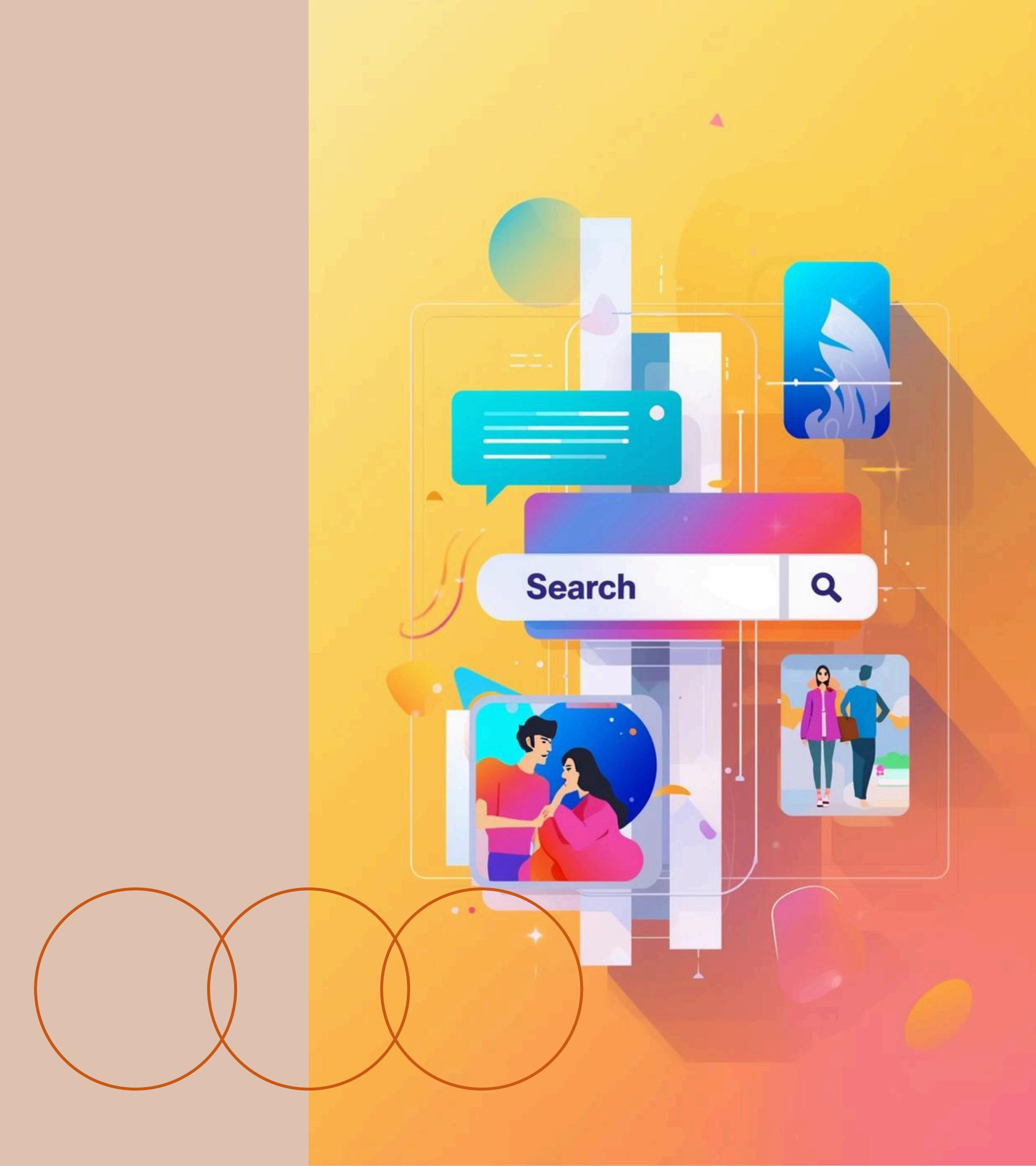


VECTORSEARCH

Multi-Modal Search Engine

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ITAI 1378 - COMPUTER VISION



Executive Summary

Bridging the "Vocabulary Gap" in E-Commerce Search

The Problem: Traditional keyword search fails when users can't describe visually complex items (e.g., specific patterns or styles).

