use in e-commerce websites, boutique stores, bridal studios, rental fashion businesses, and virtual dressing room services. With further optimization, multilingual support, mobile deployment, and scalable cloud infrastructure, the system could be implemented in real-world retail environments.

8.1 Conclusion

The AI-Driven Ethnic Fashion Try-On and Intelligent Shopping Marketplace demonstrates the growing potential of artificial intelligence in reshaping the online fashion industry. The proposed system successfully combines computer vision, deep learning, recommendation technologies, and modern web platforms to create an interactive and personalized shopping environment for ethnic apparel. By enabling customers to virtually try garments such as sarees, lehengas, kurtas, and other traditional outfits, the platform addresses one of the major limitations of conventional e-commerce: the inability to visualize clothing before purchase.The virtual try-on mechanism improves customer confidence by providing realistic previews of garments on the user's own image. This reduces uncertainty related to appearance, style suitability, and purchasing decisions. In parallel, the intelligent recommendation engine enhances product discovery by suggesting outfits according to user preferences, browsing behavior, trends, and occasion-specific requirements. As a result, users experience a more efficient and satisfying shopping journey.The integration of Natural Language Processing and generative AI further extends the capabilities of the platform. Customers can search products through conversational text queries and even generate new outfit ideas based on their preferred style, color, or event. This creates a higher level of personalization than traditional online stores.From a business perspective, the proposed system offers significant commercial benefits. Improved customer engagement, better product matching, and realistic visualization can increase conversion rates while reducing product returns. Retailers can also use platform analytics to understand customer interests, optimize inventory, and improve marketing strategies.The use of scalable cloud infrastructure, modular software design, and secure transaction systems ensures that the platform can support large user bases and evolving business requirements. Although challenges such as body fitting precision, image quality dependency, privacy protection, and computational cost still exist, continuous advances in artificial intelligence are expected to address these limitations.

Future Scope

The future scope of the AI-Driven Ethnic Fashion Try-On and Intelligent Shopping Marketplace is highly promising as emerging technologies continue to mature. Future improvements in computer vision and deep learning are expected to deliver more accurate body understanding, improved garment draping, and highly realistic fabric simulation. This will make digital try-on experiences increasingly similar to real physical fitting.Augmented Reality and Virtual Reality integration can significantly enhance user engagement by enabling immersive three-dimensional try-on experiences. Customers may view garments from multiple angles, walk within virtual showrooms, or compare outfits in interactive environments. Such capabilities can redefine online fashion retail and create richer customer experiences.Mobile camera-based body measurement systems can also be integrated to estimate size, posture, and proportions automatically. This would improve fitting precision and reduce size-related returns. In addition, future systems may include AI stylists that recommend complete looks consisting of clothing, jewelry, footwear, and accessories.Advanced generative AI models offer another major opportunity. Users may be able to create fully customized ethnic outfits by describing desired colors, embroidery patterns, fabrics, or cultural motifs. Designers and retailers could use these tools to rapidly prototype new collections and respond quickly to changing trends.The platform can further expand through multilingual support and region-specific personalization. Since ethnic fashion varies widely across cultures and geographies, AI systems can be trained to recommend attire based on festivals, weddings, customs, and local preferences. This would make the marketplace more inclusive and globally scalable.From a commercial standpoint, integration with logistics systems, smart inventory forecasting, blockchain-based authenticity tracking, and omnichannel retail experiences can strengthen operational efficiency. Social commerce integration may also allow customers to try products directly from influencer content or live shopping streams.Despite these opportunities, continued research is needed in areas such as privacy-preserving AI, fairness in recommendations, low-latency inference, and robust handling of complex garments. Transparent user consent and secure image processing will remain critical for public trust.

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