Northeastern Univeristy
EAI6080 Adv. Analytical Utilization
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Acne Severity Detection & Personalized Chatbot Assistant

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Project Overview

Objective:

Automatically detect acne severity from face images using a deep learning model, enabling early-stage skin health assessment.

This application aims to assist individuals and dermatologists by offering fast, accessible, and personalized acne analysis through a user-friendly AI interface.

Two Key Components

- **Deep learning model (MobileNetV2)**
- **Interactive chatbot for skincare advice**

Trained on acne images to classify severity levels with real-time accuracy and robustness across skin type and Powered by GPT-3.5, it provides personalized skincare guidance and answers user queries based on prediction results.

Dataset Details & Preprocessing

Dataset Details

This project uses a publicly available Acne Severity Classification Dataset sourced from Kaggle. It contains annotated facial images categorized into four severity levels: Clear, Mild, Moderate, Severe.

Dataset Source:

https://www.kaggle.com/datasets/manuelhettich/acne04

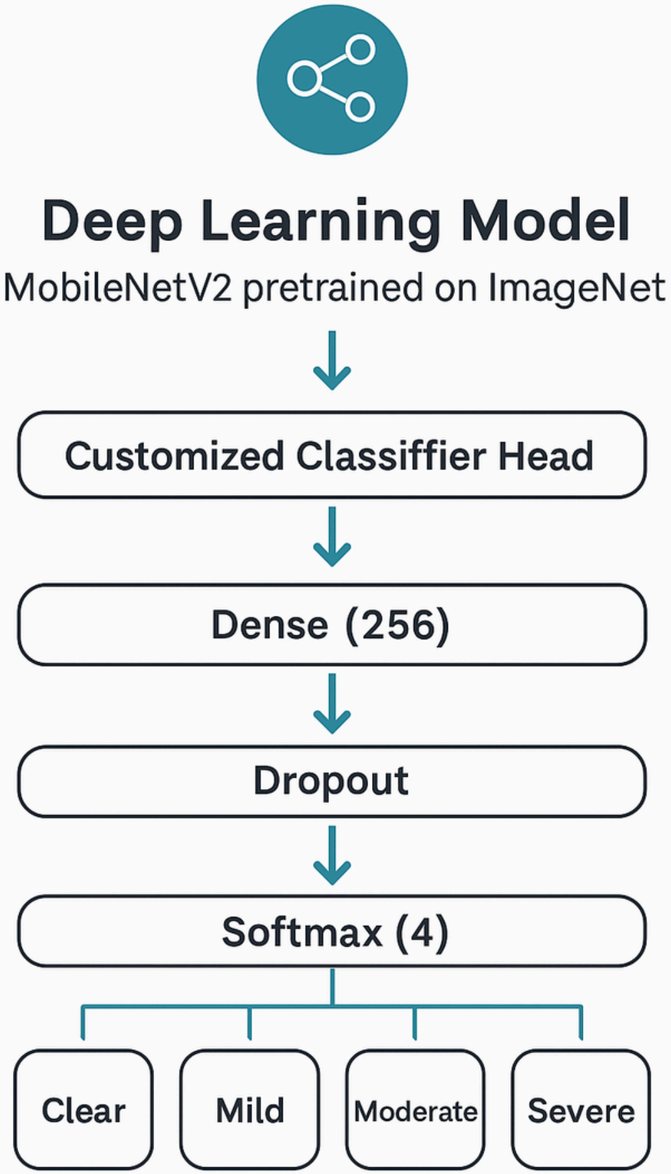
Handling and Preprocessing Data

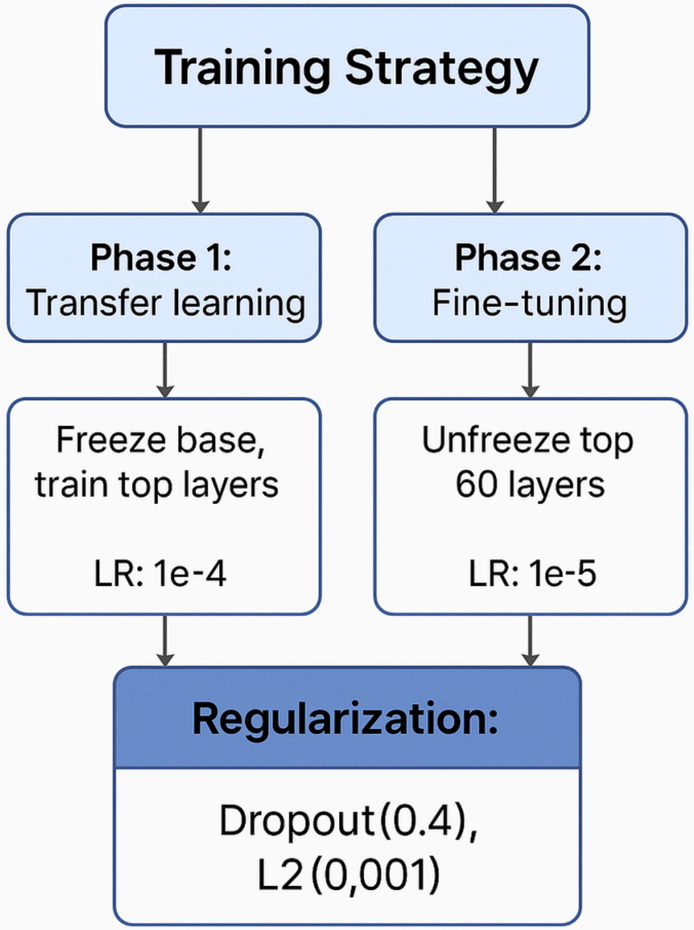
The dataset is split into train/ and test/ directories, with class labels ranging from acne0_1024 (clear) to acne3_1024 (severe). All images are resized to 160×160 pixels to maintain uniformity. During preprocessing, extensive data augmentation is applied—including rotation, zoom, brightness adjustment, and horizontal flipping—to enhance model generalization.

To address class imbalance, oversampling is applied to underrepresented classes, and compute_class_weight() from sklearn is used during training to ensure balanced learning across all severity levels.