The Solution: VectorSearch Pro, a multi-modal search engine that understands both text and images.

Technology Stack:

OpenAI CLIP: Converts images/text into a shared vector space.

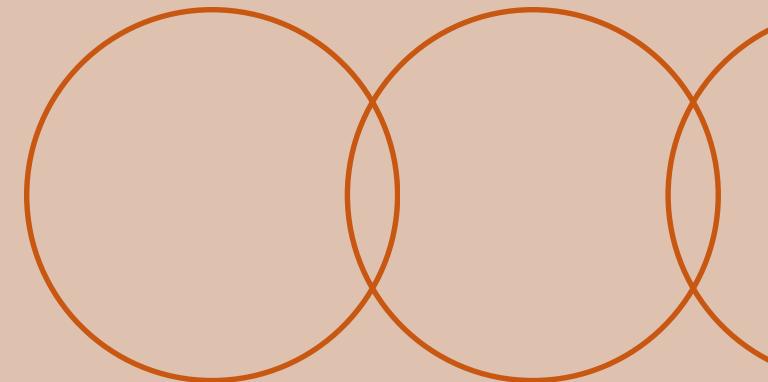
FAISS: Enables sub-millisecond similarity search.

Key Achievements:

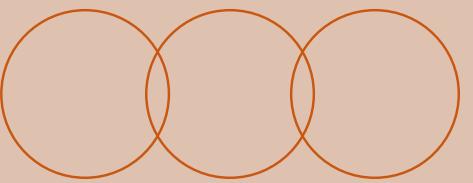
Scale: Indexed ~44,000 fashion items.

Performance: Achieved <0.3s latency (Goal: <1.0s).

Capabilities: Validated robust Text-to-Image and Image-to-Image retrieval.



Problem Statement



Addressing E-Commerce Challenges

Vocabulary Gap

The **vocabulary gap** arises when users input terms like "formal shirt" while metadata might list it as "button-down oxford," leading to irrelevant search results and user frustration.

Visual Feature Description

Complex visual features are often challenging to describe accurately with text alone, which limits user ability to find products that meet their aesthetic needs and expectations effectively.

