Rice Type Prediction – Project Documentation

1. Introduction

Project Title: RICE TYPE PREDICTION

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Overview:

It is a smart system that uses deep learning (a type of AI) to automatically detect and identify different types of rice. It uses advanced tools like LIME and SHAP to make sure the results are both accurate and easy to understand.

2. Project Overview

Purpose:

To create a reliable and understandable rice classification tool for farmers, scientists, and food quality experts.

Goals:

- Use transfer learning (reusing pre-trained models)

- Create a system that can be reused

- Add explanation tools (XAI)

- Make a user-friendly interface

Main Features:

✅Correctly identifies 5 rice types

✅Uses pre-trained AI models

✅Includes LIME and SHAP for explanations

✅Simple and clean interface

3. Architecture

System Design:

(Imagine a flow chart: Input image → Preprocessing → Deep Learning Model → Explanation via LIME/SHAP)

Model Details:

- Base Models: MobileNetV2, ResNet50, VGG16

- Layers: Average pooling → Fully connected layers → Dropout → Softmax (for prediction)

- Optimizer: Adam

- Loss Function: Categorical cross-entropy (used for multi-class classification)

4. Setup Instructions

What You Need First:

- Python 3.8 or later

- Jupyter Notebook

- TensorFlow, SHAP, LIME, Flask

How to Install:

git clone https://github.com/Kusuma225/Internship-Project.git

Create a Virtual environment and activate it

pip install -r requirements.txt

Then run the notebooks to train the model or view explanations.

5. Folder Structure

Rice Type Classification/

```
├──── data/                # Rice grain image dataset (organized by class)
├──── models/              # Saved model weights (.h5, .pt, .pickle)
├──── notebooks/           # Jupyter notebooks (training, evaluation, XAI)
│    ├──── Rice_Classification_TransferLearning.ipynb
│    └──── XAI_Explainability.ipynb
├──── src/                 # Core Python scripts
│    ├──── preprocess.py      # Data loading & augmentation
│    ├──── build_model.py     # Transfer learning model definition
│    ├──── train.py           # Training and validation routines
│    ├──── explain.py         # LIME & SHAP based explainability
│    └──── app.py             # Optional UI or API interface
├──── requirements.txt       # Project dependencies
├──── README.md              # Overview and project instructions
```

6. Running the Application

Train the Model:

```
python src/model.py --model MobileNetV2 --epochs 25
```

Explain a Prediction:

```
python src/explain_xai.py --image data/test/basmati1.jpg
```

Start the Web App:

python src/app.py

Open browser at localhost:5000

7. Model Evaluation & Results

- Dataset: 5 types of rice, split 70% for training, 15% for validation, 15% for testing

- Accuracy: Around 99%

- Precision and F1-Score: Over 98%

More details and confusion matrix available in the notebook.

