🌾 GrainPalette: Rice Classification through Transfer Learning 🤖

GrainPalette is a smart deep learning project that classifies different types of rice grains 🌾 using images 📷. It uses **MobileNetV2**, a powerful pre-trained model (transfer learning), to identify rice types accurately and efficiently.

📌 Project Overview

GrainPalette is a web app that takes an image of rice grains and tells you what type of rice it is. It's helpful for farmers, quality control teams, and food industries 🍚🏭. The app uses computer vision and deep learning to analyze the grains.

🛠️ Technologies Used

- 💻 **Frontend**: HTML, CSS

- 🧠 **Backend**: Flask (Python)

- 📊 **Model**: MobileNetV2 (Transfer Learning)

- 🔧 **Libraries**: OpenCV, TensorFlow, Keras, NumPy, Pillow

- 📈 **Visualization**: Matplotlib, Plotly

- 🚀 **Deployment**: GitHub

📂 Dataset

We used a rice grain dataset containing images of 5 rice types:

1. 🍚 Basmati

2. 🍚 Arborio

3. 🍚 Ipsala

4. 🍚 Jasmine

5. 🍚 Karacadag

Each category has 1000+ high-quality images used for training and testing.

🧠 Architecture (How it Works)

```
User Uploads Image 📷
        ⬇️
Flask Backend 🔄
        ⬇️
Preprocessing (Resize, Normalize) 🔍
        ⬇️
MobileNetV2 Model 🧠
        ⬇️
Prediction with Confidence 📊
        ⬇️
Results
```
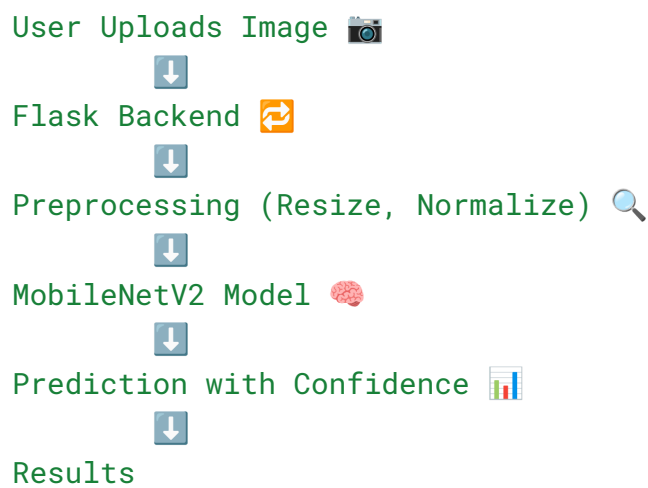
🏋️ Model Training Details

- ✅ **Base Model**: MobileNetV2

- 🖼️ **Input Size**: 224x224 pixels

- 🔄 **Epochs**: 15–20

- 📉 **Loss Function**: Categorical Crossentropy

- 🚀 **Optimizer**: Adam

- 🎯 **Accuracy**: ~95%

📊 Graphs & Visuals

📈 Training vs Validation Accuracy

- Shows how well the model is learning over time.

📉 Confusion Matrix (Pie Chart Style)

- Visualizes how the model is predicting each class.

🧠 Prediction Confidence Chart

- After uploading a rice image, the app shows how confident it is using a colorful pie chart!

python

```python
# Sample pie chart code
import plotly.express as px
fig = px.pie(names=rice_classes, values=prediction_probs,
title="Prediction Confidence")
```

✨ Features

✅ Upload rice grain images
✅ Predict rice type instantly
✅ Visual confidence results
✅ Mobile-friendly UI
✅ Warns users if image is not of rice 🌐⚠️

🚀 How to Use

Clone the project:

bash
```bash
git clone
```

1.

Set up the environment:

```bash
cd "Project Files"
python -m venv venv
venv\Scripts\activate
pip install -r requirements.txt
```

2.

Run the app:

```bash
python app.py
```

3.

Open in browser:

```arduino
http://localhost:5000
```

🔮 Future Improvements

- Add more rice varieties 🌾

- Remove background noise for better accuracy 🖼️

- Make the app mobile-friendly 📱

- Allow users to export results as PDF 📄

Team ID : LTVIP2025TMID44124

Team Size : 4

Team Leader : Marri Padmavalli

Team member : Morla Sambasivaram

Team member : Dokku Sumanth

Team member : Gottipati kavya