

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
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Upload Image	User uploads rice grain image	Flask app receives and stores image
Predict	Model processes image	Returns predicted rice type
View Result	Displays name of rice variety	Outputs classification and 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

Week	Task	
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1	Data collection and preprocessing	
2	Model training and validation	
3	Backend API development	
4	Frontend integration	
5	Testing and final documentation	

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>

DataSetLink: <https://github.com/karthik8094/GrainPalette-A-Deep-Learning-Odyssey-In-Rice-Type-Classification-Through-Transfer-Learning>