Solution Architecture – Rice Classification Project

Overview

This solution is designed to classify rice grains into their respective types using a deep learning model. It provide

High-Level Architecture

Frontend → Backend → ML Model/API

User interacts via web pages → Backend handles requests (uploads, API calls) → Model loads & predicts result

Components

1. Frontend (Client Interface)
- Built with HTML, CSS, and JavaScript.
- Pages: Home, About, Predict, Contact.
- Allows image upload and shows predictions.

2. Backend (Web Server)
- Developed in Flask / FastAPI (Python).
- REST endpoints: upload, predict.
- Connects frontend to ML model.

3. Machine Learning Model
- CNN-based classifier.
- Saved in .h5 or SavedModel format.

4. Data Storage
- Local or cloud dataset.
- Uploaded images stored temporarily.

5. Logging & Monitoring
- Logs prediction requests/errors.
- Optional: Prometheus/Grafana.

Data Flow

1. User opens Predict page → uploads an image.
2. Frontend sends image to backend (/predict).
3. Backend preprocesses image.
4. ML model predicts rice type.
5. Backend returns prediction.
6. Frontend displays result.

Deployment Options

Local Deployment:
- Run Flask/FastAPI locally.
- Access via localhost.

Cloud Deployment:
- Use Heroku, AWS, GCP, Azure.

Containerization:
- Use Docker for packaging.

Security Considerations

- Validate image type and size.
- Limit file upload size.
- Sanitize file names.
- Use HTTPS in production.

Technologies Used

- Python (Flask/FastAPI)
- TensorFlow / Keras / PyTorch
- HTML, CSS, JavaScript
- OpenCV
- GitHub Actions (optional)

Folder Structure Suggestion

```
rice-classification/
■■■ dataset/
■   ■■■ (training images)
■■■ model/
■   ■■■ rice_classifier.h5
■■■ static/
■   ■■■ css, js, images
■■■ templates/
■   ■■■ index.html, predict.html, etc.
■■■ app.py
■■■ requirements.txt
■■■ README.md
■■■ docs/
    ■■■ solution_architecture.md
```

Future Improvements

- Add feedback loop for mislabeled predictions.
- Build mobile-friendly UI.
- Add user authentication.
- Expand rice type support.