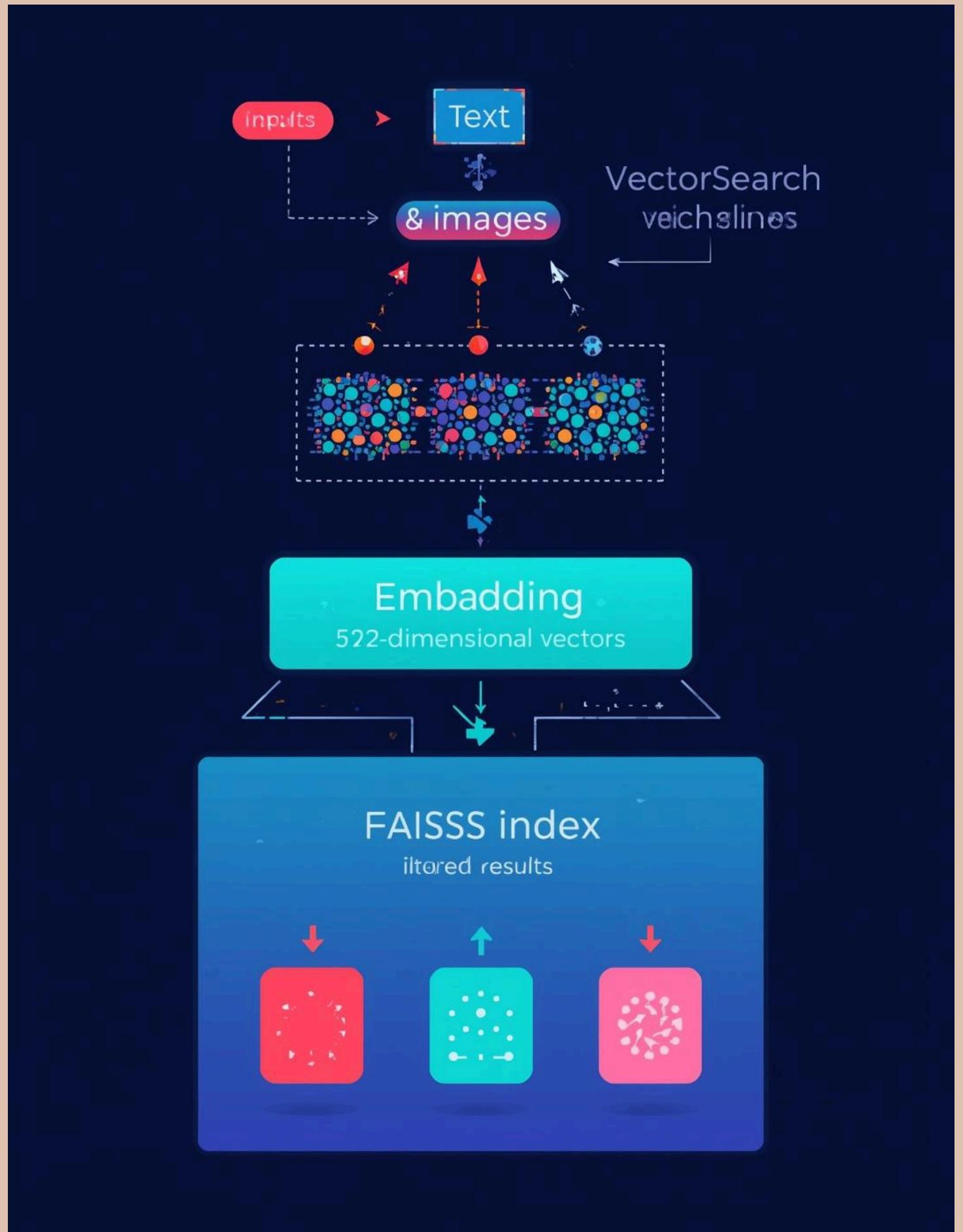
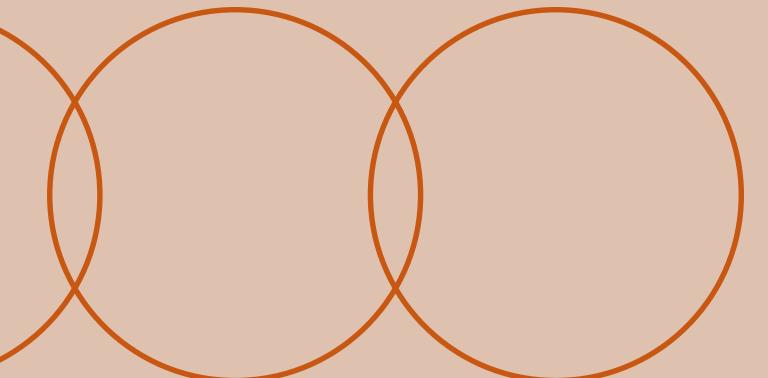
Image Queries

Supporting image queries allows users to leverage inspiration from social media photos, enhancing the search experience by tapping into visual context and enabling semantic understanding of products.

Architecture Overview

Understanding System Design

VectorSearch employs a **retrieve-and-rank pipeline** for effective search. It utilizes OpenAI's CLIP model for embedding, followed by FAISS for efficient indexing and retrieval.



Data Source and Preparation

Overview of Fashion Product Dataset

The dataset consists of over **44,400 fashion images**, meticulously linked to metadata for accurate categorization. This extensive collection enables enhanced search capabilities by providing diverse visual representations across numerous categories.

