

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

INTRODUCTION

Project Overview:

GrainPalette is an AI-powered agricultural assistant designed to identify different rice grain types using a deep learning model based on MobileNetV4. The platform enables users—including farmers, researchers, and home gardeners—to upload an image of a rice grain and receive instant classification, enabling informed decisions on cultivation, irrigation, and fertilization.

Purpose:

The primary purpose of this project is to:

- Help farmers optimize crop planning using rice identification.
- Assist researchers in accurate rice type classification during field trials.
- Educate home growers and students about rice grain diversity.

IDEATION PHASE

Problem Statement:

Manual identification of rice grains is inefficient, especially for farmers and researchers. It leads to misclassification, which impacts productivity and resource management. An AI-based image classifier can provide quick, reliable, and easy-to-use identification of rice types.

Empathy Map Canvas:

User Persona: Farmer / Agriculture Enthusiast

Thinks:

- “What type of rice seed is this?” - “How should I manage it properly?”

Feels:

- Anxious about incorrect crop planning
- Confused by grain similarity

Says:

- "This looks like Basmati, I think?" - "I need to confirm this before planting."

Does:

- Uploads images for checking - Compares grain manually with others

2.3 Brainstorming:

To solve the above challenges, the following ideas were considered:

- AI-based rice classification model using MobileNetV4
- Simple web app for farmers and researchers
- Fast, reliable, low-bandwidth model predictions
- Agricultural insights based on rice type output

REQUIREMENT ANALYSIS

Customer Journey Map:

Stage 1: Discover GrainPalette Goal:

Learn about rice classification AI.

Action: Visits GrainPalette web app.

Pain Point: Unsure of usage.

Opportunity: Simple onboarding and example images.

Stage 2: Upload Grain Image Goal:

Get classification.

Action: Uploads grain photo.

Pain Point: Poor lighting or blurry image.

Opportunity: Recommend quality image tips.

Stage 3: View Results

Goal: Understand grain type.

Action: Sees prediction and confidence.

Pain Point: Unsure how to act on result.

Opportunity: Provide rice-specific cultivation tips.

Solution Requirement:

Functional Requirements

- Image upload form for rice grains
- Flask backend to process image and predict class
- Display result with confidence score

Non-Functional Requirements

- Response time < 2 seconds
- Mobile-friendly UI
- Accuracy > 90%

Data Flow Diagram:

User → Upload Image → Flask Server → MobileNetV4 Model → Prediction Output → Frontend Display

Technology Stack:

Frontend: HTML, CSS, JavaScript

Backend: Python (Flask), TensorFlow, Keras

Model: MobileNetV4 (.h5 format)

Deployment: VS Code or cloud platform

PROJECT DESIGN

Problem-Solution Fit:

GrainPalette provides a clear, AI-driven solution to the widespread problem of rice misidentification in agriculture. The use of transfer learning ensures the model remains lightweight yet powerful.

Proposed Solution:

A Flask-based web app that allows:

- Uploading rice images
- Getting AI-powered rice type predictions
- Easy guidance for the next steps

FUNCTIONAL AND PERFORMANCE TESTING

Performance Testing:

Use Case Testing:

