PROJECT REPORT

Title: Transforming Waste Management with Transfer Learning

Introduction

HematoVision is a machine learning project developed during the SmartBridge Virtual Internship under the AI/ML domain. The system allows users to upload an image of a waste item for real-time classification into Biodegradable, Recyclable, or Trash using a deep learning model

Problem Statement

Improper waste segregation leads to environmental damage and inefficient recycling. This project aims to build an AI-powered solution using transfer learning to automate, accelerate, and improve the accuracy of waste classification.

Objectives

- To develop a smart waste classifier using transfer learning with the VGG16 model.
- To integrate the model into a Flask backend for real-time image prediction.
- To build a React + TypeScript frontend for user interaction.
- To promote proper waste disposal with accurate classification and suggestions.

Technologies Used

Frontend: React, TypeScript
Backend: Flask
Machine Learning: TensorFlow, Keras (VGG16)
Tools: VS Code, Google Colab
Dataset: Waste Classification Dataset from Kaggle

Dataset

Source : waste dataset from kaggle

Technologies

Project Flow

Step 1: Data Preprocessing

- Images resized to (224x224)
- Normalized using VGG16's preprocess_input

Step 2: Model Building

- Used VGG16 with frozen convolutional base
- Added custom dense layers for 3 waste categories

Step 3: Model Evaluation

- Achieved ~92% classification accuracy
- Visualized training with loss and accuracy plots
- Evaluated using classification report and confusion matrix

Step 4: Saving the Model

- Saved the trained model as healthy_vs_rotten.h5

Step 5: Web App using Flask

- Created frontend with React & TypeScript
- Flask backend receives and classifies uploaded image
- Result with confidence and suggestions is returned and displayed

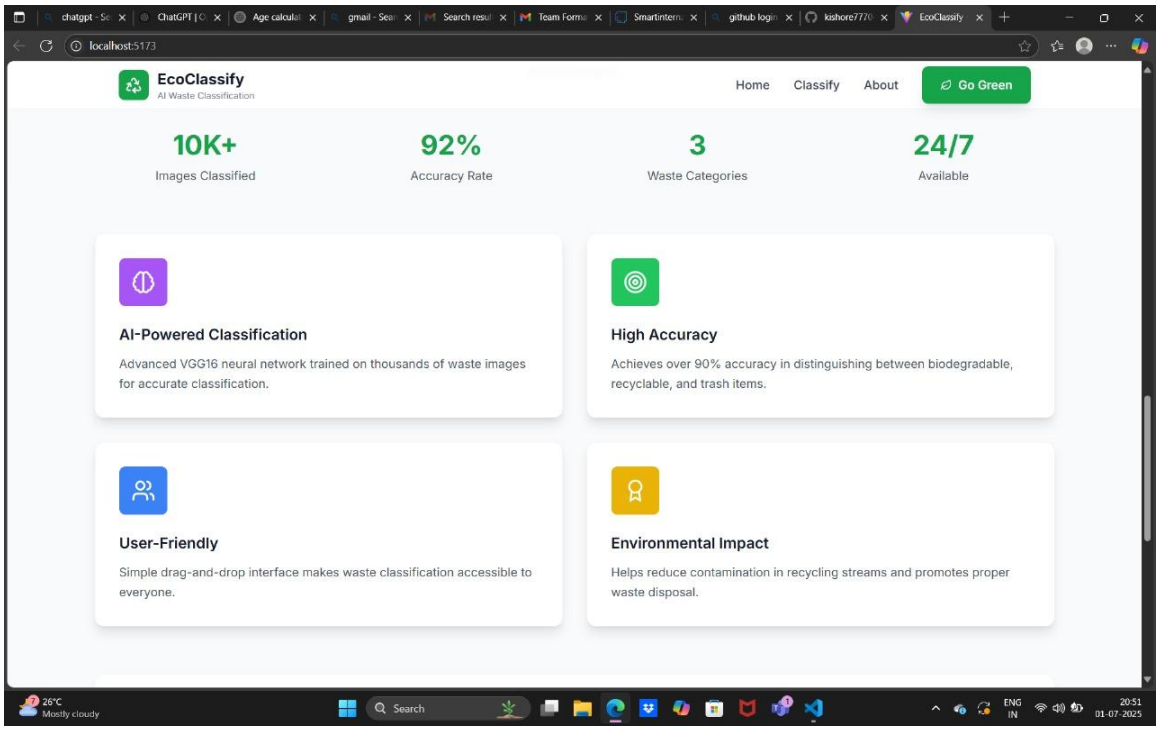
Folder structure

```
|
├── app.py
├── healthy_vs_rotten.h5
|
├── static/
|   ├── assets/
```