Deep Learning Model (MobileNetV2)

The model is built on MobileNetV2, a lightweight convolutional neural network architecture pretrained on the ImageNet dataset. To adapt it for acne severity classification, a customized classifier head was added: GlobalAveragePooling2D, followed by a Dense layer with 256 units, Dropout for regularization, and a final Softmax layer with 4 output classes. The model is trained to classify acne severity into Clear, Mild, Moderate, and Severe categories.





Training Strategy

The training process followed a two-phase strategy. In Phase 1 (Transfer Learning), the pretrained MobileNetV2 base was frozen and only the custom top layers were trained using a learning rate of 1e-4. In Phase 2 (Fine-Tuning), the top 60 layers of the base model were unfrozen and retrained with a lower learning rate of 1e-5 to refine feature representations. To prevent overfitting, Dropout (0.4) and L2 regularization (0.001) were applied during training.

Model Performance

The MobileNetV2-based model achieved a validation accuracy of approximately 60–65%, demonstrating strong performance on diverse acne severity levels. It generalizes well across varying skin tones and lighting conditions due to extensive data augmentation. The final trained model, saved as mobilenetv2_acne_model_improved.keras, is both lightweight and deployment-ready.

Chatbot Integration

The app integrates OpenAI's GPT-3.5 to enable real-time, interactive skincare Q&A. The chatbot delivers context-aware responses based on the model's acne severity prediction, offering users personalized advice and next-step suggestions. This boosts user engagement, provides expert-like guidance, and builds trust in the system.

