Smart Sorting: Transfer Learning for Identifying Rotten Fruits and Vegetables

REPORT

1. INTRODUCTION

1.1 Project Overview:

In larger food processing plant, workers manually sort through thousands of fruits and vegetables daily to separate the rotten ones from fresh products. This process is time consuming, prone to human error, and consist of large labour works. To overcome these problem we develop a project **Smart Sorting: Transfer Learning for Identifying Rotten Fruits and Vegetables**.

This projects aims to develop a system that can automatically classifies fresh and rotten fruits and vegetables. We collected data from kaggle consist 28 categories of fruits and vegetables and trained using transfer learning model VGG16 later deployed it on flask application.

1.2 Purpose:

The primary purpose of this project is to develop an AI-driven solution that helps to consumers, vendors to accurately determine the freshness of fruit and vegetables and to provide fast and accurate result.

2. IDEATION PHASE

2.1 Problem Statement

Identifying spoiled or rotten fruits and vegetable through manual inspection is often inaccurate, time-consuming and prone to human error. This leads to unnecessary food wastage and health issues. There is need of to automate the detection of freshness of fruits and vegetables.

2.2 Empathy Map Canvas

- **Think & Feel : "** I don't know if this fruit is still fresh or not"
- **Hear: "**Check clearly weather fruit is spoiled or not"
- **See :** Spoil produce on fruits and vegetable

3. REQUIREMENT ANALYSIS

3.1 Customer Journey map:

- First the visit the web page
- The user will uploads an image
- Model will predict the image belongs to which class
- Receives output and display the predicted output to user

3.2 Solution Requirement :

- Accurate image classification model
- Web interface for image upload

3.3 Data Flow Diagram :

USER → Web Interface → Uploads → Model Prediction → Display Output

3.4 Technology Stack :

- Software – Python, Flask, Tensorflow, HTML, CSS, Bootstrap

4. PROJECT DESIGN

4.1 Problem Solution Fit :

The solution targets real-life problems of food waste, unclear spoilage, and inefficient sorting by using AI to improve detection accuracy and usability

4.2 Proposed Solution :

A deep learning model deployed via Flask and accessible through web interface. The user will uploads an image and model will predict and displays the output.

4.3 Solution Architecture :

User → Image Upload → Flask API → VGG16 → Prediction → Display Output

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning :