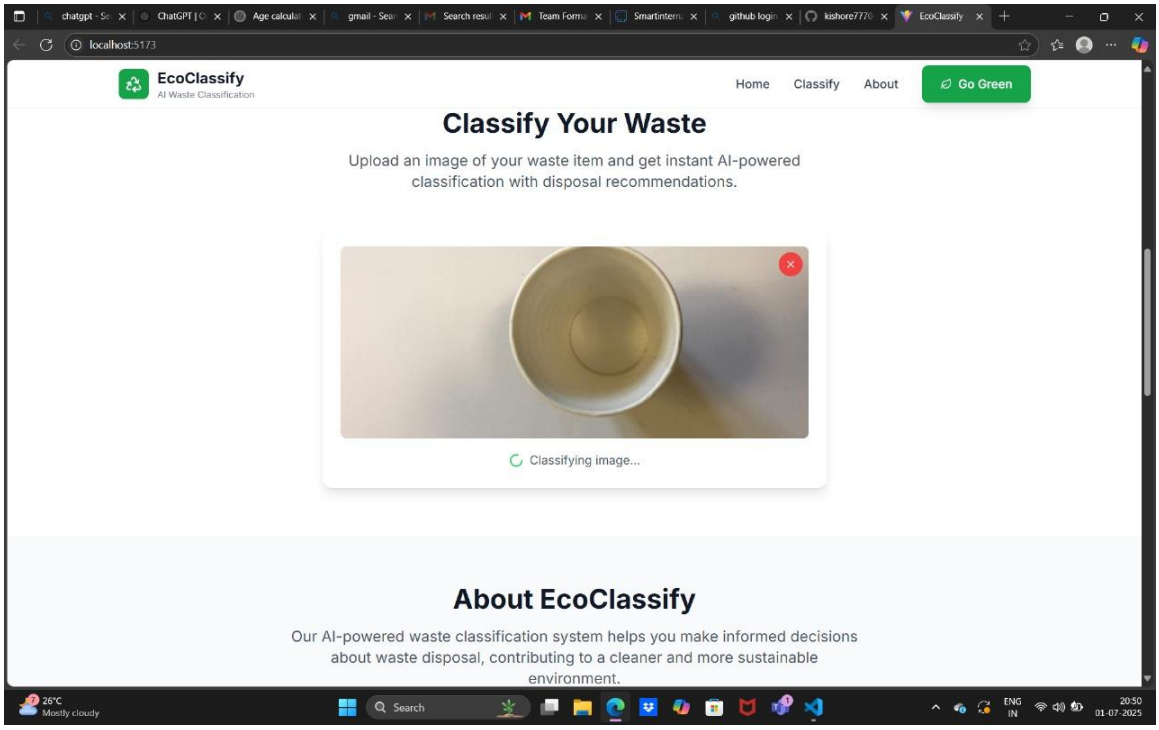
```
│   ├──── forms/
│   └──── uploads/        # Uploaded waste images
│
├──── templates/
│   ├──── index.html
│   ├──── blog.html
│   ├──── blog-single.html
│   └──── portfolio-details.html
│
├──── ipython.html
└──── Readme.txt
```