Web Application Flow and Demo

Streamlit Web App

Upload Image

↓

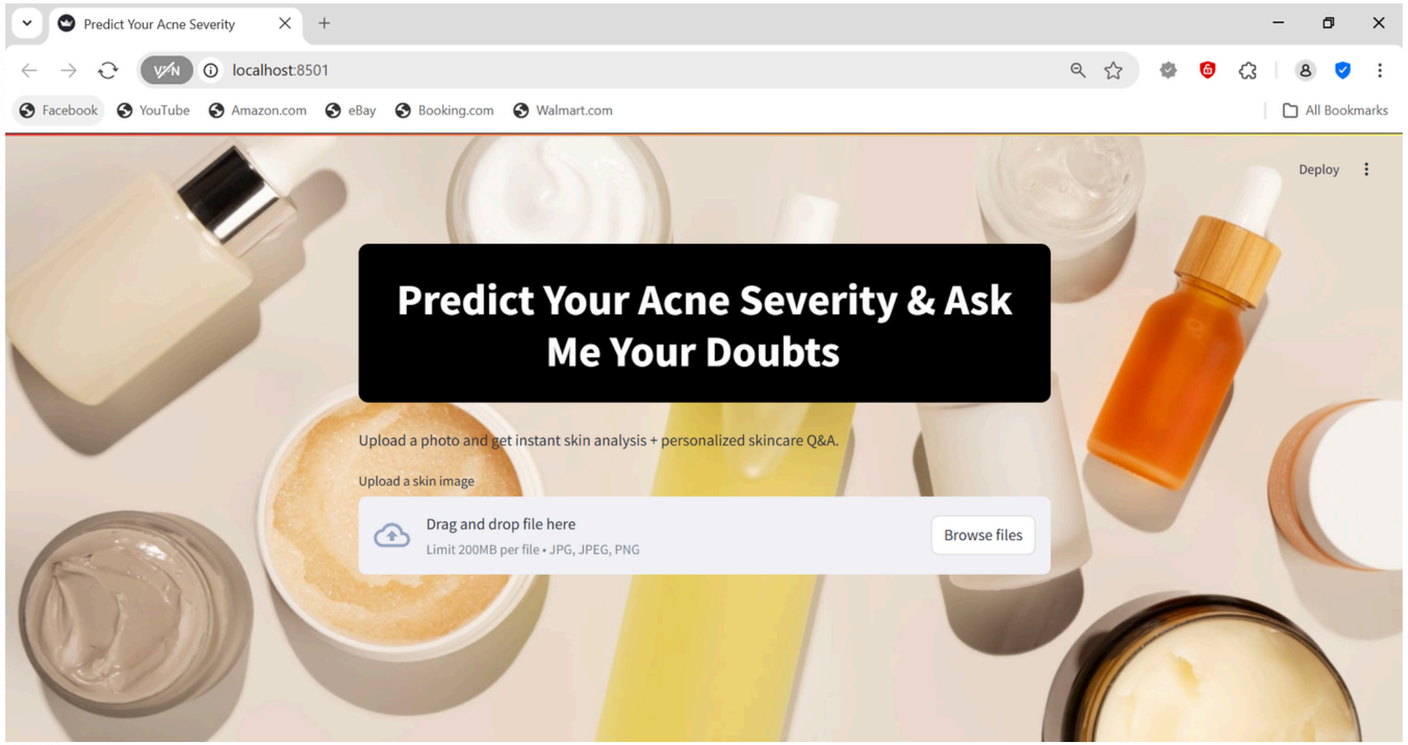
Predict Severity

↓

