Fruit Recognition using ANN + PCA

Introduction

This project presents a fruit image classification system using **Principal Component Analysis (PCA)** for dimensionality reduction and an **Artificial Neural Network (ANN)** for image classification. Users can upload a single image or a ZIP archive of multiple fruit images. The application is accessible through a **Streamlit**-powered web interface.

Features

- Upload **Single Image** or a **ZIP** file of fruit images
- Real-time fruit classification using a trained ANN
- PCA applied to reduce dimensionality before feeding to ANN
- Displays prediction confidence scores
- Visualization of **Confusion Matrix** for performance analysis
- Supports **.jpg**, **.jpeg**, and **.png** formats

Requirements

- Python 3.x
- Streamlit
- TensorFlow
- NumPy
- Pandas
- Pillow
- scikit-learn
- Matplotlib

Install dependencies:

pip install -r requirements.txt

Installation & Setup

1. **Clone this repository** or download the files manually.

2. Ensure the following files are in the project root directory:
    - `fruit_model.h5`
    - `pca_transformer.pkl`
    - `class_names.pkl`
    - `grouped_confusion_matrix_named.png`
    - `grouped_confusion_matrix_merged.png`
3. Run the app using Streamlit:

streamlit run app.py

Project Files

- `app.py` : Web application script using Streamlit
- `ann_pca.ipynb` : Jupyter notebook with training code (ANN + PCA)
- `class_names.pkl` : Pickled list of class labels
- `custom_images.ipynb` : Notebook for testing on custom images
- `custom_images.zip` : Sample custom test images
- `fruit_model.h5` : Trained ANN model
- `pca_transformer.pkl` : PCA model for feature reduction
- `grouped_confusion_matrix_named.png` : Confusion matrix with labels
- `grouped_confusion_matrix_merged.png` : Confusion matrix with merged classes

Usage Instructions

1. **Open the app** via browser after launching.
2. Choose between:
    - "Single Image" (to upload one image)
    - "Zip of Images" (for batch predictions)
3. Upload your image or zip file.
4. The model predicts fruit category and shows the **confidence score**.

Evaluation

- **PCA** with 50 components used to compress image features
- ANN trained on the PCA-reduced dataset
- Classification performance evaluated using **Confusion Matrices**:

- `grouped_confusion_matrix_named.png`
- `grouped_confusion_matrix_merged.png`

Kashish Joshi
B.Tech Computer Science, IIT Jodhpur
GitHub: github.com/kashishjoshi13
