

StyleSense AI: An Adaptive Deep Learning Model for Realistic Try-On Simulation and Sustainable Fashion Recommendations

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Abstract

The rapid rise of online fashion commerce has introduced significant challenges, including inaccurate size selection, unrealistic product visualization, and large-scale product returns that negatively impact both customer satisfaction and environmental sustainability. Traditional recommender systems depend largely on static filters and collaborative patterns that overlook individual body attributes and dynamic user preferences. To address these limitations, this paper proposes StyleSense AI, an adaptive deep learning-powered virtual try-on and recommendation ecosystem that integrates multimodal learning, generative image synthesis, and sustainability-aware personalization. The system employs CNN-based visual embeddings for apparel understanding, a GAN-driven virtual try-on module for realistic garment overlay, and a transformer-enhanced recommendation engine for contextual outfit suggestions. A sustainability score model is additionally incorporated to guide users toward eco-friendly fashion choices. Experimental evaluations across public and proprietary datasets reveal 92% recommendation accuracy, 85% try-on realism score (SSIM + LPIPS), and a 21% reduction in return likelihood. User studies further confirm improved trust, satisfaction, and decision confidence. StyleSense AI demonstrates a scalable, modular, and environmentally responsible approach for next-generation fashion retail.

Keywords

Artificial Intelligence (AI), Deep Learning, Virtual Try-On Systems, Generative Adversarial Networks (GANs), Convolutional Neural Networks (CNNs), Transformer-Based Recommendation, Fashion Technology, Computer Vision, Multi-modal Learning, Sustainable Fashion, E-Commerce Personalization, Image Synthesis, Fit Prediction Models, Human-Computer Interaction (HCI).