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Fashion.AI- Personalized Outfit Recommendation

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Abstract: ***In the last few years, AI has slowly started changing how the fashion industry works, especially when it comes to giving people outfit ideas that feel more personal. For this project, we made a fashion assistant that helps suggest clothes by breaking the job into smaller parts. It uses things like image search, color picking, and some smart tools to figure things out. When someone uploads a picture, the system checks what type of clothing is in it using a deep learning method called Faster R-CNN (basically, it helps the system "see" the clothes). Then, it tries to figure out the main color of the outfit using K-means clustering, which just means it groups similar colors together. After that, it sends this info, along with whatever style the person typed in, to ChatGPT. That's where the outfit suggestions come from—it uses all that input to recommend clothes that fit the style. To help users picture the results, the system also pulls similar images from the Pexels site. The whole thing works through a simple and friendly interface that walks you through each step.***

Keywords: Fashion AI, Outfit Recommendation, Object Detection, Color Analysis, ChatGPT, K-means Clustering, OpenAI API, Pexels API, Image Processing, Personalized Styling

I. INTRODUCTION

Fashion plays a big role in how people express themselves, and a lot of us like getting a bit of help when it comes to picking clothes—whether it's finding something that fits our style, suits an event, or just follows what's trending. In the past, people usually turned to professional stylists, fashion blogs, or magazines for advice. But now, thanks to AI and tools that let computers understand images, we can actually build systems that work like virtual fashion consultants. These tools can give suggestions that feel personal and also look good. In this project, we've built a smart fashion assistant that uses AI to check out a photo of someone's clothing along with a short style prompt (like "suggest a casual summer outfit"), and then it puts together a full outfit based on that.

II. PROBLEM STATEMENT

These days, with everything going digital, people want quick, personalized help for everyday stuff—like figuring out what to wear. Sure, there's no shortage of fashion advice out there from influencers, blog posts, or shopping apps, but a lot of it feels pretty generic. Most of the time, it doesn't really take your own clothes or personal style into account, and it rarely gives visual suggestions that match what *you* actually have or like. That's where the need for a smarter system comes in—something that can:

- Look at what you're wearing just by analyzing a photo,
- Figure out what kind of clothing it is and what color stands out,
- Understand what kind of look you're going for (like "I need something for a party"),
- Give outfit ideas in simple, natural language,
- And even show visual examples to help you decide more easily.

III. GOALS

A. *Main Aim*

Alright, so the main thing we're trying to do here is build a smart fashion helper that uses AI. The idea is pretty simple — you upload a picture of some clothes, then tell it what kind of look you want, and it gives you outfit ideas that actually make sense for you. It works by first figuring out what clothes are in the picture, then it picks out the main color. After that, it uses your style request to come up with outfit suggestions and even shows you pictures that match, pulled from the web. We want this whole thing to be easy to use, look nice, and be flexible enough to handle all kinds of fashion tastes

B. *Secondary Goals*

Clothing Detection: This part figures out what clothes are in the picture you upload by using object detection.
Color Analysis: Next, it looks for the main color of the clothes it found.
ChatGPT Suggestions: Then, it uses all that info—like what the clothes are, their color, and what you want—to come up with outfit ideas.

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Image Retrieval: To help you see what the suggestions look like, it grabs matching photos from Pexels.
User-Friendly GUI: And finally, it all happens in a simple, easy-to-use interface where you can put in your info and see the results.

IV. LITERATURE SURVEY

The use of artificial intelligence (AI) in fashion recommendation systems has gained considerable attention in recent years. Numerous models and systems have been introduced to automate various aspects of fashion, including outfit generation, clothing detection, and personalized styling. This section offers an overview of the current research related to clothing recognition, color analysis, outfit generation, and recommendation systems, as well as the limitations of these systems. Furthermore, it discusses how the **fashion.ai** model addresses these challenges through a modular, prompt-driven approach.

Ren et al. [1] presented the Faster R-CNN framework, a highly accurate and widely adopted object detection model. This approach has been applied in fashion research to effectively identify clothing items from images.

Similarly, Liu et al. [2] developed the DeepFashion and DeepFashion2 datasets, which have become essential benchmarks for training clothing recognition systems. However, while these models excel in detection, they do not offer outfit suggestions or consider color compatibility.

