Rice Type Classification Web Application

Project Title: *GrainPalette –A Deep Learning Odyssey In Rice Type Classification Through Transfer Learning*

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1. Purpose of the Project

The purpose of this project is to develop a smart application that can classify **different types of rice grains** using AI and provide useful agricultural suggestions based on the classification. This aids farmers, researchers, and food quality inspectors in improving rice handling, crop planning, and storage processes.

2. Use Cases

- **Farmers**: Determine rice type to receive water and fertilizer suggestions.
- **Traders & Buyers**: Verify grain type quality in marketplaces.
- **Researchers**: Analyze classification performance in regional varieties.
- **AgriTech Startups**: Integrate into larger platforms for crop advisory systems.

3. Advantages

- Fast and accurate rice type identification
- User-friendly interface for both web and desktop
- Smart suggestions for agricultural actions
- Can integrate with mobile or field devices
- Reduces manual errors in grain classification

4. About the Model

- **Model Type**: Convolutional Neural Network (CNN)
- **Transfer Learning**: Yes, used MobileNetV2 for base architecture
- **Classes Predicted**:
    - Arborio
    - Basmati
    - Ipsala

    - Jasmine
    - Karacadag
- **Final Format**: TensorFlow Lite (.tflite) model for efficiency

5. Phases of the Project

Phase 1: Problem Identification

- Manual grain sorting is inefficient.
- Needed a scalable, AI-based classification system.

Phase 2: Data Collection & Preprocessing

- Collected and labeled rice grain images.
- Augmented and resized images for uniformity.

Phase 3: Model Training

- Used MobileNetV2 with custom top layers.
- Trained using categorical crossentropy.
- Achieved high accuracy (e.g., 95%+ on validation set).

Phase 4: Model Conversion

- Converted the model to **TFLite** for efficient deployment.
- Optimized for mobile and web use.

Phase 5: Application Development

- Developed a **Flask-based Web Application**
- Users can upload or capture rice images from webcam.
- Model classifies and returns:
    - Rice Type
    - Confidence Level
    - Suggestion (e.g., water, fertilizer tips)

Phase 6: UI/UX Enhancement

- Green-black themed UI inspired by screenshots.
- Includes banners, social icons, and responsive design.

Phase 7: Deployment

- Local deployment with Flask
- Easily deployable on:
    - Render

- PythonAnywhere
- AWS EC2
- Heroku (with filesystem adjustments)

6. Tools & Technologies Used

Category	**Tools Used**
Language	Python, HTML, CSS, JavaScript
Framework	Flask (for backend web server)
ML Framework	TensorFlow, TFLite
Model	MobileNetV2 (Transfer Learning)
Deployment	Localhost / PythonAnywhere-ready
UI Design	Custom CSS, HTML5, Responsive Layout
Image Capture	HTML5 <video> + JS Blob API

7. Project Structure

bash

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```
GrainPalette_WebApp/
|
├── app.py                # Flask backend
├── templates/
|   └── index.html        # Main page
|   └── result.html       # Result display page
├── static/
|   ├── css/style.css     # Theme styling
|   ├── js/script.js      # Camera and upload JS
|   └── images/hero.jpg   # Banner image
├── uploads/              # Temp image storage
├── rice_model.tflite     # Deep Learning model
```

8. Future Enhancements

Add real-time auto-classification pipeline

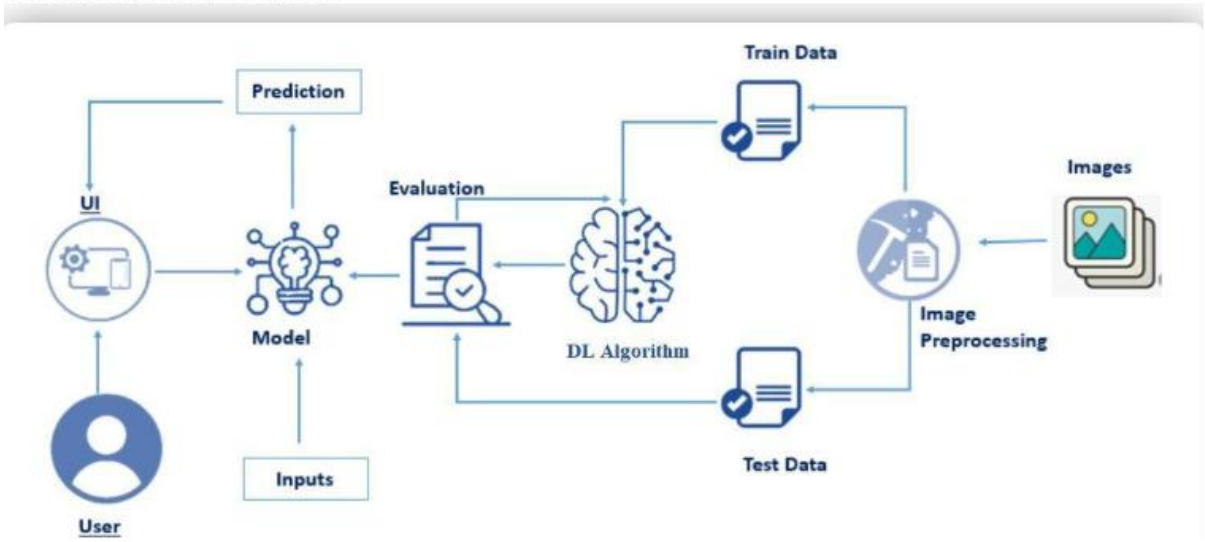
Multilingual support for rural users

Mobile app version with camera integration

Cloud storage for result history and analytics

9. Architecture

Technical Architecture:



10. Quick reference links:

Python code:

https://colab.research.google.com/drive/1TTRWUdJ6eSLLrG27fI8XP2j3pCERGmtX?usp=sharing

Flask application:

https://drive.google.com/file/d/1kxfBjRjti-_CctZrqdKSQgpp8DSIdSQi/view?usp=sharing

Rice data set:

https://drive.google.com/file/d/1rxWHDElhxLF4HSZ44FFYojyv57zx9A8D/view?usp=sharing

Demo video:

https://drive.google.com/file/d/1I30Pxa65AuVoZ7yeks6HSJsaA9dLvWXi/view?usp=sharing

Git Hub:

https://github.com/kunchalahemanthkumar1432-sudo/Grain-palette.git