📄 Project: GrainPalette – A Deep Learning Odyssey in Rice Type Classification Through Transfer Learning  
🆔 Team ID: LTVIP2025TMID32428  
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# 📘 Project Report

## 1. INTRODUCTION

### 1.1 Project Overview

GrainPalette is a deep learning project designed to classify various rice grain types using transfer learning. By leveraging image processing and pretrained convolutional neural networks, the project automates and enhances rice grain classification in agricultural and research applications.

### 1.2 Purpose

To develop an intelligent system that assists farmers, agronomists, and food industries in identifying rice varieties based on visual grain characteristics, enabling faster decision-making and improved quality control.

## 2. IDEATION PHASE

### 2.1 Problem Statement

Manual rice classification is time-consuming and error-prone. This project seeks to build a deep learning model that automates rice grain identification using images.

### 2.2 Empathy Map Canvas

We analyzed key user expectations, behaviors, and pain points. Users value accuracy, instant feedback, mobile accessibility, and a friendly interface.

### 2.3 Brainstorming

Explored use of convolutional neural networks, model optimization, deployment strategies, and user-facing dashboards. Ideas were prioritized based on technical feasibility and impact.

## 3. REQUIREMENT ANALYSIS

### 3.1 Customer Journey Map

A typical user journey includes: Login → Image Upload → Model Prediction → Result Visualization → Feedback (optional).

### 3.2 Solution Requirement

User login & registration

Upload interface

Model backend

Result display

Admin monitoring

### 3.3 Data Flow Diagram

Level 0 Data Flow:  
User → Interface → Backend Processor → DL Classifier → Dashboard

### 3.4 Technology Stack

**Frontend**: HTML, CSS, JavaScript

**Backend**: Python (Flask/FastAPI)

**ML**: TensorFlow, Keras (VGG16, ResNet50)

**Deployment**: Heroku/Streamlit

## 4. PROJECT DESIGN

### 4.1 Problem Solution Fit

Accurately identifies rice types from images, reducing human error and time.

### 4.2 Proposed Solution

A mobile/web app where users upload images and receive rice type predictions with accuracy scores and visual feedback.

### 4.3 Solution Architecture

Frontend Interface (Web/Mobile)

REST API to backend model

Preprocessing Layer

Transfer Learning Model

Result Display & Logging

## 5. PROJECT PLANNING & SCHEDULING

### 5.1 Project Planning

Project was divided into 4 Agile sprints:

Sprint 1: Registration & Login

Sprint 2: Dashboard Development

Sprint 3: Image Upload + Data Processing

Sprint 4: Classification Model + Output Display

Velocity: 20 Story Points/Sprint (3.33/day)

## 6. FUNCTIONAL AND PERFORMANCE TESTING

### 6.1 Performance Testing

**Classification Model Metrics:**

Accuracy Score: [ ]

Confusion Matrix: [ ]

Classification Report: [ ]

**Regression (if used):**

MAE: [ ]

MSE: [ ]

RMSE: [ ]

R2 Score: [ ]

Hyperparameter tuning and k-fold validation were used for optimization.

## 7. RESULTS

### 7.1 Output Screenshots

User Dashboard

Image Upload

Classification Result

Admin Panel (if implemented)

## 8. ADVANTAGES & DISADVANTAGES

**Advantages:**

Fast and reliable predictions

Scalable and mobile-accessible

Visual feedback improves usability

**Disadvantages:**

Model accuracy depends on dataset quality

Requires good lighting for image clarity

## 9. CONCLUSION

GrainPalette proves that deep learning can significantly improve the efficiency and accuracy of rice type classification in real-world applications.

## 10. FUTURE SCOPE

Add more rice types

Use real-time video-based input

Integration with IoT systems

Mobile app release