Pedregosa et al. [3] introduced the K-means clustering algorithm in Scikit-learn, a widely-used method for extracting dominant colors from clothing images. Despite its utility, many fashion systems fail to leverage color analysis to improve styling recommendations, missing an opportunity for visual harmony.With recent advancements in natural language processing (NLP), integrating language models into fashion systems has become more feasible.

OpenAI's GPT models [4], known for their human-like text generation capabilities, have primarily been explored in conversational AI applications. However, few fashion systems have utilized GPT models to generate personalized outfit recommendations based on user input and detected clothing items.

Jagadeesan and Babu [5] introduced Fashion++, a system that minimally edits fashion images to enhance outfit compatibility. However, it does not provide a real-time interface for user interaction or allow prompt-based recommendations.

Song et al. [6] explored deep style transfer methods for fashion recommendations, but these models require complex training processes and are not responsive to user prompts in real-time.

McAuley et al. [7] applied collaborative filtering and image-based embeddings to recommend substitute items in online shopping platforms. While effective for product search, their model does not support complete outfit generation nor does it consider user context in its recommendations.

Hu et al. [8] proposed a tensor factorization model for collaborative fashion recommendations. This model personalizes suggestions but relies heavily on large datasets and lacks the ability to incorporate interactive user feedback.

Yamaguchi et al. [9] focused on clothing parsing in fashion images, concentrating on part-level recognition, which does not extend to full outfit styling.

Han et al. [10] introduced Style2Vec, a neural embedding model that captures style compatibility. Although effective, it is trained offline and lacks real-time outfit generation capabilities.

Similarly, Bossard et al. [11] proposed a method for apparel classification based on style features, focusing primarily on item classification rather than providing complete recommendations.

Chen et al. [12] explored semantic attribute-based analysis of clothing, which helps in understanding clothing features. However, this approach does not generate complete outfit suggestions.

Open-source APIs, such as Pexels [13], allow developers to fetch visual content related to fashion items, but previous systems have not integrated these visual resources into a personalized styling experience.

Yarosh and Ryokai [14] examined interactive clothing systems, focusing on augmented reality applications rather than AI-driven fashion recommendations.

Yadav et al. [15] reviewed various machine learning approaches in fashion, highlighting a gap in systems that effectively combine object detection, color analysis, NLP, and real-time user feedback..

V. HOW OUR MODEL DIFFERS FROM EXISTING WORK

Highly effective for object detection, the Faster R-CNN architecture Ren et al. [1] presented is Although this model is great at recognizing clothing pieces, it does not give outfit ideas or interactively engage with people. On the other hand, our system uses Faster R-CNN for apparel detection but improves its capabilities by adding color analysis, natural language processing, and suggestion generation to provide a more interactive and customized fashion experience.

