StyleThread - A style quiz app

Design Document

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1. Introduction

This project explores the design and implementation of a personalized fashion recommendation system using a hybrid approach that combines quiz-based preference elicitation, style DNA modeling, and LLM-powered interpretation.

The goal is to provide a fashion discovery experience where the system learns their style preferences. Over time, the system continuously refines its understanding and surfaces increasingly relevant recommendations.

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2. Assumptions

- **User Preferences Can Be Learned Through Choices:** Liking/disliking a small curated set of outfits is a good proxy for uncovering deeper style attributes (Set gets updated over time.)
- **User Psychology and Clothing Design:** Clothing design depends heavily on fabrics and patterns, as these define possible styles. This makes users prioritize patterns and fabrics in their fashion choices; the system models preferences with higher weightage on these attributes.
- **Attributes are Latent Signals of Style:** Every clothing item can be broken into attributes (fabric, fit, occasion, color, etc.), which collectively represent a “Style DNA”.
- **LLMs Can Act as Stylists:** Large Language Models (LLMs) like Gemini can map raw clothing attributes into human-understandable categories and generate summaries of user preferences.
- **Continuous Feedback is Valuable:** Users’ swipes on recommendations can feed back into the system for ongoing learning, not just one-time preference capture.

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3. Scope of Work

- **Initial Preference Capture**: Present 20 randomized outfit cards; record user swipes.
- **Style DNA Construction**:
    - Parse raw attributes from clothing dataset.
    - Categorize attributes into fashion-relevant categories.
    - Build weighted vectors (Style DNA) for liked vs. disliked features.
- **LLM Integration**:
    - Use Gemini API to classify tokens into categories.
    - Summarize preferences into natural-language insights and archetype spectrum.
- **Recommendation Engine**: Score dataset items against liked preferences and Style DNA; recommend top-ranked items excluding previously swiped outfits.
- **Continuous Learning**: After the quiz, recommendations adapt dynamically based on ongoing swipes with reasoning fetched from the llm.
- **Frontend Experience**: Tinder-style swipe deck using react-native-deck-swiper for quiz and recommendation phases.

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4. Problem-Solving & Decision-Making Approach

4.1 Key Challenges

- **Cold Start Problem**: How to learn user style quickly without overwhelming them.
- **Attribute Mapping**: Raw dataset fields were noisy and inconsistent.
- **Model Choice**: Balance between accuracy, cost, and feasibility (since paid APIs were restrictive).
- **Continuous Adaptation**: Ensure recommendations don't stagnate after initial quiz.
- **Explainability over Accuray**

4.2 Decisions Taken

- **Deck-based Quiz**: Chosen for its intuitive UX; users swipe left/right instead of traditional button clicks
- **Style DNA Representation**: Weighted attribute maps, inspired by TF-IDF scoring, balancing positive and negative weights.
- **LLM Role**: Used for categorization (mapping raw tokens to clean categories) and interpretation (natural-language style summaries).
- **API Choice**:
    - Initially evaluated Gemini, Claude, Perplexity, Llama.
    - Settled on Gemini (when quota allowed) for structured JSON outputs and style interpretation.
- **Frontend**: React Native + Expo for portability across iOS simulator and devices.

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5. Recommendation System Design

5.1 Data Flow

1. **User Quiz**
    - User swipes on 20 outfits.
    - Preferences sent to backend via /preferences.
2. **Backend Processing**
    - Parse attributes → clean tokens.
    - LLM categorizes tokens into weighted fashion categories.
    - Build Style DNA: a weighted map of liked vs. disliked attributes.
    - Generate summary + archetype spectrum via LLM.
3. **Recommendations**
    - /recommendations endpoint computes similarity score for each outfit in dataset
    - Sort descending; exclude already seen items.
    - Return top N recommendations.
4. **Continuous Learning**
    - As users swipe on new recommendations, preferences + Style DNA update.
    - Recommendations loop continues.

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6. Experiments

- **Initial Dataset Sampling**: Random vs. clustered sampling of quiz outfits.
- **LLM Categorization**: Compared Gemini vs. manual regex mappings; Gemini produced cleaner taxonomy.
- **Frontend Behavior**: Tested different deck sizes (10, 20, 30); 20 provided best balance of user engagement and style coverage.
- **Continuous Learning**: Verified that recommendations shift noticeably after user swipes (e.g., more casualwear after rejecting multiple formal outfits).

7. Future Improvements

- **Better Embedding Models**: Replace token matching with semantic embeddings (e.g., OpenAI, HuggingFace, or fashion-specific embeddings).
- **Robust Agentic AI Solution**: Move beyond simple request-response LLM calls toward agentic pipelines where the AI autonomously manages categorization, retraining, and recommendation orchestration.

- **Image Understanding**: Use vision models (e.g., CLIP) to directly analyze outfit photos instead of relying solely on metadata.
- **Cold Start Optimization**: Instead of random quiz, cluster-based quiz (representative items from diverse style groups).
- **Scalability**: Deploy backend with caching and vector databases (like Pinecone/Weaviate) for fast recommendation retrieval.

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8. Additional Notes

- **Innovation Highlight**: Prioritized explainability over raw accuracy; fashion recommendations follow human taste and psychology (e.g., fabric, patterns) and classify users into archetypes for a personal touch.
- **Technical Stack**:
    - **Frontend**: React Native (Expo) with swipe-based UI.
    - **Backend**: Node.js, Express, Gemini API, JSON dataset.
    - **LLM Role**: A fashion psychologist
- **Resilience**: Built fallback paths for when LLM quota is exceeded (basic scoring without LLM categorization).

Screenshots from the app

5:24

StyleThread

Swipe right to like, left to dislike

ZOLA Women Maroon Ethnic Motifs Embroidered Chikankari Kurta

5:25

StyleThread

Recommended Outfits For You

Your Style Archetype

You are more into Desi, Bohemian, Chic styles!

OK

(Recommendations get printed in the console)