

Snap Search Shop with Personal AI Assistant

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Abstract: *Online consumers encounter challenges such as identifying appropriate keywords for product searches or navigating extensive product databases to locate specific items, which consequently requires significant time and resources. The convergence of computer vision and artificial intelligence is reshaping the fashion retail industry by enabling intelligent and user-centric shopping experiences for consumers. Traditional text-based search engines on e-commerce platforms often fail to capture users' visual and stylistic intent. To overcome this limitation, we propose Snap Search Shop, a smart fashion discovery system that allows users to upload or capture an image of apparel or accessories and retrieve visually similar items from the product database. The system leverages convolutional neural networks (CNNs) and pretrained deep learning architectures, such as ResNet, for feature extraction, coupled with similarity-matching algorithms for efficient visual search. In addition, an AI-driven fashion designer module employs recommendation algorithms and trend analyses to provide personalized styling suggestions and complementary product pairings. The framework integrates visual recognition, recommendation systems, and real-time retrieval to reduce the search effort and enhance user satisfaction. Preliminary evaluations highlight the potential of the proposed model to bridge the gap between fashion inspiration and product acquisition, making it a scalable solution for next-generation AI-powered retail platforms.*

Keywords: Computer Vision, Deep Learning, Fashion Recommendation, Image Retrieval, Convolutional Neural Networks (CNNs), ResNet, Personalized AI, E-commerce.

I. INTRODUCTION

The global fashion retail industry is undergoing a digital transformation driven by artificial intelligence (AI), computer vision, and machine learning (ML). With the exponential growth of e-commerce platforms, consumers increasingly rely on technology to discover, compare, and purchase fashion products online. However, traditional text-based search methods are often insufficient for accurately retrieving clothing items, as fashion products are best described by visual attributes such as color, texture, silhouette, and style rather than textual keywords [1], [2]. This limitation has motivated the adoption of AI-powered fashion technologies that enable more intuitive and user-centric shopping experiences for consumers.

One of the most significant advancements in this domain is the image-based search, where users upload or capture an image of apparel or accessories and retrieve visually similar products from online or offline databases. Deep learning models, particularly convolutional neural networks (CNNs), have demonstrated remarkable success in extracting discriminative visual features for these tasks [3]. State-of-the-art architectures such as ResNet, VGG, and Inception have been applied to fashion datasets, achieving high accuracy in product classification, retrieval, and recommendation [4], [5]. When combined with recommendation algorithms, these systems can deliver personalized styling suggestions that adapt to user preferences and current fashion trends [6].

In spite of these advancements, several persistent issues continue to hinder consumers' ability to efficiently locate desired fashion items. Text-based queries often produce irrelevant results, and many e-commerce systems fail to incorporate personalization based on body type, lifestyle, or evolving fashion preferences. Furthermore, existing



platforms typically separate image search and fashion recommendations without offering an integrated system that bridges inspiration (what a consumer desires) and acquisition (what is available for purchase).

To address these limitations, this study introduces Snap Search Shopping with AI Modelling, a novel framework that integrates computer vision and intelligent recommendation engines to create a seamless shopping experience for users.

The proposed system is designed around three key components.

1. **Image-Based Search:** A CNN-powered module that extracts deep visual features from user- provided images and retrieves similar products from a fashion database using similarity matching techniques.
2. **AI Fashion Designer Module:** A recommendation engine that provides complementary outfit suggestions and styling tips by leveraging collaborative filtering, content-based filtering, and trend analysis.
3. **Personalized Shopping Experience:** A hybrid AI modelling approach that combines user profiling, preference learning, and fashion trend forecasting to deliver personalized recommendations in real time.