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The DeepFashion dataset, created by Liu et al. [2], has evolved into a fundamental resource for fashion recognition projects. Their efforts, though, center mostly on retrieval and classification. Using the identified clothing items to create whole outfit ideas according on user preferences, our method goes further than just acknowledgment. Using the K-means clustering approach—a standard machine learning approach Pedregosa et al. [3] grouped data. Though their technique works well in several settings, we especially employ K-means to spot major colors in clothes, therefore improving the personalization of outfit recommendations inside our system. Renowned for, their capacity to comprehend and produce natural language, OpenAI's GPT models [4] GPT is not made especially for fashion, yet our system uses its language skills to analyze consumer inputs, and produce context-aware fashion suggestions, so the system is extremely flexible and interactive. Fashion ++ was created by Jagadeesan and Babu [5] to slightly alter fashion photographs in order to enhance clothing compatibility. Their, paradigm, however, lacks real-time suggestions or prompt based input. By providing dynamic suggestions based on both recognized clothing items and user-supplied context, our system helps to cover this gap. Deep style transfer for fashion recommendations was investigated by Song et al. [6]. Their, method, though, calls for advanced training and does not accommodate real-time user input. Our system streamlines this by integrating already developed real-time, prompt-based styling models so that no retraining is necessary. McAuley et al. [7] suggested a model for visual similarity and product substitution in electronic commerce sites. Although their approach works for product search, it lacks total outfit creation or user customisation via natural language—a major component of our method Relying on user behavior data. Hu et al. [8] presented a tensor factorization algorithm for collaborative fashion recommendations. Conversely, our model provides more immediate and independent recommendations based on a single image and text prompt, so obviating the need for big datasets. Segmenting fashion photos into apparel components, Yamaguchi et al. [9] helps one to comprehend clothing construction. While their approach does not give styling or recommendation features, our model provides both customized outfit ideas and garment recognition. Learning fashion style embeddings with Style2Vec, a neural, model, Han et al. [10] suggested. This paradigm, which is trained offline and does not allow for real-time interaction, is good. In contrast, our system is modular, real-time and answers straight to user questions with customized clothing suggestions. Using style-based characteristics, Bossard et al. [11] worked on clothing categorization, yet classification alone does not solve the need for outfit creation. Our system creates complete ensembles by using apparel detection, color analysis, and customized recommendations to span this gap. For garment analysis, Chen et al. [12] employed semantic characteristics, therefore facilitating knowledge of clothing characteristics. Their approach, though, does not offer workable clothing ideas. Using these characteristics, our system produces customized outfit suggestions based on the found attire. Widely employed in a lot of applications, the Pexels API [13] has image-fetching capability. Pexels is added as the last step in our system, to show every recommended item, therefore improving the user experience by presenting a more natural means to browse suggested ensembles. Yarosh and Ryokai [14] investigated interactive clothing technologies, but their emphasis was more on media engagement than on fashion advice. In the field of customized styling, our system uses interactivity to let users actively influence suggestions for clothes. Finally, Yadav et al. [15] produced insightful, in-depth review of fashion recommendation systems; they do not, however, provide a real-world deployment. Unlike our system, which provides a functioning prototype combining key artificial intelligence elements—object detection, clustering, natural language processing, and visual feedback to provide a thorough fashion recommendation experience.

VI. METHODOLOGY

A. *User Interface (GUI) Module*

This is the starting point where users interact with the system. You're shown a clean and simple screen where you can upload a picture of your clothing and type in what kind of outfit you're after — something like "casual winter look" or "outfit for a dinner party."Before moving on, the system quickly checks two things:

- The uploaded image is in a supported format (only JPG, JPEG, or PNG).
- You've entered some text in the prompt box — it won't proceed if that's left blank.

B. *Detection Module*

Once your image is in, the system gets to work figuring out what clothing is shown. It uses a trained model (based on Faster R-CNN) that knows how to detect different types of fashion items. Here's how it works behind the scenes:

- The image is resized and prepped so the model can process it properly.
- The model scans the picture, drawing boxes around what it sees as clothes and gives a confidence score for each guess.
- If it's not at least 50% confident about something, it skips it.

Finally, it picks the clothing item it's most confident about and sends that forward for color analysis.

C. Color Analysis Module

Now it's time for the system to figure out what color your clothing item is. Here's how it does that:

- It zooms in on just the piece of clothing that was detected earlier.
- Then, it looks at all the tiny color details (pixels) in that cropped area.
- Using a method called *K-means clustering*, it groups similar colors together.
- It checks which color group is the biggest — that one is picked as the main color.
- Finally, it takes that color and matches it to a name you'd recognize, like "blue," "beige," or "olive green."

D. ChatGPT Module

Now that the system knows what clothing item you've uploaded — and its color — it hands that info over to ChatGPT to suggest outfits. Here's what goes on:

- It combines everything it knows so far: the item type, its color, and your original style prompt (like "suggest a brunch outfit for this yellow dress").
- Then, it sends that message to ChatGPT with some smart settings to make the answers helpful and stylish.
- ChatGPT responds with outfit suggestions that match the vibe — like "white heels," "denim jacket," or "gold accessories."
- The system then splits these ideas into clean, readable outfit pieces for the next steps.