Display Class + Confidence

↓

Show Recommendation



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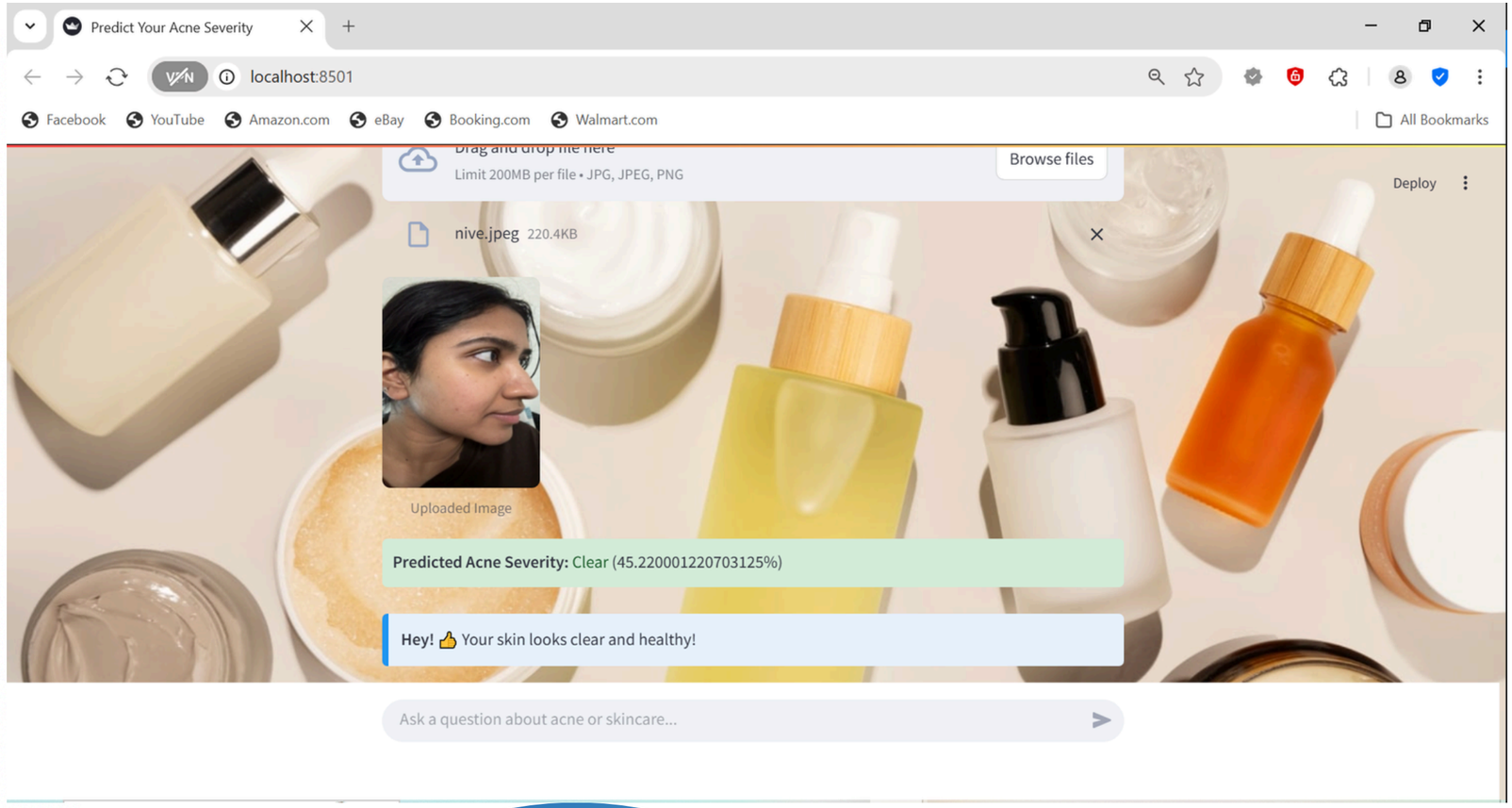