II. PROBLEM STATEMENT

In the realm of online fashion retail, keyword-based search methods are still widely used; however, they have several drawbacks. Users often find it challenging to convey detailed visual attributes, such as texture, pattern, silhouette, or cut, through text alone, resulting in a disconnect between their intent and search results. For instance, research on Indian traditional textile motifs indicates that keyword-based descriptions are inadequate for conveying subtle visual characteristics, and that manual text annotation processes are both subjective and inefficient. Furthermore, Sanghyuk et al. highlighted issues in Fashion Image Retrieval (FIR), including inconsistencies between user-submitted photos and catalog images, appearance distortions caused by lighting, pose, and viewpoint, and trade-offs between model complexity and performance. These limitations contribute to reduced user satisfaction and lower conversion rates, as many potential purchases are abandoned when consumers struggle to find what they are seeking.

Consequently, there is an urgent need for sophisticated image-based or multimodal fashion search systems capable of processing visual input (e.g., an uploaded photo), integrating it with textual or attribute information, and delivering personalized, accurate results. Existing research, such as "Flexible Fashion Product Retrieval Using Multimodality-Based Deep Learning," shows promise, as employing both image and textual query modalities significantly enhances retrieval accuracy in fashion search tasks.

III. OBJECTIVES OF THE STUDY

This research primarily seeks to present and validate the Snap Search Store, a cutting-edge fashion search platform that employs multimodal AI to transform the way users discover clothing items. The specific objectives are outlined as follows:

Presenting the Snap Search Store Concept Our intention is to develop a comprehensive fashion search ecosystem that merges image-based retrieval with AI-driven design, establishing the Snap Search Store as an innovative framework in the digital fashion sector.

1. Develop Core Functional Modules Image-based Search:

This feature allows users to upload images or snapshots of clothing and find visually similar items in the catalog by extracting deep visual features such as colors, textures, and shapes, and comparing them using metric learning or attention mechanisms. This module is informed by techniques like attentive bilinear networks for determining "where to look" versus "how to describe" in fashion retrieval.

2. AI Designer / Generative Module:

Incorporates generative AI models capable of suggesting new clothing designs or variations based on user preferences, trend data, and retrieved images. For example, research on AI-based garment development systems employs StyleGAN2 and domain expertise to replicate the workflows of designers.



3. Personalized Dress Suggestions:

Integrate historical user behavior, preferences, contextual cues (such as occasion and season), and visual similarity to provide tailored outfit recommendations. Studies have highlighted the significance of embedding compatibility and visual features into fashion recommender systems.

4. Evaluate Effectiveness and Industry Impact:

We measured retrieval accuracy (e.g., Precision@k) and recommendation relevance through user studies and benchmarks, comparing them to existing fashion retrieval systems. Previous research has reported values of 0.774 for image-based retrieval precision in deep learning systems.

User satisfaction, usability, and shopping conversion improvements when using the Snap Search Store compared to traditional search methods were analyzed. Investigate the broader effects on e-commerce and fashion retail, including enhanced consumer experience, reduced search friction, and potential disruption to current catalog-browsing practices. By achieving these objectives, this study aims to demonstrate that the integration of image retrieval, generative design, and personalized suggestions can significantly improve fashion discovery systems, potentially influencing future practices in online fashion retail.

IV. LITERATURE SURVEY

Artificial Intelligence (AI) and Deep Learning have transformed how people interact with fashion e-commerce platforms. One of the major innovations is image-based product retrieval, which allows users to upload or capture photos to find visually similar items online. Early fashion search engines relied heavily on text-based queries, which struggled to describe fine visual attributes such as texture, color tone, or silhouette. With the emergence of Convolutional Neural Networks (CNNs), systems could automatically extract deep visual features from images, achieving far higher accuracy in matching clothing styles and patterns [1].

Yuan and Moghaddam (2020) applied Generative Adversarial Networks (GANs) for garment design, allowing systems to create new apparel concepts automatically [5]. These approaches empower retailers to offer AI-generated clothing variations that match customer preferences and current fashion trends. Grabe et al. (2022) used evolutionary search in latent spaces to generate diverse fashion styles, further bridging creativity and computation [6].

