Project Title: Smart Sorting: Transfer Learning for Identifying Rotten Fruits and Vegetables.

Team ID: LTVIP2025TMID47159

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1. Introduction

The"SmartSorting"projectaimstoleverageTransferLearningtechniquestoautomatically classify
fruitsandvegetablesasfreshorrotten.Thissystemassistsinminimizingfoodwaste, improving quality control, and streamlining the sorting process in supply chains.

2. Problem Statement

Rottenfruitsandvegetablesoftengounnoticedinbulktransportationandretail,leadingto health hazards and financial losses. Manual sorting is time-consuming, inconsistent, and inefficient.

3. Objective

To build an AI-based image classification model using Transfer Learning that accurately distinguishesbetweenfreshandrottenproduceandintegratesitintoaweb-basedinterface.

4. Methodology

- Dataset Collection: Images of fruits and vegetables in fresh and rotten conditions.
- Preprocessing: Image resizing, augmentation, and normalization.
- Model Selection: VGG16 pre-trained model used for Transfer Learning.
- Training&Validation:Modeltrainedwithfrozenconvolutionallayersandfine-tunedon dense layers.
- Evaluation: Accuracy, loss metrics, confusion matrix.
- Deployment: Flask-based web application for testing and demonstration.

5. System Architecture

1. User uploads image.

2. Flask server processes and forwards the image to the model.

3. Model predicts the class (Fresh or Rotten).

4. Prediction displayed on the user interface.

6. HTML Pages Overview

- index.html: Landing page for image upload.

- inspect.html: Displays uploaded image and intermediate processing.

- result.html: Shows classification result (Fresh/Rotten).

7. Non-Functional Requirements

FR No. | Non-Functional Requirement | Description

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NFR-1|Usability|SimpleandintuitiveUIfornon-technicaluserstouploadimagesandview results.

NFR-2|Security|Secureimagehandlingandprotectionofuserdata. NFR-3|Reliability|Consistentperformanceandaccuratepredictions. NFR-4 | Performance | Quick response time for predictions.

NFR-5 | Availability | Accessible 24/7 with minimal downtime.

NFR-6 | Scalability | Handles multiple concurrent users and large datasets.

8. Results

- Model Accuracy: ~95% on validation data.

- Real-time predictions within 3 seconds.

- Robust classification across common fruit types: tomatoes, bananas, apples, etc.

9. Conclusion

This project successfully demonstrates how Transfer Learning can be effectively applied to

real-worldproblemslikefoodqualitymonitoring.Thewebinterfacemakesitaccessiblefor practical use in agriculture and retail sectors.

10. **Future Enhancements**

- Expand dataset to include more fruit/vegetable categories.
- Mobile app integration.
- Edge device deployment for offline use.
- Multilingual user interface for global accessibility.

11. **Team ID**

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