CHAPTER 1

INTRODUCTION

1.1 Motivation

- Fashion today is not just about clothing, but a way of expressing individuality and confidence. However, with endless options available both online and offline, people often struggle to make the right styling choices that truly match their personality, body type, and occasion. This challenge motivated us to develop *Tiyara – Fashion Recommender System*, a solution that makes styling easier, smarter, and more personalized. Our vision is to help users receive recommendations that fit their body shape, skin tone, and specific occasions, so they can feel confident and stylish in every moment of life.
- We were also inspired by the need to bridge the gap between technology and fashion, combining data-driven intelligence with creative styling. Personalized recommendations not only save time but also reduce confusion and enhance user satisfaction. Moreover, features like image-based product recommendations allow users to explore fashion in an innovative way by simply uploading what they like. In today's fast-paced world, where digital solutions influence almost every aspect of life, a personalized fashion recommender system can empower individuals to make better styling decisions and truly "slay" with confidence in any situation.

1.2 Problem Statement

- Users face difficulty in choosing outfits that match their body shape, skin tone, and occasion due to overwhelming fashion choices. There is a need for a system that provides personalized and image-based fashion recommendations to boost confidence and styling.

1.3 Objectives of the Project

i) To develop a personalized fashion recommender system that suggests outfits based on category and occasion.
ii) To provide **personalized recommendations** tailored to a user's **body shape** and **skin tone** for better styling.
iii) To implement **image-based product recommendation**, enabling users to upload an image and find visually similar fashion items.
iv) To bridge the gap between **technology and fashion** by delivering intelligent, data-driven styling solutions.
v) To enhance user **confidence and satisfaction** by making fashion choices easier, faster, and more relevant.

1.4 Overview Of Deep Learning

- Deep learning is a branch of artificial intelligence and machine learning that uses artificial neural networks to process data and learn complex patterns. Unlike traditional machine learning models, which require manual feature extraction, deep learning models automatically learn useful features from raw data such as images, text, or audio.
- These models are structured in multiple layers of interconnected neurons, which allow them to understand data at different levels of abstraction. For example, in image recognition tasks, the initial layers may detect edges and shapes, while deeper layers identify objects, styles, or categories.
- In the fashion industry, deep learning plays a key role in building recommendation systems, image-based product search, and personalized styling. Its ability to analyze images and user preferences makes it highly effective for providing tailored fashion recommendations, as demonstrated in this project.

CHAPTER 2

SYSTEM ANALYSIS / PROBLEM FORMULATION

2.1 Dataset Description

For this project, the dataset was obtained from the **Myntra Clothing Dataset** available on Kaggle. To enrich the dataset, an additional field for **product images** was incorporated by extracting image URLs through **web scraping** techniques. This allowed the system to support image-based product recommendations. The dataset was then pre processed by handling missing values, removing null rows, and ensuring consistency in attributes. These steps helped in creating a clean and reliable dataset suitable for building personalized recommendations based on category, occasion, body shape, skin tone, and visual similarity of products.

2.2 Requirement Analysis

1. **Hardware Requirement**
   - **Processor:** Minimum Intel i5 / AMD Ryzen 5 or higher
   - **RAM:** At least 8 GB with batches(16 GB recommended for faster model training and image processing)
   - **Storage:** 512 GB SSD
   - **GPU (Optional but recommended):** NVIDIA GPU with CUDA support for efficient image-based processing and model training (can use GPU provided by Kaggle and Google CoLab editor)
   - **Display:** Standard HD display for testing and visualization

2. **Software Requirement**

   - **Operating System: Windows 11**
   - **Programming Language: Python 3.x**
   - **Machine Learning: TensorFlow / PyTorch / Scikit-learn**
   - **Data Handling: Pandas, NumPy**
   - **Image Processing: OpenCV**
   - **Web Scraping: BeautifulSoup, Requests, Selenium**
   - **Recommendation Algorithms: Cosine, Euclidean**
   - **Database: MySQL / MongoDB for storing user and product data**
   - **Web Framework: Flask / Vite**
   - **Frontend: HTML, Tailwind CSS, JavaScript, Vite**
   - **Tools: Jupyter Notebook / VS Code / Kaggle Code editor**

CHAPTER 3

Methodology & Implementation

3.1 Deep Learning Architecture Used

1. Body Shape Classification

- Used **K-Nearest Neighbors (KNN) algorithm.**

2. Skin Tone Classification

- Used ResNet-152 (fine-tuned) deep learning model.
- Custom fully connected layers added for classification into 4 skin tone categories: dark, light, mid-dark, mid-light.