1. Problem Statement
2. Data collection
3. Data Preprocessing
4. Model Training
5. Result Evaluation
6. Fine Tuning

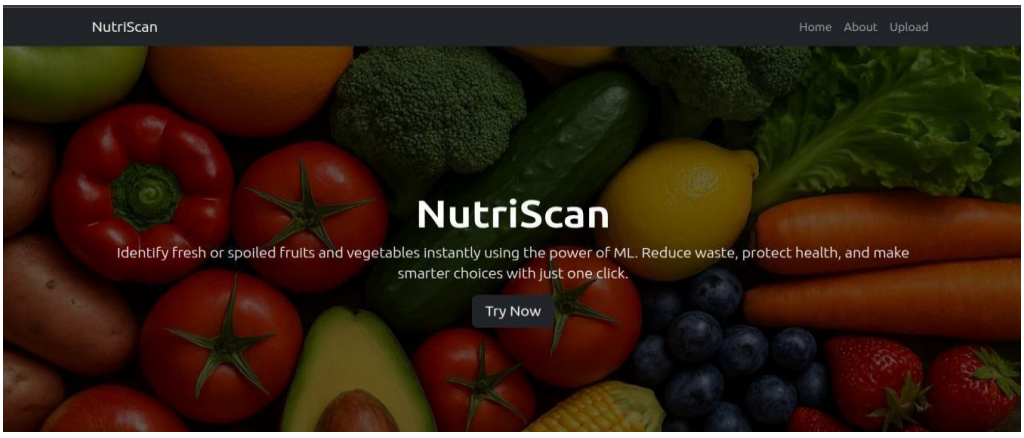
6. FUNCTIONAL AND PERFORMANCE TESTING

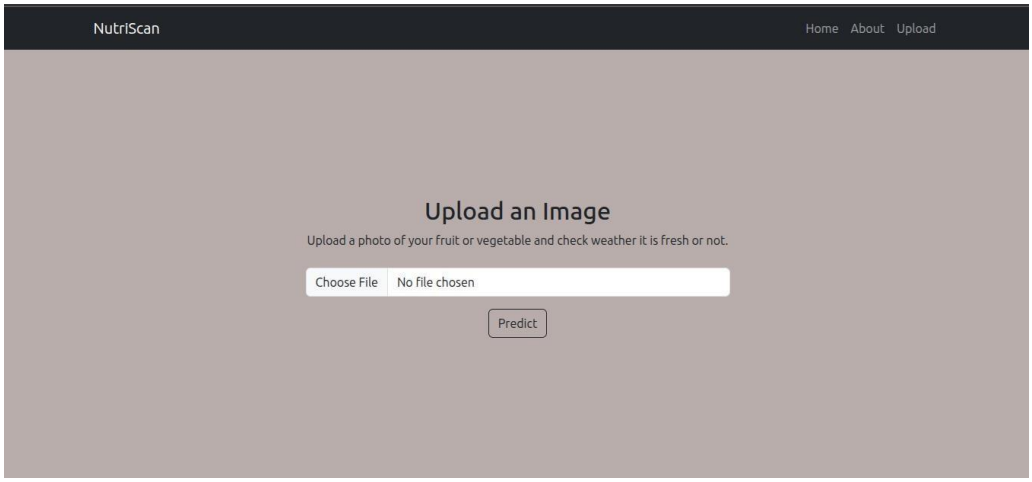
6.1 Performance Testing :

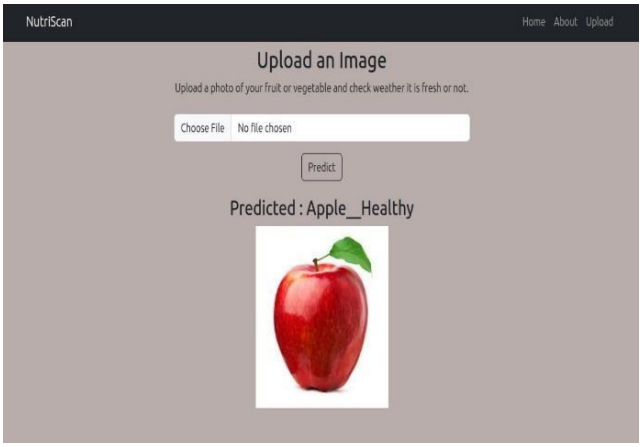
The model achieves a validation accuracy of 80%, demonstrates strong performance in unseen data.

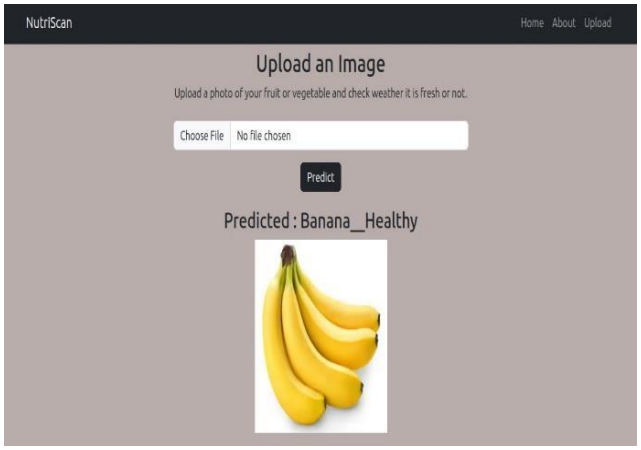
7. RESULTS

7.1 Output Screenshots









8. ADVANTAGES & DISADVANTAGES

Advantages:

- Helps to identify spoiled fruit and vegetable accurate and early
- Consist of user friendly interface

Disadvantages:

- Only work on specific fruits and vegetables(26 categories)

9. CONCLUSION

The project successfully delivers a practical AI solution for sorting fruits and vegetables based on freshness. By using image classification with transfer learning we identified weather the fruit and vegetables are fresh or not.

10. APPENDIX

Dataset: https://www.kaggle.com/datasets/muhammad0subhan/fruit-and-vegetable-disease-healthy-vs-rotten
Demo Link: https://drive.google.com/file/d/1p3CN4RkZk3w9RbUt6A7-49EqwQ3EZlXA/view?usp=sharing

11. FUTURE SCOPE

- **Accuracy Improvement:** Fine-tune the VGG16 model or implement ensemble methods to achieve 90%+ accuracy for more reliable commercial use
- **Multi-image Analysis:** Enable batch processing to analyze multiple fruits/vegetables simultaneously, improving efficiency for large-scale operations
- **Freshness Scoring:** Instead of binary classification, provide a freshness score (0-100%) with estimated shelf life predictions