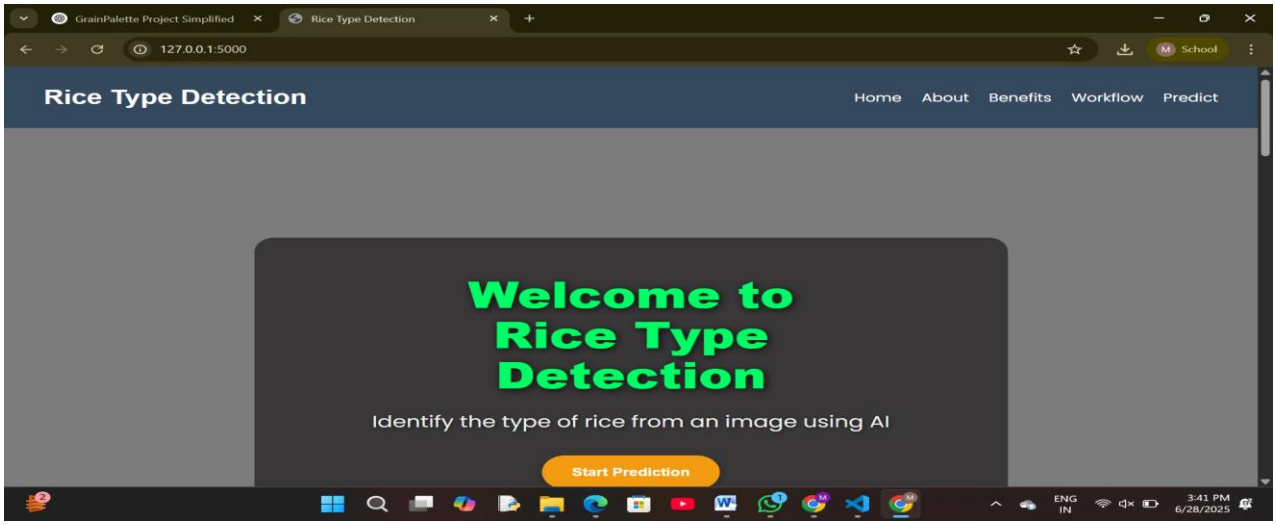
8. Explainability with XAI

- LIME shows which image areas influenced the prediction

- SHAP explains which features matter most overall

These tools help users trust the AI model.

