Project Final Report

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

Team details :

Team id: LTVIP2025TMID46631
Team Members:
1. Malakapalli Raja Sekhar
2. Mandadi Pydinaidu
3. Munduri Venkata Sriram
4. Musunuri Harshitha

1. INTRODUCTION

1.1 Project Overview

GrainPalette is a deep learning-powered web application that identifies different rice varieties from grain images. The system classifies rice types such as Arborio, Basmati, Ipsala, Jasmine, and Karacadag using a Convolutional Neural Network (CNN) with MobileNetV2 transfer learning. The application simplifies the process of rice classification through an intuitive interface and real-time predictions.

1.2 Purpose

This project is designed to:
Automate rice type classification from images
Assist farmers, researchers, and food quality inspectors
Demonstrate the effectiveness of transfer learning in agricultural AI applications

2. IDEATION PHASE

2.1 Problem Statement

Manual identification of rice grain types is time-consuming and error-prone. Existing methods require domain expertise and often lack scalability. A smart deep learning solution can overcome these challenges efficiently.

2.2 Empathy Map Canvas

Users: Farmers, researchers, food industry
Needs: Accurate, fast rice grain classification
Pains: Manual identification is slow, lacks consistency
Gains: Saves time, ensures quality, enables automation

2.3 Brainstorming

Multiple model architectures were considered (VGG16, ResNet, MobileNetV2). MobileNetV2 was chosen for its efficiency and high accuracy on small devices.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

User visits the web app
Uploads a rice grain image
Gets real-time classification result
Views prediction confidence and probabilities

3.2 Solution Requirements

CNN with transfer learning (MobileNetV2)
Flask backend and HTML/CSS frontend
Image preprocessing and prediction logic
Deployment via Render

3.3 Data Flow Diagram

User Upload → Flask Backend → Preprocess Image → Model Prediction → Results Rendered

3.4 Technology Stack

Python, TensorFlow, Keras
Flask, HTML, CSS
PIL, NumPy, OpenCV

3.5 Data set

Rice Image Dataset from Kaggle:
https://www.kaggle.com/datasets/muratkokludataset/rice-image-dataset

---

4. PROJECT DESIGN

4.1 Problem-Solution Fit

The proposed solution provides a practical and accessible approach to identify rice varieties. It addresses real-world agricultural problems and enhances classification speed and accuracy.

4.2 Proposed Solution

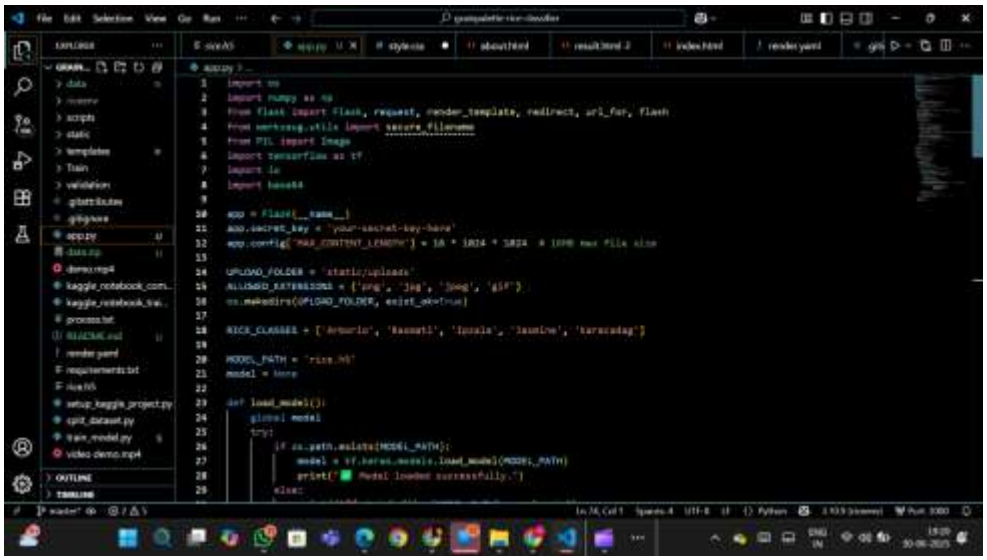
Train a CNN model using MobileNetV2 and Kaggle rice dataset
Build a Flask-based web interface
Integrate the model to accept image input and return prediction

4.3 Solution Architecture

Frontend ↔ Flask App ↔ Preprocessing ↔ Trained Model (rice.h5) → Prediction Output

---

5. PROJECT STRUCTURE



- Static folder contains css files
- Template folder contains all 3 HTML pages.
- Data folder contains Training and Validation images
- Training file consist of train.ipynb , rice.h5 model

---

6. PROJECT PLANNING & SCHEDULING

6.1 Project Planning

Phase	Duration
Data Collection	0.5 day
Model Training	1 day
Web App Development	1 day
Deployment	0.5 day
Testing & Debugging	0.5 day