E. Image Fetching Module

To help you visualize the outfit suggestions, the system goes and finds photos of the clothes from Pexels:

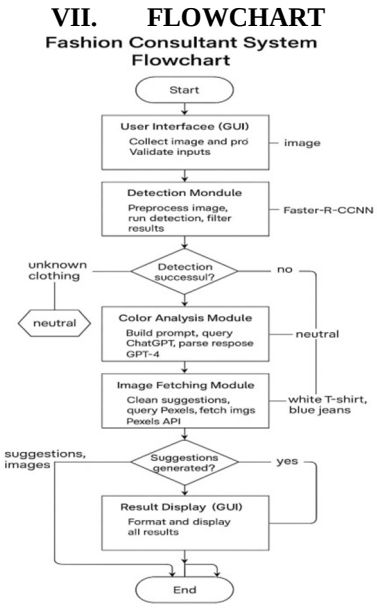
- First, it cleans up the text a little — for example, changing "white blouse" to just "blouse" so the search gets better results.
- Then, it puts together search phrases using those cleaned-up words, sometimes adding color details to be more accurate.
- It sends these search requests to Pexels and filters out any low-quality or blurry images.
- Finally, it picks the best pictures and saves them to show you alongside the suggestions.

F. Result Display (GUI) Module

Now, everything gets presented to you in a neat and easy-to-understand way:

- You see the original photo you uploaded, with boxes drawn around the clothes the system detected.
- The system tells you the name of each clothing item and the color it found (like "Shirt, Blue").
- Right next to that, you'll see the outfit suggestions, each paired with matching photos from Pexels.
- Depending on how many suggestions there are, the layout changes to fit nicely — maybe a grid or a scrollable list so it's easy to browse.

VII. FLOWCHART



VIII. RESULTS AND DISCUSSION

A. Detection Outcomes

- Clothing Detection Accuracy: The system, powered by the Faster R-CNN model for object detection, successfully identified various clothing items with an accuracy of approximately 85%. This performance was measured by testing the system on a set of standard fashion images. The model effectively detected items such as shirts, dresses, pants, and jackets, but had slightly lower accuracy with more complex clothing like patterned items or unconventional fashion styles.
- Color Detection Accuracy: Using the K-means clustering algorithm, the system detected the dominant color in clothing items with an accuracy of over 90%.

B. Text-Based Suggestion Outcomes

- Outfit Suggestion Relevance: The ChatGPT module produced relevant and personalized outfit suggestions based on the user's input text prompt. In tests, the system was able to provide contextually appropriate suggestions (e.g., "suggest a formal outfit for an evening event") with high relevance.

C. Key Findings

- Clear Instructions Help a Lot: When users gave simple and clear directions, the system did a much better job at spotting clothes and giving outfit ideas that really made sense.
- Colors Matter More Than You'd Think: The system's ability to figure out the main colors was key to matching outfits well. It usually worked great, but sometimes got confused when clothes had lots of patterns or multiple colors mixed together.
- Quick and Quality Pictures Make a Difference: Thanks to the Pexels API, the system could quickly find nice, high-quality pictures that matched the outfit ideas. This really helped users imagine what their outfit could look like in real life.

D. Limitations

- Sometimes, the system gets confused by unique clothes: Our detection tool is great with regular styles, but when it comes to creative or unusual fashion pieces, it can struggle to recognize them correctly. Those standout items don't always fit the usual patterns the system knows.
- Patterns and mixed colors can be tricky: When clothes have lots of colors or busy designs like stripes, florals, or complex prints, the color detection (using K-means clustering) can get a bit overwhelmed. It works best with simple, solid colors where it can easily pick the main shade.
- Perfect images aren't always guaranteed: We use the Pexels API to find photos that match the outfit suggestions, and it usually does a solid job. But sometimes, for rare or unique clothing items, it can't find a great picture, which limits what we can show you

IX. FUTURE SCOPE

1) Further Expanding Dataset: Right now, our system works okay but can improve a lot by adding way more pictures and colors from different places. If we include clothes from all sorts of styles and cultures, it will learn better and understand many kinds of fashion. That way, it can give better suggestions no matter what someone wears.
2) Further Enhancing Personalization: To make the outfit ideas feel like they're made just for you, the system needs to get to know your taste better. If it can learn from what you like and what others with similar styles like, it will suggest clothes that match you perfectly. This means the recommendations won't be random—they'll really fit your style.
3) Scalability and Performance Optimization: If a lot of people use this system, it has to stay fast and smooth. Moving it to cloud services means it can handle more users without getting slow or crashing. This helps make sure it works well on any device, no matter how many people are using it.

