**Project Report: GrainPalette – A Deep Learning Odyssey in Rice Type Classification**

**1. INTRODUCTION**

**1.1 Project Overview**  
GrainPalette is a deep learning-based solution that classifies different types of rice grains using image recognition. It leverages transfer learning to reduce training time and increase classification accuracy.

**1.2 Purpose**  
The purpose of this project is to aid agricultural industries and quality control units in automating rice type identification, ensuring faster and more accurate sorting processes.

**2. IDEATION PHASE**

**2.1 Problem Statement**  
Manual classification of rice is time-consuming and error-prone. An AI-based solution is needed to automate and optimize this task.

**2.2 Empathy Map Canvas**

* **Who**: Farmers, distributors, rice mill workers.
* **What they say**: “It’s hard to tell rice types visually.”
* **What they feel**: Pressure to ensure quality and speed.
* **What they do**: Manual sorting and checking.
* **What they hear**: “Mistakes in classification affect sales.”

**2.3 Brainstorming**  
Ideas included traditional ML vs DL, classification of polished/unpolished grains, using CNNs, deploying a mobile/web app for predictions.

**3. REQUIREMENT ANALYSIS**

**3.1 Customer Journey Map**  
From image input (camera/upload) → Model prediction → Rice type output → Accuracy report.

**3.2 Solution Requirement**

* Image dataset of various rice types
* Deep learning model (Transfer Learning using CNN)
* Python, TensorFlow/Keras
* Evaluation metrics (accuracy, precision, etc.)

**3.3 Data Flow Diagram**  
User → Image Input → Preprocessing → CNN Model → Prediction Output

**3.4 Technology Stack**

* Python, Jupyter Notebook
* TensorFlow / Keras
* NumPy, OpenCV, Pandas
* Google Colab
* Streamlit (for demo app, optional)

**4. PROJECT DESIGN**

**4.1 Problem-Solution Fit**  
Matching real-world grain classification issues with AI’s image classification power.

**4.2 Proposed Solution**  
Develop a CNN model using transfer learning (e.g., MobileNet, ResNet) trained on labeled rice grain images.

**4.3 Solution Architecture**

* Image preprocessing → Feature extraction (via pretrained model) → Classification layer → Output (rice type)

**5. PROJECT PLANNING & SCHEDULING**

**5.1 Project Planning**

* Week 1–2: Data collection & preprocessing
* Week 3–4: Model training and evaluation
* Week 5: Performance tuning
* Week 6: Deployment & documentation

**6. FUNCTIONAL AND PERFORMANCE TESTING**

**6.1 Performance Testing**

* Accuracy: XX%
* Loss: YY
* Confusion matrix and classification report used for evaluation.
* Testing on unseen rice images.

**7. RESULTS**

**7.1 Output Screenshots**

* Model summary
* Accuracy/loss graph
* Confusion matrix
* Sample predictions (rice type with image)

**8. ADVANTAGES & DISADVANTAGES**

**Advantages:**

* High accuracy
* Automated and scalable
* Reduces manual labor

**Disadvantages:**

* Needs large and clean datasets
* Performance drops on low-quality images

**9. CONCLUSION**

GrainPalette showcases the power of deep learning in agricultural automation, providing a reliable tool for rice type classification using transfer learning.

**10. FUTURE SCOPE**

* Support for more grain types
* Real-time classification via mobile app
* Integration with supply chain systems
* Multilingual user interface

**11. APPENDIX**

* **Source Code:** [GitHub Link]
* **Dataset Link:** [Dataset Source/Link]
* **Demo Link:** [Streamlit or video demo]