3. Image-Based Product Recommendation

- Extracted **CNN features** from pre-trained models.
- Added **HSV color histogram** for color representation.
- Used **Local Binary Pattern (LBP)** for texture features.
- Combined features into a single vector and applied similarity matching for image-based recommendations.

3.2 Model Design & Training Process

1. Skin Tone Classification (ResNet-152):

- Used **pre-trained ResNet-152** as the base model for feature extraction.
- Replaced the final fully connected layer with custom layers (Dropout + Dense layers) for **4-class skin tone classification**.
- Preprocessed images with resizing (224×224), normalization, and batch dimensioning.
- Trained the model using **transfer learning** with fine-tuning, minimizing cross-entropy loss and applying dropout to prevent overfitting.
- Evaluated the model with metrics like accuracy and confusion matrix to validate performance.

2. Image-Based Recommendation (Feature Extraction + Similarity Matching):

- Designed a hybrid feature extraction pipeline combining **CNN features, HSV color histograms, and Local Binary Patterns (LBP)**.
- Normalized and concatenated features into a single vector representation.

- Trained similarity-based retrieval using **Euclidean distance** to recommend visually similar fashion products.

3.3 Tools / Frameworks

- **Programming Language**:
  - Python 3.x – for implementing machine learning, deep learning, and preprocessing tasks.
- **Deep Learning & Machine Learning Libraries**:
  - PyTorch / Torchvision – for ResNet-152 model and training skin tone classifier.
  - Scikit-learn – for KNN implementation and evaluation.
  - TensorFlow / Keras – for CNN-based feature extraction in image recommendation.
- **Image Processing & Feature Extraction**:
  - OpenCV – for image preprocessing and color histogram extraction.
  - Pillow (PIL) – f006Fr handling image transformations.
  - Scikit-image – for extracting Local Binary Patterns (LBP).
- **Data Handling & Preprocessing:**
  - Pandas and NumPy – for dataset cleaning, manipulation, and preprocessing.
- **Web Scraping:**
  - BeautifulSoup and Requests – for extracting product image URLs from Myntra dataset.
- **Visualization & Analysis:**
  - Matplotlib and Seaborn – for visualizing dataset distributions and training performance.
- **Development Tools:**
  - Jupyter Notebook / VS Code – for coding, testing, and experimentation.
  - Kaggle Notebook / Google Colab – for GPU-based model training.

3.4 Workflow Diagram

- **BodyShape –** Enter User's Body measurements => Calculated body shape using Formula => Suggest style and clothes for that particular bodyshape.
- **Skintone –** Upload photo of user => Skintone will be calculated using model => Suggest Colors that will suit their complexion
- **Image Recommendation – Upload Image => Model will extract features of that image => model will suggest similar products to that from our website.**

