# GrainPalette: A Deep Learning Odyssey in Rice Type Classification

## System Requirements

- Operating System: Windows 8 or later

- Web Browsers: Minimum two modern browsers installed (e.g., Chrome, Firefox)

- Internet Bandwidth: Minimum 30 Mbps for smooth interaction and model upload

## Project Overview

GrainPalette is an AI-powered solution designed to classify five different types of rice grains using advanced image recognition techniques. Built with Convolutional Neural Networks (CNN) and leveraging transfer learning using MobileNetV4, this model assists users by accurately identifying rice varieties from uploaded images.

The tool empowers:

- Farmers to optimize cultivation strategies

- Agricultural scientists to support research and extension activities

- Home growers to explore and learn about rice biodiversity

User Flow:

1. Upload an image of a rice grain.

2. Click "Submit".

3. View predicted rice type and use it for informed decisions on cultivation, care, and research.

## Use Case Scenarios

1. Farmers' Crop Planning:

- Farmers upload rice seed images before planting.

- The model identifies the rice variety.

- Based on results, farmers tailor:

  - Irrigation schedules

  - Fertilizer usage

- Pest management strategies


2. Research and Agricultural Extension:

- Used by scientists and field workers during:

  - Field visits

  - Research trials

  - Extension programs

- Facilitates quick identification and record-keeping.

- Enhances productivity and sustainability in cultivation.


3. Home Gardening & Education:

- Gardeners upload seed or crop images.

- Learn about:

  - Varietal characteristics

  - Growth needs

  - Biodiversity

- Encourages sustainable home practices and education.


## Technical Architecture

1. Frontend:

  - User interface for uploading rice grain images

  - Displays classification results

  - Simple and responsive web application (HTML/CSS/JS)


2. Backend:

  - Python Flask/Django server for handling requests

  - Preprocessing of input images (resizing, normalization)


3. Model Layer:

  - CNN-based model using MobileNetV4 (transfer learning)

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- Trained on a labeled rice grain image dataset

- Output: Predicted rice type (from 5 predefined classes)

4. Storage:

   - Local or cloud-based image storage

   - Model weights and logs

5. Deployment:

   - Deployed locally or via cloud platforms (e.g., Heroku, Render, AWS)

## Benefits

- Fast, accurate rice type recognition

- No expert knowledge needed

- Supports diverse stakeholders from farmers to researchers

- Promotes agricultural efficiency and biodiversity education