9. User Interface



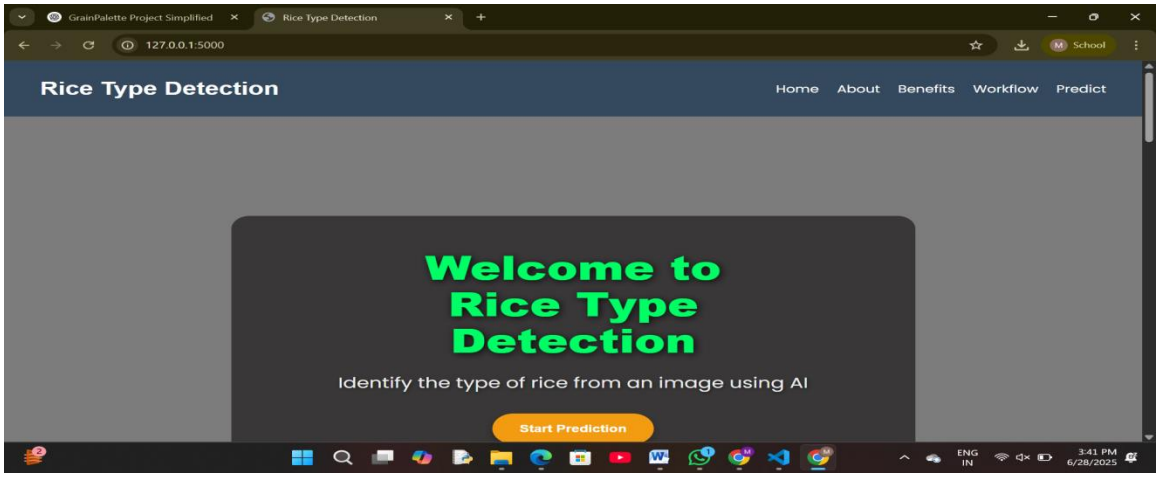
10. Testing Strategy

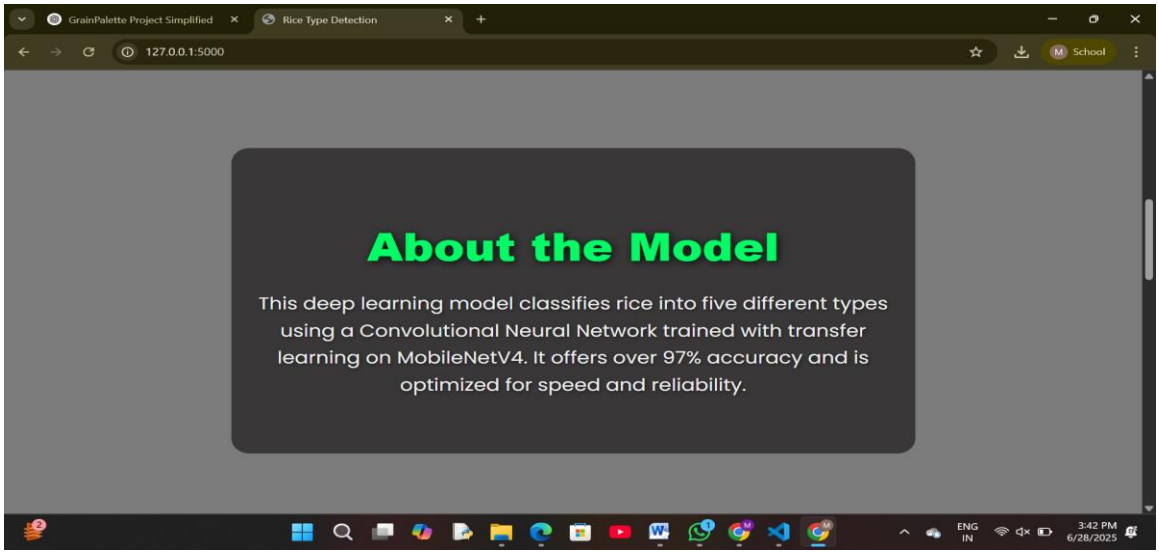
- Checked model accuracy with different scores

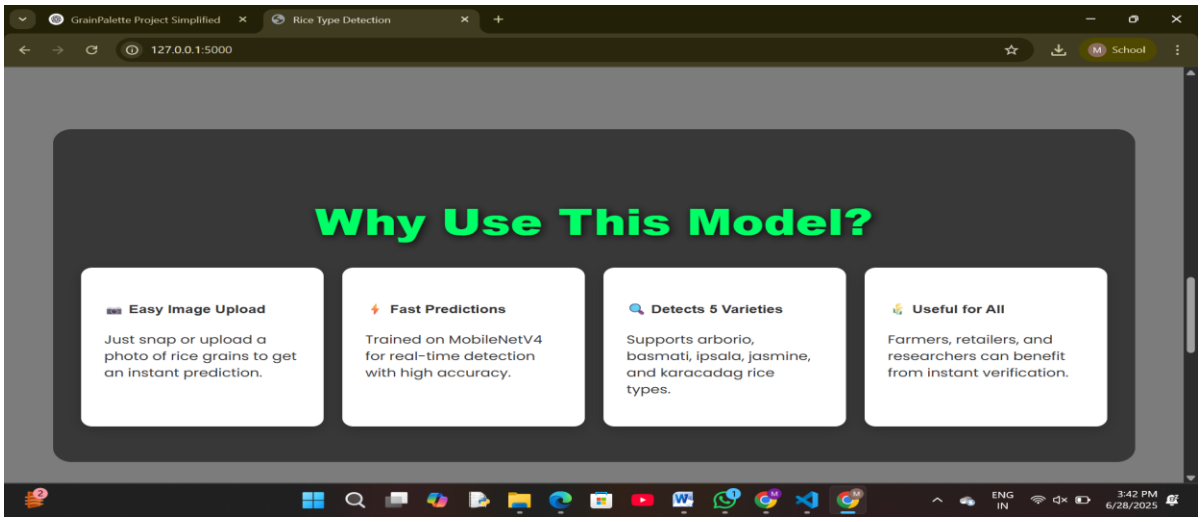
- Manually reviewed LIME and SHAP visual results

