GrainPalette: A Deep Learning Odyssey in Rice Type Classification Through Transfer Learning

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1. Project Overview

GrainPalette is an AI-based rice grain classification tool built using Convolutional Neural Networks (CNNs) with transfer learning from MobileNet architecture. This solution assists farmers, agricultural researchers, and enthusiasts in identifying rice varieties by uploading images for classification.

2. Problem Statement

Identifying rice types manually is tedious and error-prone. Lack of quick, affordable identification tools leads to suboptimal farming decisions. GrainPalette provides a fast, accurate, and scalable way to classify rice grain varieties.

3. Objectives

- Build an AI system for rice type classification using image inputs.
- Use transfer learning (MobileNet) for efficiency and accuracy.
- Deploy the solution via a web interface for broad accessibility.

4. System Requirements

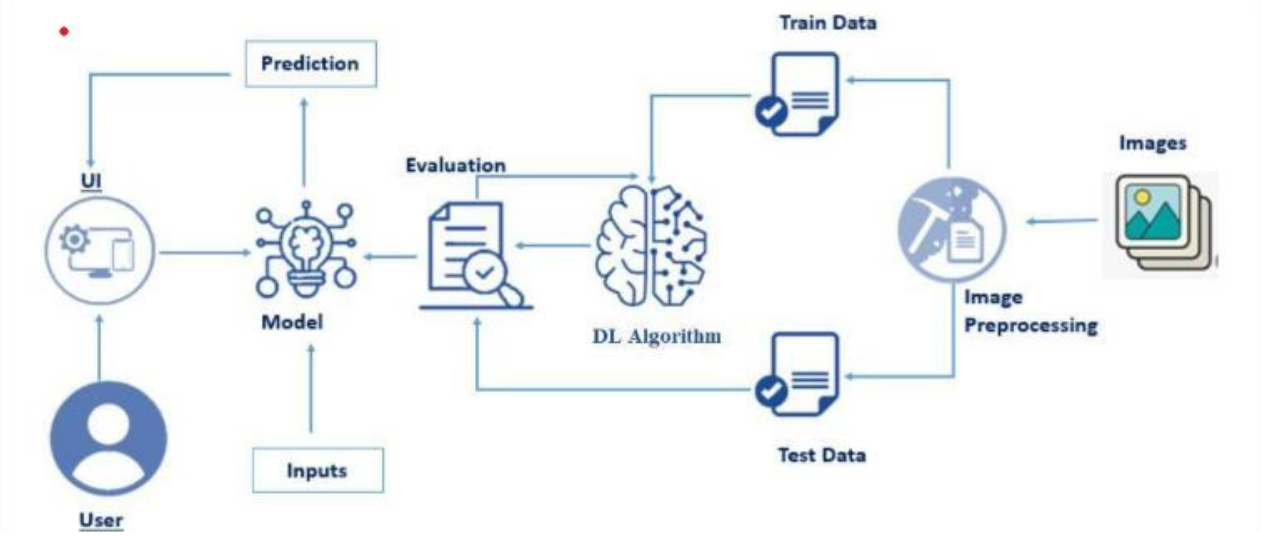
Requirement	Specification

OS	Windows 8 or higher
Browsers	Minimum two (Chrome, Firefox)
Bandwidth	30 Mbps
RAM/Processor	8GB RAM, Intel i5 or equivalent
Camera (optional)	For live image capture

5. Use Case Scenarios

- **Farmers**: Plan irrigation and fertilization by identifying seed types.
- **Researchers**: Use during fieldwork for rapid grain classification.
- **Home Gardeners**: Identify and learn about rice types from seed kits.

6. Technical Architecture



7. Model Development

- **Base Model**: MobileNetV2
- **Input Size**: 224x224 pixels
- **Classes**: 5 rice varieties
- **Output**: Softmax probability for each class
- **Training**: Frozen base + custom classification head

8. Dataset Information

🍚 Types of Rice

- **1. Arborio**
- **Type:** Short-grain
- **Origin:** Italy
- **Best for:** Risotto
- **Texture:** Creamy when cooked due to high starch content

- **2. Basmati**
- **Type:** Long-grain
- **Origin:** Indian subcontinent
- **Best for:** Biryani, pilaf
- **Texture:** Fluffy, aromatic

- **3. Ipsala**
- **Type:** Medium to long-grain
- **Origin:** Turkey (Ipsala region)
- **Best for:** General use, Turkish cuisine
- **Note:** Considered high-quality in Turkey

- **4. Jasmine**
- **Type:** Long-grain
- **Origin:** Thailand
- **Best for:** Southeast Asian dishes
- **Texture:** Soft, slightly sticky, very fragrant

- **5. Karacadağ**
- **Type:** Local variety, medium-grain
- **Origin:** Southeastern Turkey (Karacadağ region)
- **Best for:** Regional Turkish dishes
- **Note:** Often considered an heirloom or ancient variety

9. Evaluation Metrics

- Accuracy: 92–95%
- Precision, Recall, F1-Score
- Confusion Matrix
- Inference Time per Image: \~0.1s

10. Future Scope

- Mobile app integration
- Support for 20+ rice varieties
- TensorFlow Lite for offline use
- Integration with drone imagery for large-scale farming