Grain Palette: Deep Learning-Based Rice Type Classification Using Transfer Learning

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PHASE 1: Brainstorming & Ideation

The idea for Grain Palette stemmed from a desire to assist farmers and agricultural researchers in identifying rice varieties more accurately. Traditionally, rice classification is done manually, which can be time-consuming and prone to error. By harnessing the power of deep learning, this project aims to automate rice type identification using transfer learning with MobileNetV2.

This solution addresses challenges such as:
- Misidentification of rice varieties
- Limited access to agronomy experts
- Time and labor required for manual classification

The model predicts the rice type from an uploaded grain image, empowering farmers and researchers to make informed decisions on cultivation strategies.

PHASE 2: Requirement Analysis

Tools and Libraries:

- Python
- TensorFlow/Keras
- NumPy & Matplotlib
- Flask
- Pillow (for image handling)

Functional Requirements:

- Upload image of rice grain
- Predict rice variety using trained CNN model
- Show result and optionally log it
- Display prediction history

Constraints & Challenges:

- Limited datasets for rare rice types
- Need for robust preprocessing (resizing, normalization)
- Ensuring model generalizes to unseen data

PHASE 3: Project Design

System Flow:
Input Image → Preprocessing → CNN Model → Prediction → Output Display

User Flow:
1. User uploads image
2. Model makes prediction
3. Output is displayed 4. Entry is logged in history

UI/UX:
- Simple upload interface
- Clear prediction result - Link to view prediction history

PHASE 4: Project Planning

Adopted Agile methodology with 2 sprints:

Sprint 1: Data collection, cleaning, augmentation Sprint 2: Model training and Flask app integration

Milestones:
- Dataset ready by end of Week 1 - Working model and UI by end of Week 2

PHASE 5: Project Development

Data Preprocessing:
- Resize to 224x224
- Normalize pixels
- Apply augmentations

Model:
- Base: MobileNetV2
- Custom layers: GAP → Dense(128) → Softmax(5)
- Categorical crossentropy loss
- Adam optimizer

Training:
- 10 epochs with validation monitoring
- Save model as rice.h5

PHASE 6: Functional & Performance Testing

Functional Tests:
- Uploads different rice images
- Ensures correct prediction - Handles non-image inputs gracefully

Performance:
- Accuracy >90% on validation
- Real-time prediction (~1s) - Stable logging to CSV file

Conclusion

Grain Palette successfully demonstrates how AI can enhance agricultural workflows. Using transfer learning, the system efficiently identifies rice types from images, offering valuable insights to farmers and researchers. Future enhancements include expanding rice types, cloud deployment, and mobile app integration.