---

7. FUNCTIONAL AND PERFORMANCE TESTING

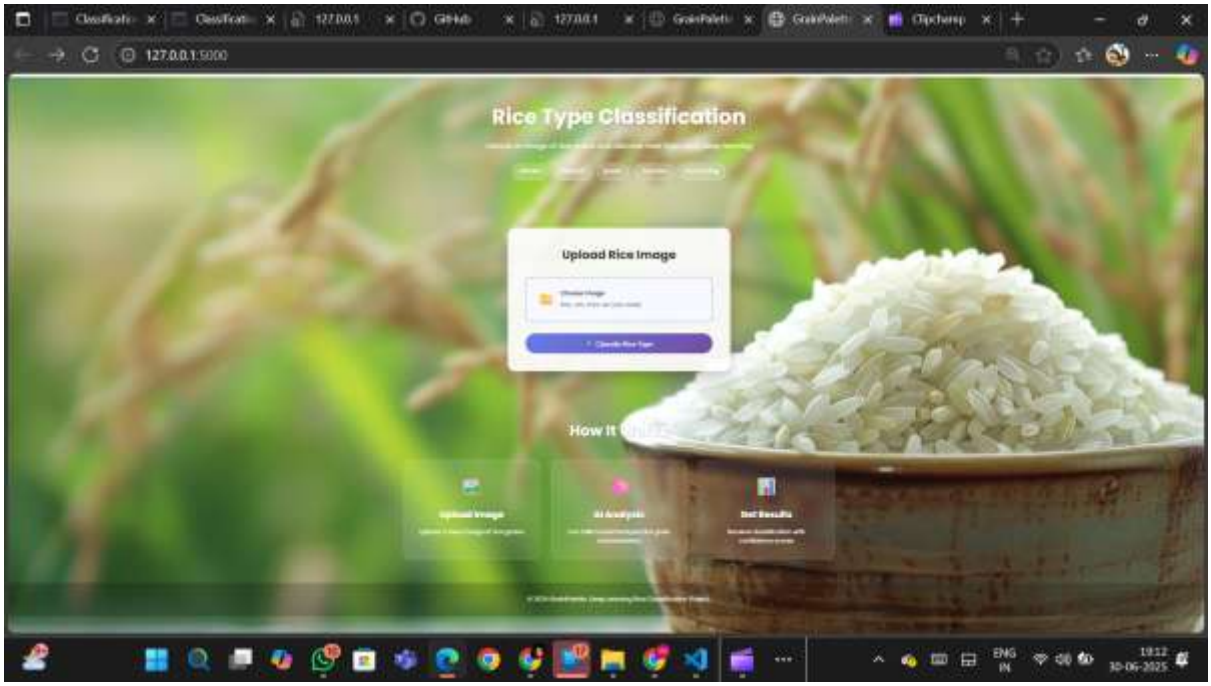
7.1 Performance Testing

Model: MobileNetV2 with Transfer Learning
Accuracy: ~96% on validation data
Image Size: 224x224
Training Time: ~3 hours on CPU
Preprocessing includes resizing and normalization