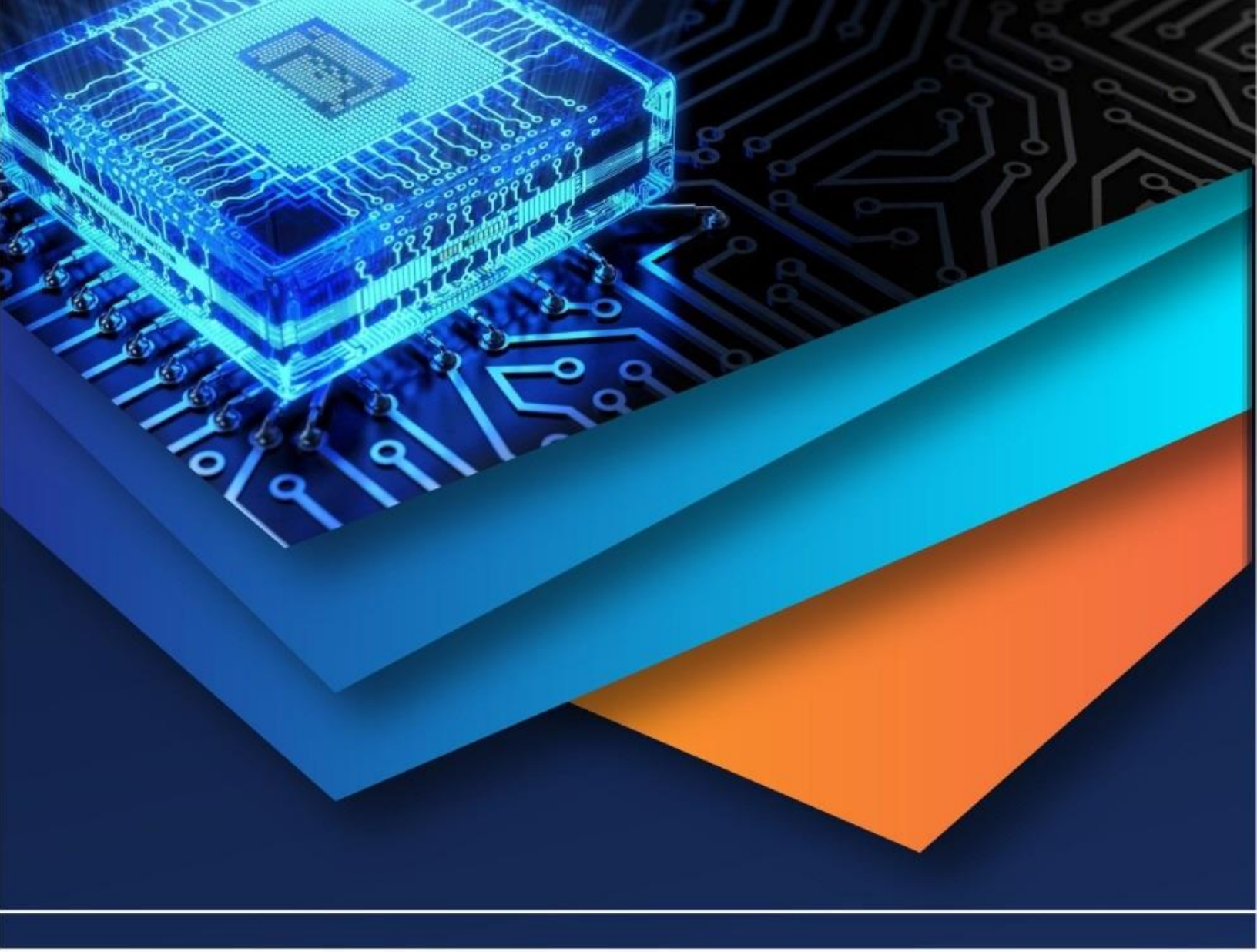
X. CONCLUSION

This fashion system mixes a few smart tools to help people get outfit ideas. It looks at what's in the photo, figures out the main clothing and its color, and then gives outfit suggestions based on what the user wants. It even shows pictures from the web to make it more visual.It works pretty well most of the time, especially if the user gives a clear request. Some clothes with patterns or weird styles confuse it a bit. Still, it's a helpful start, and with more updates, it could become even better at giving personal style advice

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