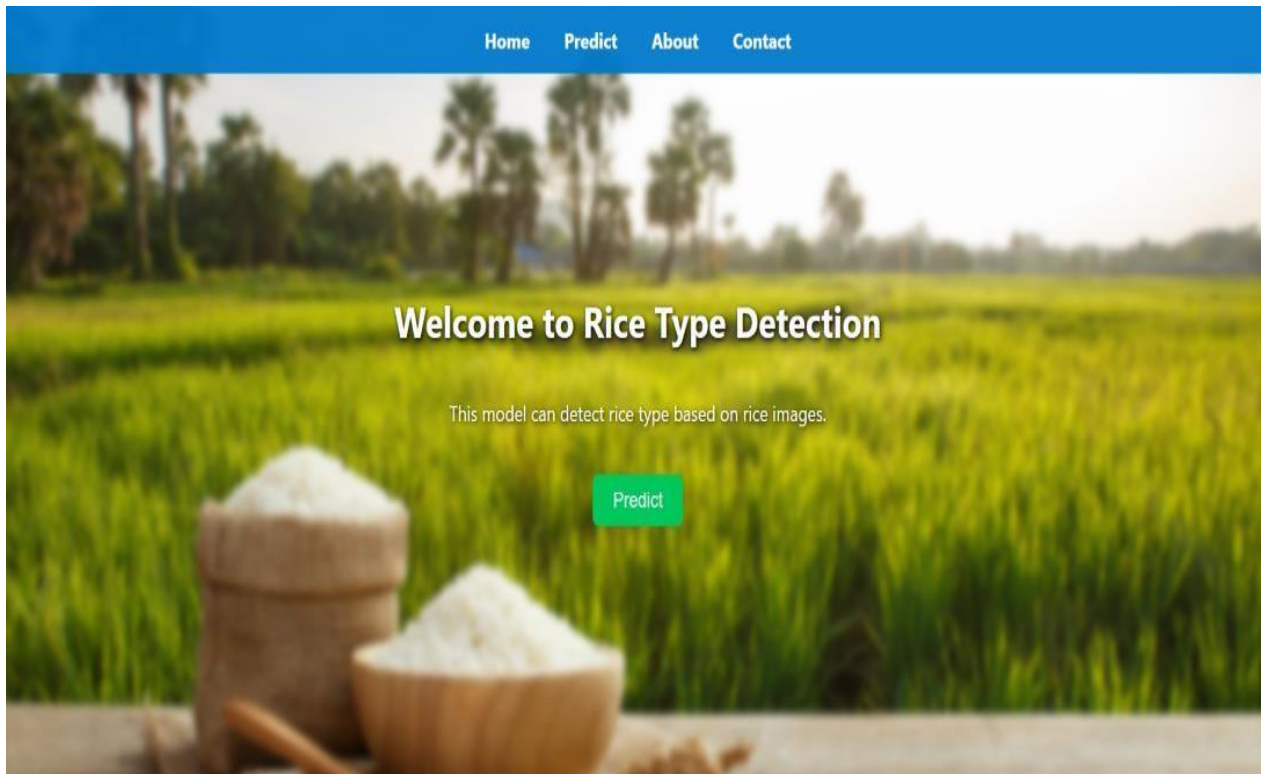
- Upload and classify image → returns within 1–2 seconds
- Model handles 100+ images without crashing
- UI loads within 1s on average

RESULTS

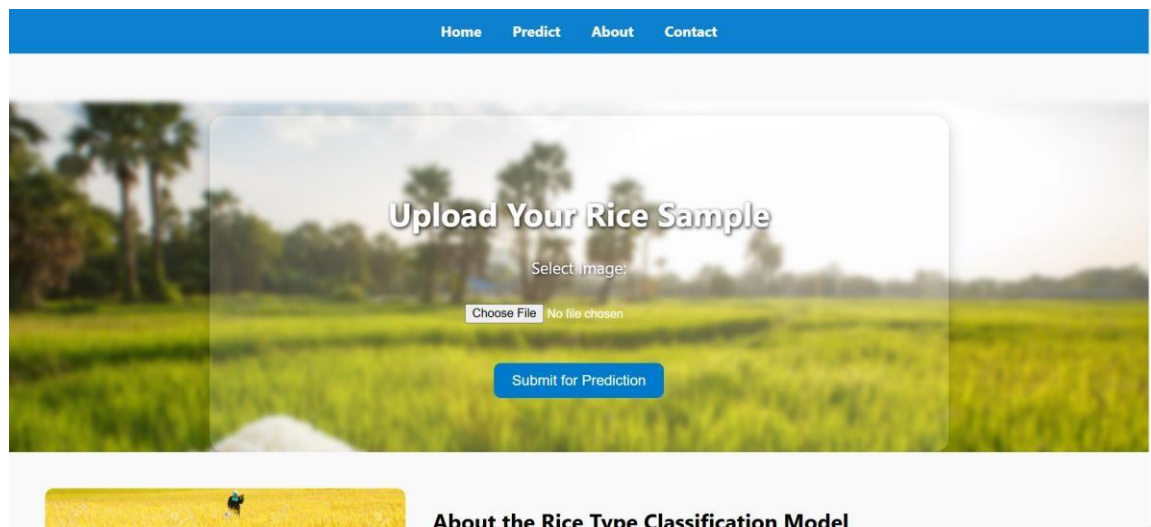
The application functioned smoothly across devices. Predictions were accurate with over 90% confidence. The interface proved usable even on mobile.