3.5 Training & Validation

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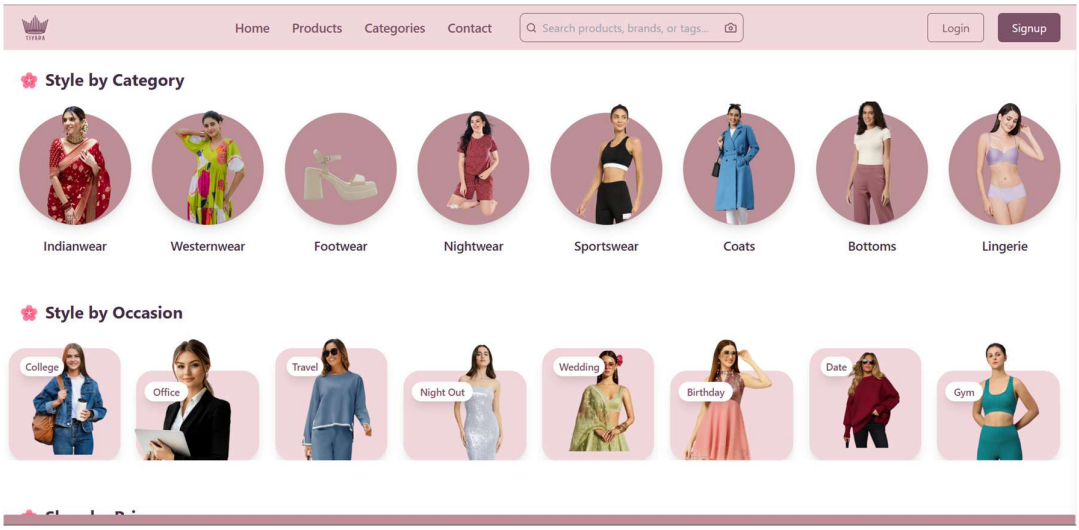
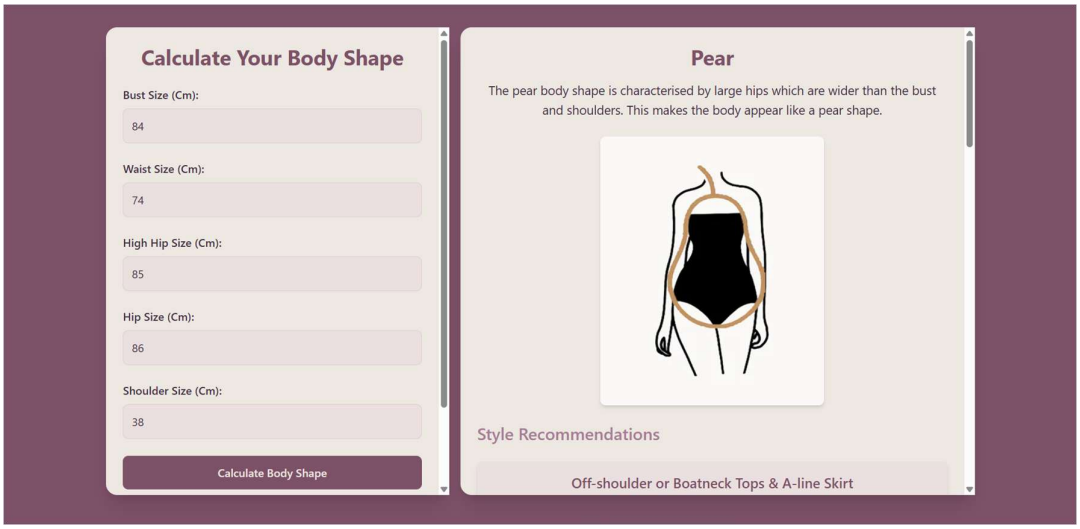
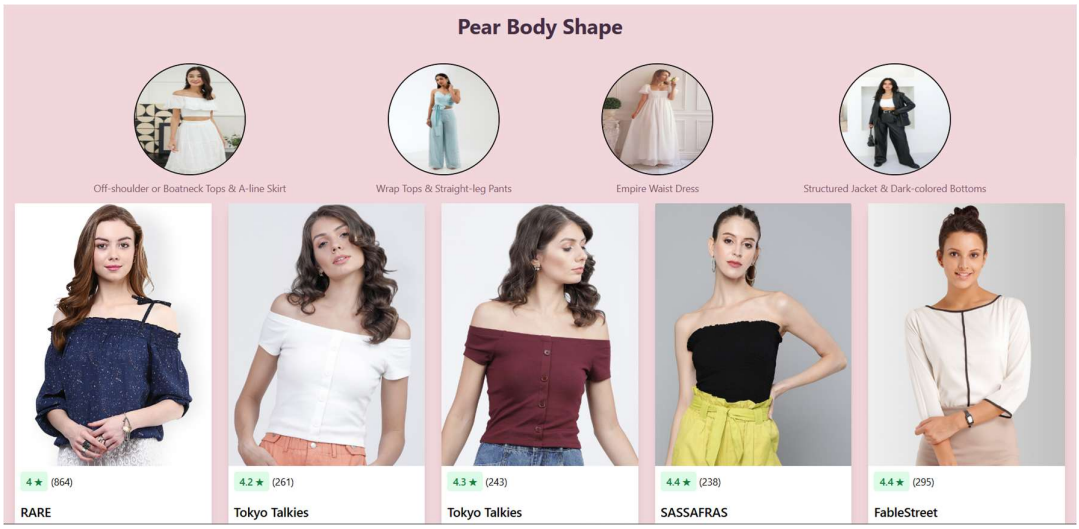
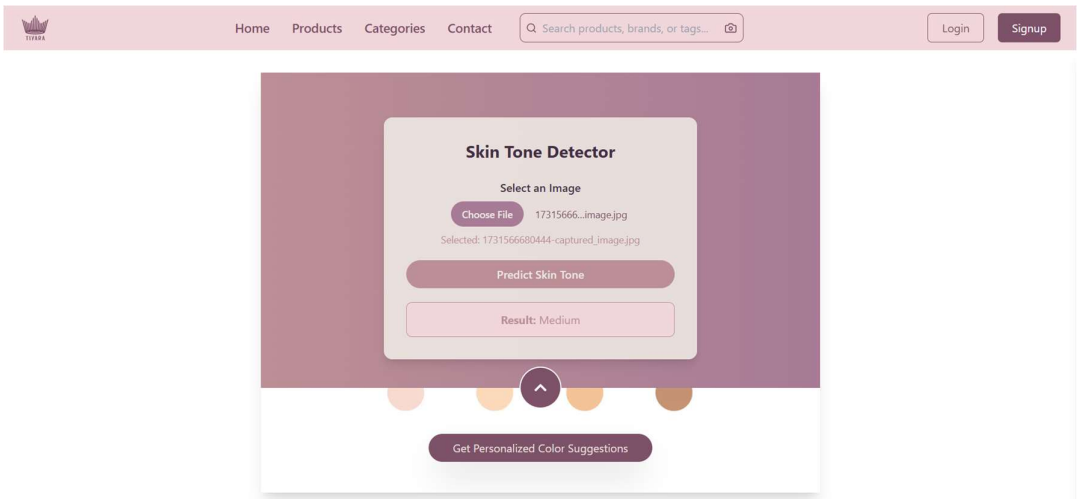
3.6 Screenshots of Outputs