Another key advancement is the integration of AI-based recommendation systems. Shirkhani et al. (2023) studied hybrid recommender systems combining visual similarity with collaborative filtering to personalize suggestions [7]. These hybrid methods help systems understand not just what looks similar, but what users are most likely to purchase. Ding et al. (2023) conducted a survey highlighting that hybrid models, combining deep visual features with behavioral data, achieve the highest relevance and diversity in fashion recommendations [8].

Furthermore, generative AI frameworks such as StyleTrendGAN have been introduced to automatically create stylistic accessories and fashion prototypes [9]. Sciuca et al. (2022) demonstrated how deep generative models can learn visual style trends, providing designers with automated tools to generate new product concepts. The integration of such models into fashion retail platforms has opened new possibilities for rapid product design and virtual try-on systems.

Finally, recent studies have pointed toward personalized AI shopping assistants that combine computer vision, recommendation algorithms, and real-time interaction. Such systems can understand user preferences, analyze current trends, and generate AI-assisted design suggestions instantly [12]. The concept of a “Snap Search Shop with Personal AI Assistant” builds on this line of work—merging visual search, generative design, and recommendation intelligence into one seamless fashion discovery framework.

V. METHODOLOGY

The methodology for the proposed Snap Search Store system is crafted to seamlessly integrate computer vision techniques, generative artificial intelligence models, and recommendation algorithms, thereby offering an intelligent



fashion search and personalized shopping experience. This approach is structured into four main modules: System Architecture, Image Recognition and Search Algorithm, AI Designer Module, and Recommendation Engine.

5.1 System Architecture

The Snap Search Store's architecture is based on a modular, client-server design, facilitating efficient interaction between users and the back-end computational modules.

Client Layer: The front-end interface allows users to upload clothing images or input textual queries, which are then sent to the back-end for processing.

Processing Layer: This layer comprises three integrated modules: the Image Recognition Module, which extracts key attributes from user inputs; the AI Designer Module, which generates new fashion designs based on these extracted features; and the Recommendation Engine, which personalizes suggestions for users.

Data Layer: A structured database stores fashion images, metadata (attributes such as color, fabric, and style), and user preference history. The data flow begins with image acquisition and preprocessing, moves through feature extraction and similarity matching, and culminates in design generation and recommendation delivery. This modular architecture ensures scalability, real-time performance, and adaptability to new datasets and design parameters.

5.2 Image Recognition and Search Algorithm

The Image Recognition Module is tasked with extracting meaningful information from input images, enabling the efficient retrieval of similar items. Noise reduction is utilized to remove artifacts, while background removal is accomplished through segmentation techniques like Mask R-CNN. Normalization adjusts pixel intensity to account for varying lighting conditions. Feature extraction employs Deep Convolutional Neural Networks (CNNs) to identify high-level features, such as texture, shape, and color distribution. These feature embeddings are represented as multidimensional vector spaces for further comparison. Similarity matching involves comparing the extracted embeddings with the database using metrics such as cosine similarity and Euclidean distance. For large-scale databases, efficient indexing methods, such as KD-Trees and Approximate Nearest Neighbor (ANN) search, are used to reduce the computation time. Search optimization and ranking were achieved by ranking the retrieved results using a hybrid model that combined visual similarity scores, trend relevance, and inventory availability. The system also incorporates feedback loops that promote frequently selected items in subsequent searches.

5.3 AI Designer Module

The AI Designer Module enhances the system by introducing a novel fashion design generation method using generative artificial intelligence. The generative model uses Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs) to create new fashion designs that are both realistic and creative. The generator produces clothing prototypes, and the discriminator evaluates their quality and realism. Training data and design parameters involve training models on a curated dataset of fashion images annotated with attributes such as garment type, fabric, color, and seasonal category. The design parameters included style constraints (e.g., neckline type and sleeve length) and user preferences, ensuring that the generated designs remained practical and relevant. Design generation and iteration involve creating multiple prototypes for each query, which are iteratively refined based on feedback and style evaluation metrics. This iterative refinement enables the production of unique, trend-aligned fashion items that balance creativity and usability.