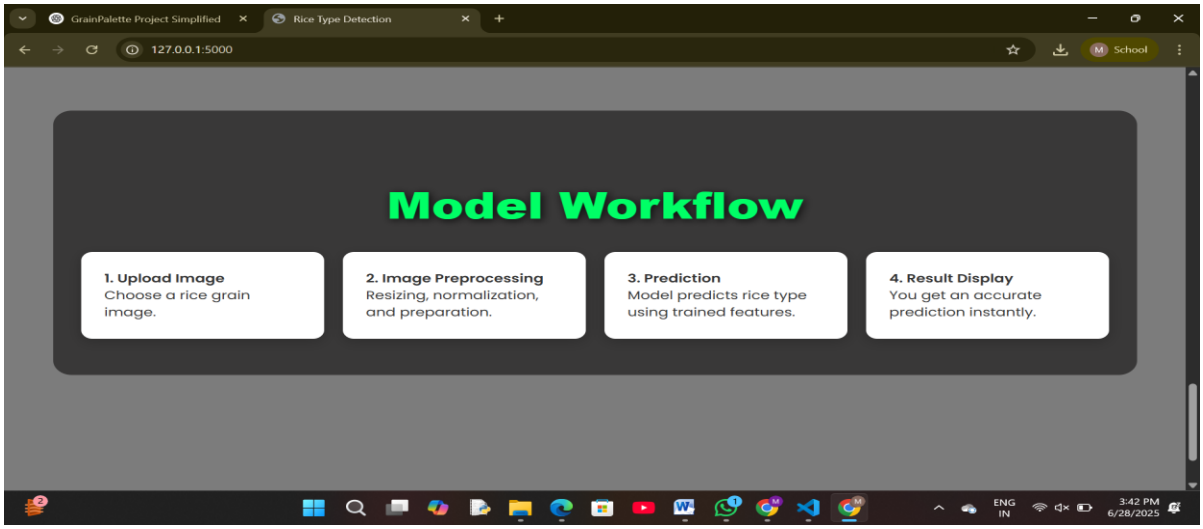
- Used image changes (data augmentation) to test stability

