1. INTRODUCTION

1.1 Project Overview:

The project 'Grain Palette – A Deep Learning Odyssey: Rice Classification through Transfer Learning' aims to automate the classification of rice grains using deep learning.

1.2 Purpose:

To develop a reliable and efficient system using transfer learning that can accurately classify rice varieties, helping streamline quality control and processing.

2. IDEATION PHASE

2.1 Problem Statement:

Manual identification of rice grains is slow and prone to human error. This project solves that using computer vision.

2.2 Empathy Map Canvas:

Users (e.g., farmers, distributors) seek a quick, accurate method to identify rice varieties without technical expertise.

2.3 Brainstorming:

Techniques considered: classic ML, CNNs, pre-trained networks. Transfer learning was selected for performance and data efficiency.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map:

From capturing rice images to model predictions and insights.

3.2 Solution Requirement:

- High accuracy
- Mobile deployability
- Low inference time

3.3 Data Flow Diagram:

User input → Preprocessing → Model Inference → Output Class

3.4 Technology Stack:

- Python, TensorFlow/Keras
- Google Colab
- OpenCV
- MobileNetV2

4. PROJECT DESIGN

4.1 Problem Solution Fit:

Transfer learning allows leveraging large datasets for better performance on small rice datasets.

4.2 Proposed Solution:

A CNN model (MobileNetV2) trained on rice images with custom classification layers.

4.3 Solution Architecture:

[Input Image] → [Pretrained Base] → [Flatten] → [Dense + Dropout] → [Softmax Output]

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning:

- Week 1: Dataset collection
- Week 2: Preprocessing & augmentation
- Week 3: Model training
- Week 4: Testing and documentation

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing:

- Accuracy: 96.2%

- Precision: 95.7%

- Recall: 96.0%

- Confusion matrix analyzed to ensure class separation

7. RESULTS

7.1 Output Screenshots:

Included images of training accuracy/loss curves and predictions with confidence scores

8. ADVANTAGES & DISADVANTAGES

Advantages:

- Fast inference

- Accurate predictions

- Easy to extend

Disadvantages:

- Limited by dataset variety

- Needs internet for model training if using Colab

9. CONCLUSION

Transfer learning provides a practical and scalable approach to automate rice classification, demonstrating impressive accuracy even on relatively small datasets.

10. FUTURE SCOPE

- Mobile/web deployment for farmers

- Include more rice varieties

- Use EfficientNet or transformer-based models

11. APPENDIX

Source Code: https://github.com/ThasmiyaBhanu/GrainPalette/tree/main/Project%20Files

Dataset Link: https://www.muratkoklu.com/datasets/

GitHub & Demo:

https://github.com/ThasmiyaBhanu/GrainPalette/blob/main/Video%20Demo/Rice_grain_

pelette_demo.mp4