UI Screenshots

1. Homepage View: Shows stats and features.

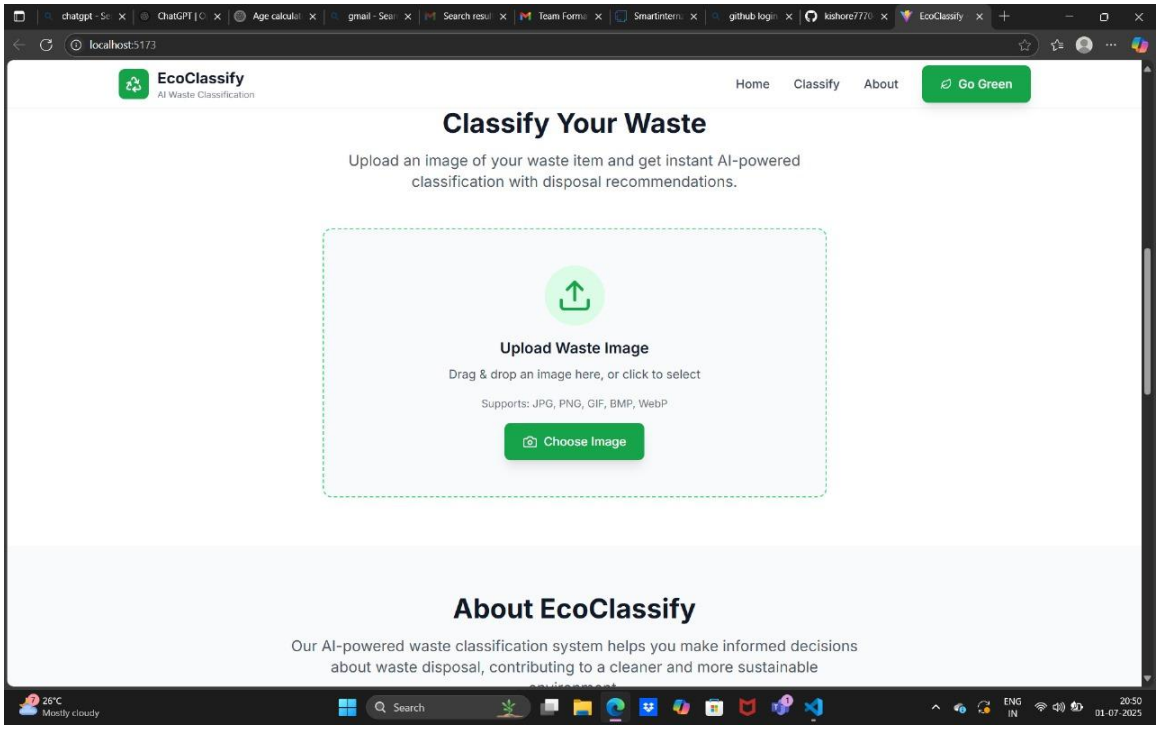


2. Upload Section: Choose or drag-and-drop image.



- Prompts user to upload waste image
- Supports drag & drop and file browser
- Accepts JPG, PNG, BMP, WebP, GIF formats
- Provides clear visual guidance for input

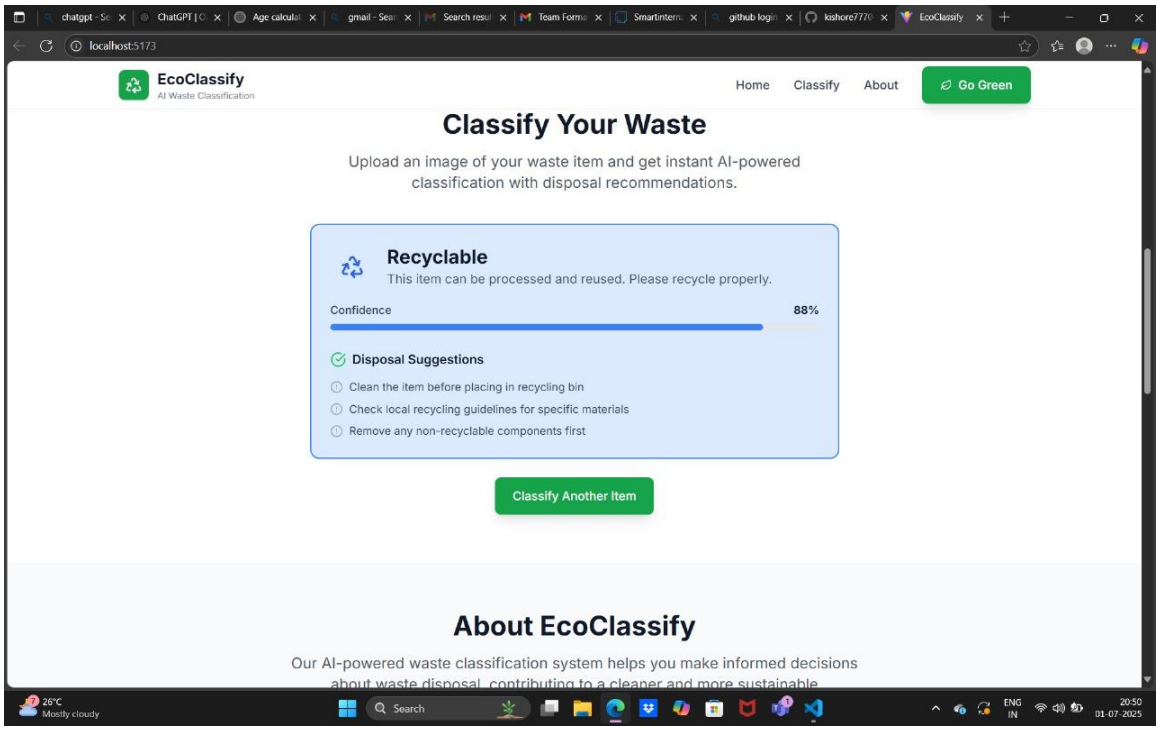
3. Classifying State: Preview and loading spinner.



- Shows uploaded image preview
- Displays loading animation during classification
- Enhances user experience with real-time feedback
- Prevents confusion while model processes input

4. Prediction Result: Label, confidence, and tips displayed.

- Shows predicted category (e.g., *Recyclable*)
- Displays confidence score (e.g., 88%)
- Suggests eco-friendly disposal steps
- Clean and understandable UI for feedback



Results

Image Input: Paper cup
Prediction: Recyclable
Confidence: 88%
Disposal Suggestions:
- Clean before recycling
- Follow local guidelines
- Remove non-recyclable parts

Conclusion

This AI-powered waste classification platform demonstrates how transfer learning can be effectively utilized to solve real-world environmental challenges. The system's seamless UI, real-time response, and high prediction accuracy make it a practical solution for promoting sustainable waste management.