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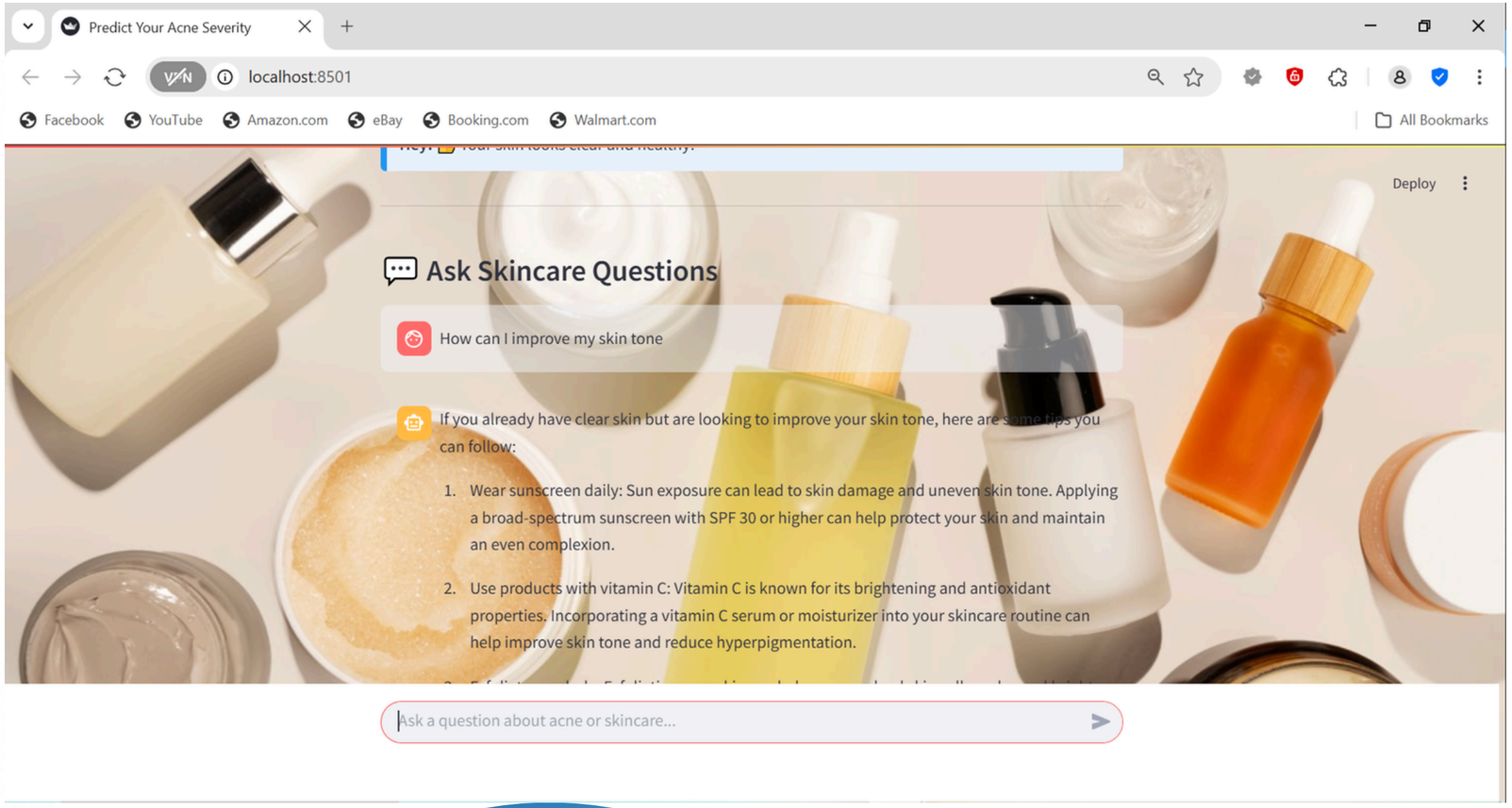

Future Enhancements

To further enhance accuracy and interpretability, the model can be upgraded to EfficientNetB0 or Vision Transformers (ViT) for deeper feature extraction.

Incorporating Grad-CAM visualizations will provide explainability by highlighting regions influencing predictions.

Additionally, including metadata inputs such as age and gender could personalize severity analysis. For broader accessibility, the system can be deployed on Streamlit Cloud or Hugging Face Spaces for real-time global access.

THANK YOU

ANY QUESTIONS ?