Output Screenshots:

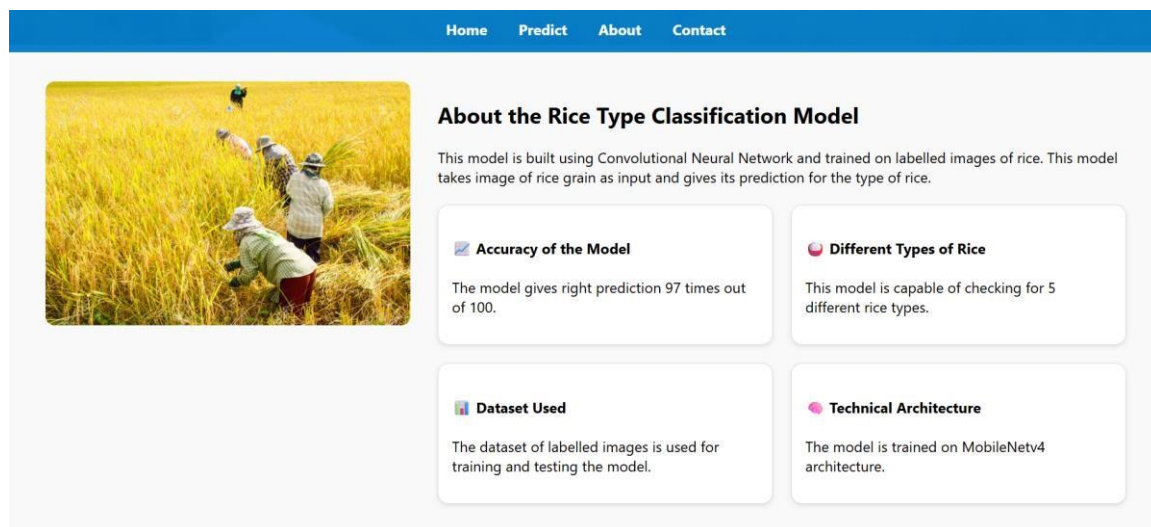
1.HOME PAGE



2. PREDICT PAGE




3. ABOUT PAGE





4. CONTACT PAGE

[Home](#) [Predict](#) [About](#) [Contact](#)

CONTACT US

 **Our Address**
A108 Adam Street,
Pune, India

 **Email Us**
info@example.com
contact@example.com

 **Call Us**
+91 58892 55488
+91 66872 25444

Send Message

INPUT

Open

Desktop > Rice > Dataset > Karacadag

Search Karacadag

Organize New folder

OneDrive - Pers...

