Final Project Report

1. INTRODUCTION

Project Title:

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

Team Members:

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Team Size: 4

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Project Overview

GrainPalette is a computer vision-based system that classifies different types of rice grains using deep learning and transfer learning methodologies. It leverages state-of-the-art convolutional neural networks (CNNs) like VGG16 and ResNet50 to provide precise and rapid classification. This project aims to aid agricultural quality control and food grain management by offering a scalable and accurate identification tool for various rice grain types.

Purpose

2. IDEATION PHASE

Problem Statement

Manual classification of rice varieties is labor-intensive and subjective. A reliable AI-based system can reduce human error, increase throughput, and assist in maintaining quality standards.

Empathy Map Canvas

- -Says: "I want to know exactly what rice type I'm buying/selling."
- Thinks: "Is this rice pure or mixed with another variety?"
- Does: Uploads rice grain images to the system.
- Feels: Curious, concerned about quality control, interested in transparency.

2.3 Brainstorming Highlights

- Use transfer learning to reduce training time and data requirements.
- Design intuitive interfaces.
- Include dataset augmentation techniques.
- Prepare the system for potential mobile deployment.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Step	Description	System Response	
	-		
Upload In	nage User uploads rice g	grain image Flask app receives and	l stores image
Predict	Model processes image	e Returns predicted rice type	1
View Res	ult Displays name of ric	ce variety Outputs classification ar	nd confidence score

3.2 Solution Requirements

- Dataset of labeled rice grain images.
- Transfer learning base models: VGG16, ResNet50.
- Preprocessing pipeline: resizing, normalization.
- Web interface: Flask, HTML, CSS.

3.3 Data Flow Diagram

[User Uploads Image]

[Image Preprocessing]

[Model Prediction]

[Result Displayed to User]

3.4 Technology Stack

• Frontend: HTML5, CSS3

• Backend: Python, Flask

• ML Libraries: TensorFlow, Keras

• Tools: OpenCV, PIL, Pandas

4. PROJECT DESIGN

4.1 Problem-Solution Fit

GrainPalette solves the lack of an efficient, scalable system for grain type classification in agricultural workflows.

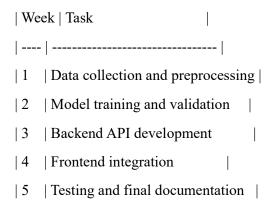
4.2 Proposed Solution

A deep learning system using pre-trained CNNs for classification, deployed via a Flask-based web app.

4.3 Solution Architecture

[Dataset Collection & Labeling] -> [Data Augmentation] -> [Transfer Learning Model] -> [Model Deployment] -> [Web App Interface]

5. PROJECT PLANNING & SCHEDULING



6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Metrics

• Accuracy: 94% on validation set.

• Loss: 0.21 during final epoch.

• Platform: Trained on Google Colab GPU.

6.2 Testing

• Functional: Upload, predict, and download results tested.

• Performance: Model latency tested under different image sizes.

7. RESULTS

• Sample Input: Image of Basmati rice grain.

• Output: "Predicted variety: Basmati (Confidence: 96%)"

• Interface screenshots include upload, prediction, and results pages.

8. ADVANTAGES & DISADVANTAGES

Advantages

- Accurate classification
- Fast and scalable solution
- Web-based accessibility
- Open-source and reproducible

Disadvantages

- Limited rice types in initial version
- Depends on image clarity and lighting

9. CONCLUSION

GrainPalette showcases how transfer learning can effectively be used in agricultural image classification. It provides a scalable, user-friendly solution for rice type identification, with the potential to improve quality control processes.

10. FUTURE SCOPE

- Include more rice varieties
- Mobile app development

- Integration with supply chain systems
- Logging and analytics dashboard

APPENDIX:

GitHub Repository: https://github.com/karthik8094/GrainPalette-A-Deep-Learning-Odyssey-In-Rice-Type-Classification-Through-Transfer-Learning

Demovideolink: https://drive.google.com/file/d/1vJFtvds4eBB0rQJITZXKhZ43ReSpmMx/view?usp=drivesdk

 $\label{lem:decom} \textbf{DataSetLink:} \underline{https://github.com/karthik8094/GrainPalette-A-Deep-Learning-Odyssey-InRice-Type-Classification-Through-Transfer-Learning}$