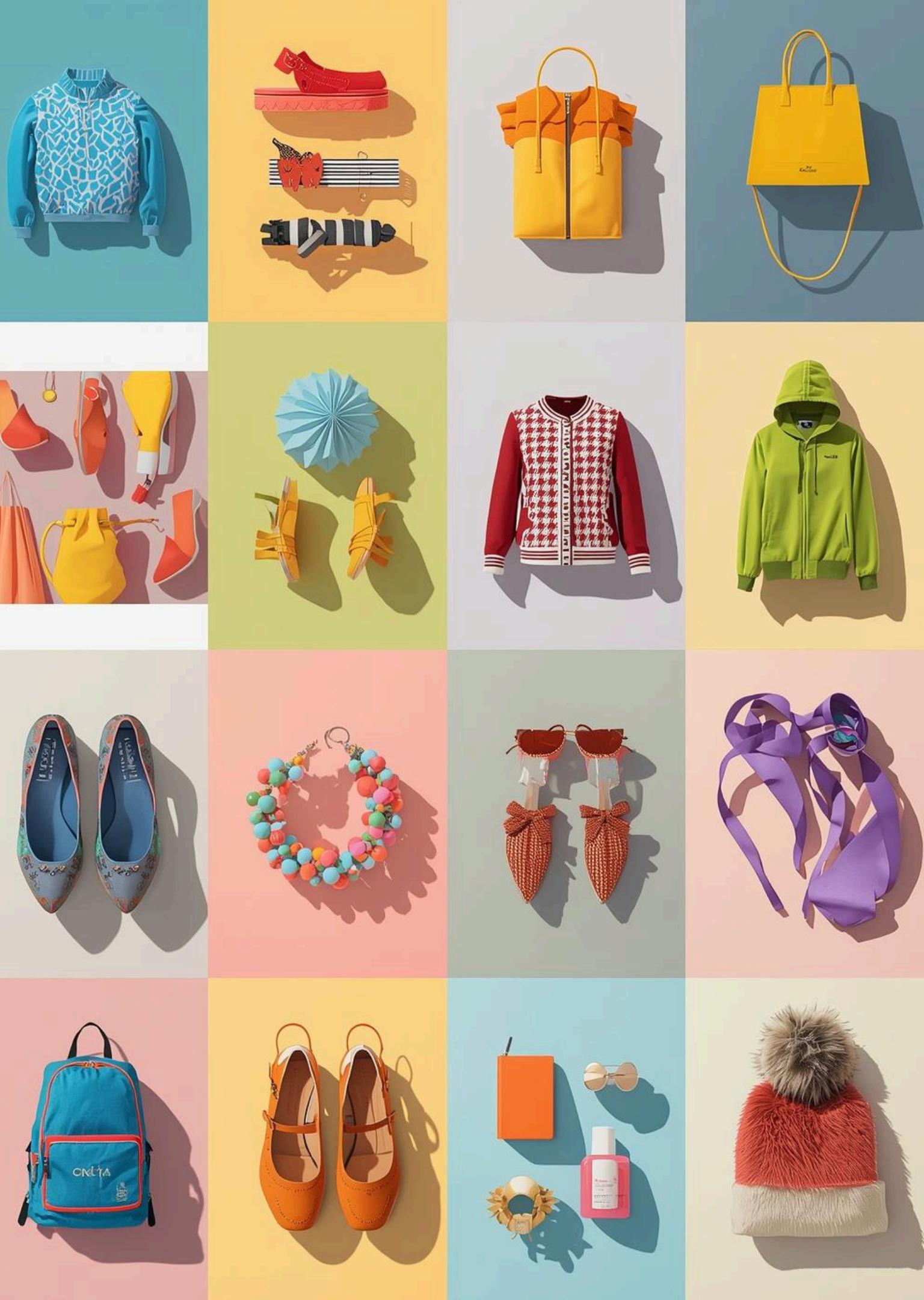


Image-to-Image Search

The screenshot displays the VectorSearch Pro: Tier 2.5 Demo interface, which consists of three main sections: 1. Search Query, 2. Filters, and 3. Results.

- 1. Search Query:** A text input field labeled "Text Query" contains the word "red". Below it is a preview image of a gold-toned luxury watch with a dark dial, resting on green foliage. A "Save Query" button is visible above the preview.
- 2. Filters:** A "Category Filter" dropdown is set to "All". A "Search" button is located below the filter. A "Query Latency" indicator shows "0.2871 seconds".
- 3. Results:** A grid of four watch images, each with a caption and a match score:
 - The top-left result is a "Casio Men Black Dial Watch ED339 (Accessories) Match: 0.76".
 - The top-right result is a "Titan Men Chronograph Black Dial Watch (Accessories) Match: 0.76".
 - The bottom-left result is a "Casio Men Black Dial Watch ED339 (Accessories) Match: 0.76".
 - The bottom-right result is a "Titan Men Chronograph Black Dial Watch (Accessories) Match: 0.76".