Calculate Your Body Shape
Bust Size (Cm):
84
Waist Size (Cm):
74
High Hip Size (Cm):
85
Hip Size (Cm):
86
Shoulder Size (Cm):
38
Calculate Body Shape
Pear
The pear body shape is characterised by large hips which are wider than the bust and shoulders. This makes the body appear like a pear shape.
Style Recommendations
Off-shoulder or Boatneck Tops & A-line Skirt


Pear Body Shape
Off-shoulder or Boatneck Tops & A-line Skirt
Wrap Tops & Straight-leg Pants
Empire Waist Dress
Structured Jacket & Dark-colored Bottoms
4 ★ (864)
RARE
4.2 ★ (261)
Tokyo Talkies
4.3 ★ (243)
Tokyo Talkies
4.4 ★ (238)
SASSAFRAS
4.4 ★ (295)
FableStreet


Home
Products
Categories
Contact
Search products, brands, or tags...
Login
Signup
Skin Tone Detector
Select an Image
Choose File
17315666...image.jpg
Selected: 1731566680444-captured_image.jpg
Predict Skin Tone
Result: Medium
Get Personalized Color Suggestions

3.7 Conclusion

The Tiyara fashion recommendation system successfully demonstrates how artificial intelligence can bridge the gap between technology and fashion. By leveraging clothing datasets, image processing, and recommendation algorithms, the system provides personalized styling suggestions that enhance user experience. The integration of machine learning ensures that recommendations improve with user preferences over time. This project not only highlights the practical use of AI in everyday life but also opens opportunities for innovation in the fashion industry by making style more accessible, personalized, and data-driven.

REFERENCES

- Chatgpt
- Kaggle