---

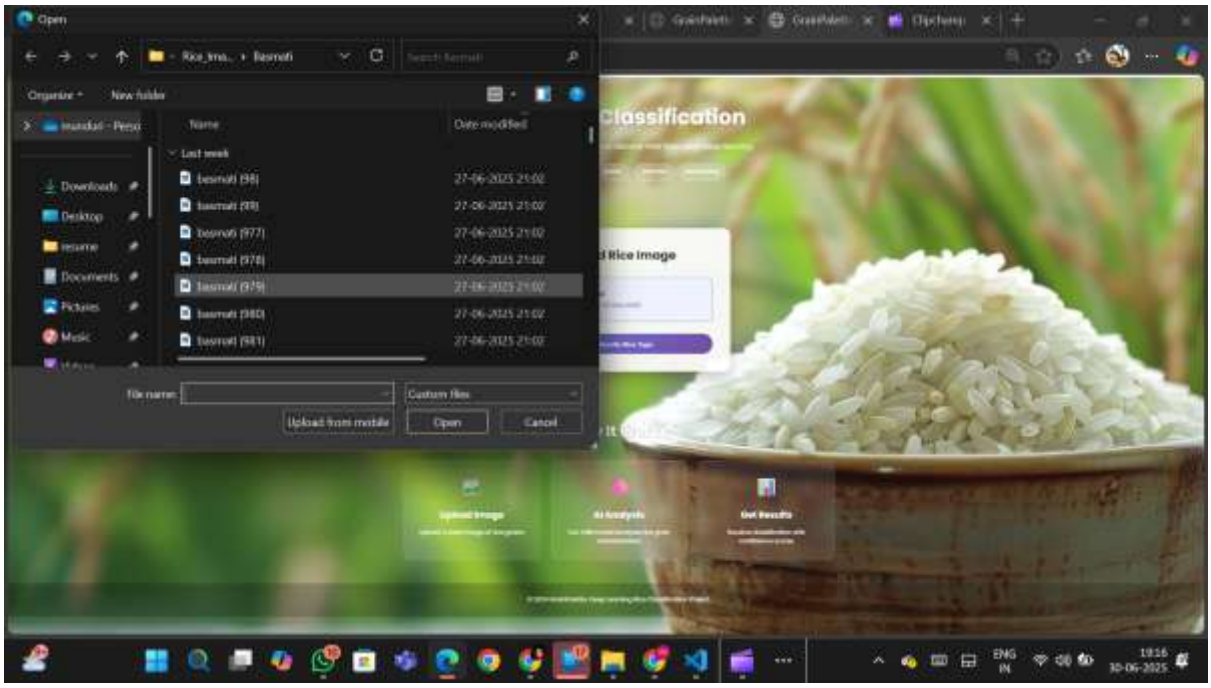
8. RESULTS

8.1 INDEX.HTML Screenshot

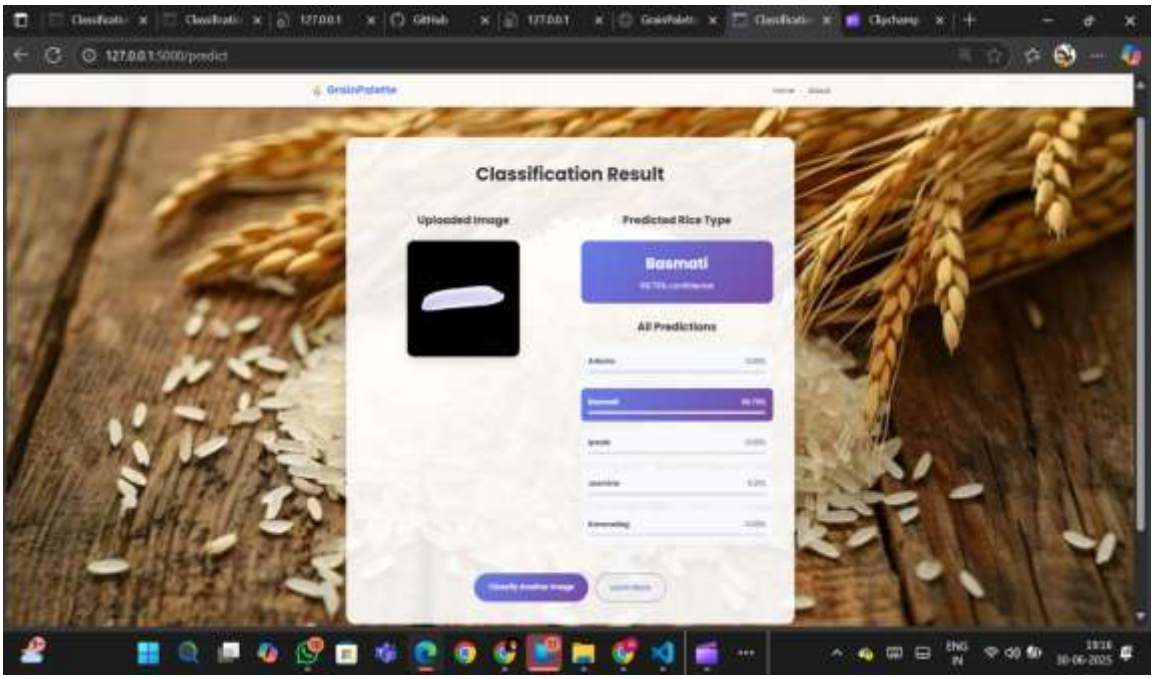


- THIS INDEX.HTML IS USED TO INTERACT WITH THE USER AND THIS WE SHOULD THE IMAGE(JPG, PNG, JPEG) FORMATS FOR THE CLASSIFICATION.

8.2 OUTPUT.HTML Screenshot



- FIRST WE HAVE TO UPLOAD A SAMPLE PIC FOR THE CLASSIFICATION. After upload click “Classify Rice type” and then it will show the output.



9. ADVANTAGES & DISADVANTAGES

Advantages

High accuracy with low computation
Easy to use UI
Deployed online (accessible anytime)
Based on real-world dataset

Disadvantages

Depends on image quality
Dataset-specific; limited to trained rice varieties
High model file size (requires Git LFS)

10. CONCLUSION

GrainPalette successfully demonstrates the application of deep learning in agriculture. It automates the classification of rice types with high accuracy and minimal human intervention. This project showcases end-to-end AI development from model training to web deployment.

11. FUTURE SCOPE

Add more rice types to dataset
Integrate live webcam capture
Develop a mobile app version
Include disease detection in future models

12. APPENDIX

Source Code: https://github.com/sriramvenkat47/grainpallete-using-deep-learning/tree/main
Dataset Link: Kaggle Rice Image Dataset
Demo link :
https://drive.google.com/file/d/15EuoGS6oCCBEPWaKvd5ulwITwwX4rwc4/view?usp=sharing