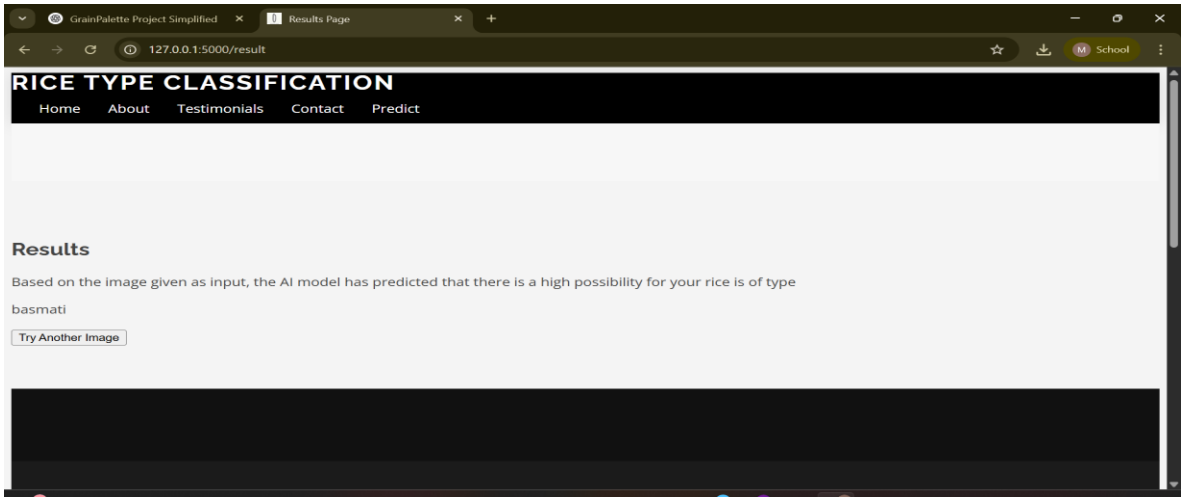
11. Screenshots or Demo

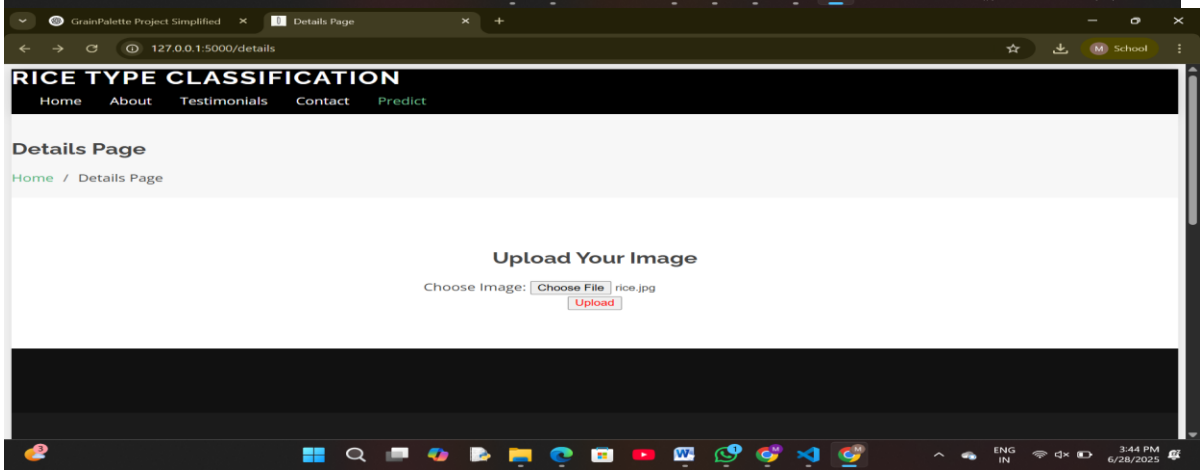



GrainPalette Project Simplified
Rice Type Detection
127.0.0.1:5000
School
About the Model
This deep learning model classifies rice into five different types using a Convolutional Neural Network trained with transfer learning on MobileNetV4. It offers over 97% accuracy and is optimized for speed and reliability.
ENG
IN
3:42 PM
6/28/2025


GrainPalette Project Simplified
Rice Type Detection
127.0.0.1:5000
School
Why Use This Model?
Easy Image Upload
Just snap or upload a photo of rice grains to get an instant prediction.
Fast Predictions
Trained on MobileNetV4 for real-time detection with high accuracy.
Detects 5 Varieties
Supports arborio, basmati, ipsala, jasmine, and karacadag rice types.
Useful for All
Farmers, retailers, and researchers can benefit from instant verification.
ENG
IN
3:42 PM
6/28/2025


GrainPalette Project Simplified
Rice Type Detection
127.0.0.1:5000
School
Model Workflow
1. Upload Image
Choose a rice grain image.
2. Image Preprocessing
Resizing, normalization, and preparation.
3. Prediction
Model predicts rice type using trained features.
4. Result Display
You get an accurate prediction instantly.


GrainPalette Project Simplified
Results Page
127.0.0.1:5000/result
School
RICE TYPE CLASSIFICATION
Home
About
Testimonials
Contact
Predict
Results
Based on the image given as input, the AI model has predicted that there is a high possibility for your rice is of type
basmati
Try Another Image


GrainPalette Project Simplified
Details Page
127.0.0.1:5000/details
School
RICE TYPE CLASSIFICATION
Home
About
Testimonials
Contact
Predict
Details Page
Home / Details Page
Upload Your Image
Choose Image:
Choose File
rice.jpg
Upload

Demo Link
https://drive.google.com/file/d/1sFsdVe5E7A4_i5_Yya_st5VJ0vQesCNz/view?usp=sharing

12. Known Issues

- Only supports 5 rice types

- Sensitive to poor-quality images

- No mobile or real-time camera support yet

13. Future Plans

- Add more rice varieties

- Make it work on phones

- Use live camera input

- Try AutoML and smaller models

14. References

- Rice images: muratkoklu.com

- Pre-trained models: Keras Applications

- Explanation tools: SHAP and LIME documentation

- Research paper: arxiv.org/abs/2505.05513