Luxury Watch Retrieval

This system retrieves visually similar watches, ensuring high relevance and speed.

Text-to-Image Search: "Red"

The screenshot shows the VectorSearch Pro: Tier 2.5 Demo interface. On the left, under '1. Search Query', a 'Text Query' input field contains the word 'red'. Below it, an 'Image Query' section has a placeholder 'Drop Image Here - or - Click to Upload'. Under '2. Filters', a 'Category Filter' dropdown is set to 'All'. A central search bar contains the word 'Search'. At the bottom, 'Query Latency' is listed as '0.1166 seconds'. On the right, under '3. Results', a 'Top Matches' section displays two blurred images: one of a red heart and another of a red tie.

Semantic Color Understanding

The system effectively retrieves items based on the color **red** across categories.

Text-to-Image Search: Scenario C

The screenshot shows the VectorSearch Pro: Tier 2.5 Demo interface. The left side has a 'Search Query' section with a 'Text Query' input containing 'blue' and an 'Image Query' section with a placeholder for dropping or uploading an image. Below it is a 'Filters' section with a 'Category Filter' set to 'Personal Care'. A central search bar contains the word 'Search' and a 'Query Latency' indicator showing '0.0630 seconds'. The right side displays the 'Results' section under 'Top Matches', showing two images of blue perfume bottles with the caption 'Rising Wave Men Perfume (Personal Care) Match: 0.25' repeated for each.

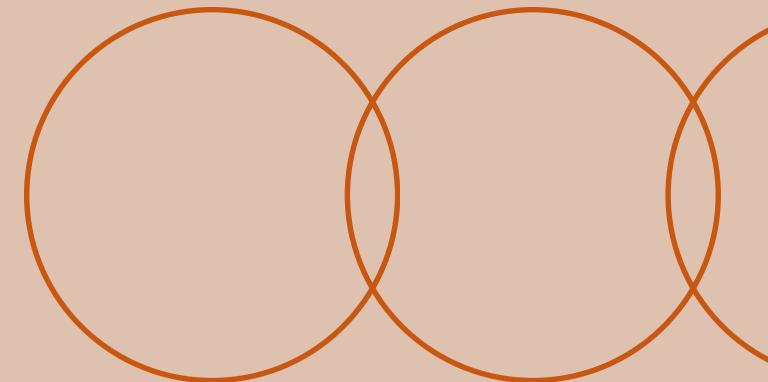
Filtered Blue Bottle Perfume

The system efficiently retrieved a stunning blue perfume bottle based on input.

Key Insights Recap

Summary of VectorSearch Achievements

VectorSearch Pro effectively addresses the vocabulary and visual nuance gaps in e-commerce search, delivering fast retrieval through innovative AI solutions and enhancing user experience across platforms.

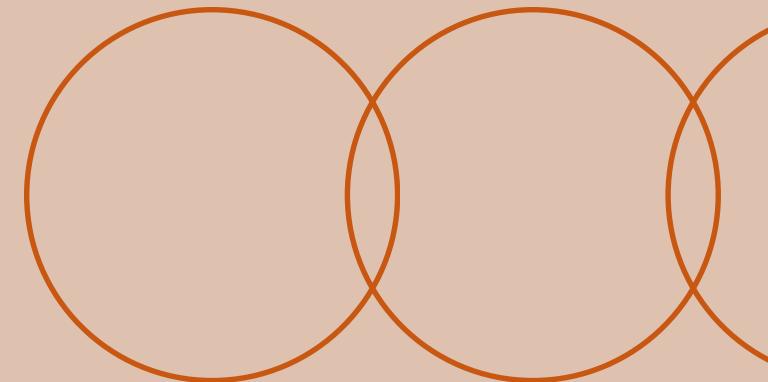


Future Enhancements for VectorSearch

Expanding capabilities and reach

Hybrid Search: Combine keyword matching with vector search for higher precision.

Fine-Tuning: Retrain CLIP on fashion-specific data to understand niche styles.



THANK YOU

Github

https://github.com/asamassekou10/ITAI-1378-FINAL_VectorSearch

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