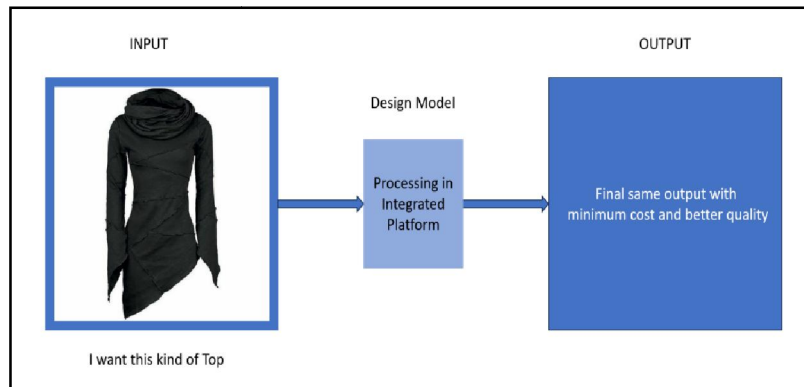


Fig : Module 1



Fig : Module 2

5.4. Recommendation Engine

The recommendation engine delivers personalized and context-aware suggestions, thereby enhancing user engagement and shopping satisfaction. The algorithmic framework adopts a hybrid recommendation approach: content-based filtering matches items with attributes similar to user preferences, whereas collaborative filtering leverages similarities among users and historical behavior to predict relevant items. This hybrid approach balances the accuracy and diversity of the recommendations. User profiling and preference learning involve dynamically updating user profiles using explicit feedback such as ratings, likes, and comments, as well as implicit behavior such as browsing patterns, time spent on items, and purchase history. Machine learning models continuously learn from these profiles to adapt to evolving fashion preferences. Contextual recommendations and suggestions go beyond standard item recommendations by providing complementary fashion advice, including matching accessories and related clothing items, highlighting seasonal trends and emerging styles, and generating personalized stylistic comments. This enhances the shopping experience by transforming the system into an AI fashion assistant rather than just a search tool.

VI. EXPECTED RESULTS

The Snap Search Store system is expected to significantly improve the online fashion experience by integrating advanced image recognition, AI-driven design generation, and personalized recommendations. The image recognition module will allow users to find fashion items efficiently using only images, providing a more intuitive alternative to traditional keyword-based searches. Simultaneously, the AI Designer Module is anticipated to generate innovative and



realistic clothing prototypes, enabling users to explore new styles and offering designers a tool for rapid ideation and trend experimentation. The recommendation engine will enhance personalization by combining user preferences, historical behavior, and contextual data to deliver adaptive and relevant suggestions, increasing engagement and satisfaction. Collectively, these features are projected to not only streamline the shopping process but also support fashion brands and e-commerce platforms in improving customer retention, optimizing product offerings, and fostering data-driven design strategies. By bridging the gap between consumer input and AI-driven creativity, the system aims to make fashion discovery more interactive, personalized, and accessible on a global scale.

VII. CONCLUSION

The Snap Search Store system demonstrates the potential of combining image recognition, AI-generated design, and personalized recommendations to enhance the fashion shopping experience. The study indicates that image-based search can simplify product discovery, while the AI Designer Module can produce creative and realistic clothing prototypes, providing both users and designers with enhanced design capabilities. The recommendation engine further enhances personalization by adapting to user preferences and behavioral patterns, ensuring that suggestions remain relevant and engaging. Collectively, the system meets its objectives of delivering an intelligent, interactive, and user-centric platform.

The approach also has practical implications for the fashion industry, including improved customer engagement, optimized product offerings, and accelerated design-to-market cycles for brands. Nonetheless, limitations such as dependency on high-quality training datasets, computational demands of deep learning models, and the need for more advanced user feedback mechanisms remain. Future work will focus on addressing these challenges through the use of larger and more diverse datasets, represents a step forward in merging AI innovation with practical applications in fashion technology, enabling personalized, efficient, and engaging online shopping experiences

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