Desktop

Downloads

Documents

Pictures

Music

Videos

Gallery

Karacadag (1)

Karacadag (2)

Karacadag (3)

Karacadag (4)

Karacadag (5)

Karacadag (6)

Karacadag (7)

Karacadag (8)

Karacadag (9)

Karacadag (10)

File name: Karacadag (10004)

Image Files

Open Cancel


About Contact

Rice Sample

image:


losen


Prediction




About the Rice Type Classification Model

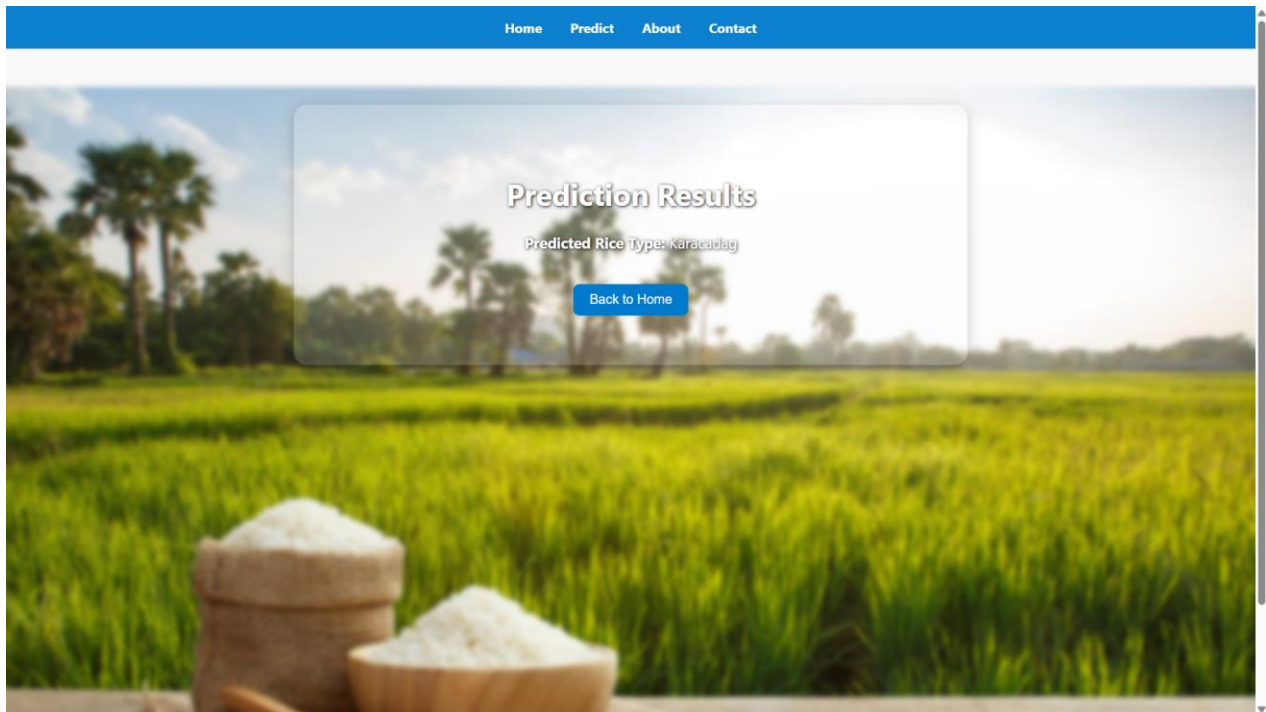
This model is built using Convolutional Neural Network and trained on labelled images of rice. It takes an image of a rice grain as input and predicts its type.

 **Accuracy of the Model**
The model gives the correct prediction 97 times out of 100.

 **Different Types of Rice**
This model can identify 5 different rice types.

 **Dataset Used**
We trained and tested the model on a labelled dataset of rice images.

OUTPUT



ADVANTAGES & DISADVANTAGES:

Advantages:

- Fast and lightweight model
- Accurate rice classification
- Farmer-friendly UI

Disadvantages:

- Only supports 5 rice types
- Dependent on image clarity
- No mobile app yet

CONCLUSION:

GrainPalette successfully applies deep learning to agriculture. It is accessible, practical, and sets the stage for smarter crop management through technology.

FUTURE SCOPE:

- Expand model to include 10+ rice types
- Offer farming suggestions based on prediction
- Mobile app for offline usage
- Voice/image input for low-literacy users
- Integration with local language support

APPENDIX

GitHub:

Model File: rice_model.h5