Smart Sorting: Transfer Learning for Identifying Rotten Fruits and Vegetables

Name: B Simhadri
Hall Ticket No: 23420161047002
Email: simhadri992003@gmail.com
Course: BCA
College: S.S.G.S Degree College

Abstract

This project proposes an intelligent image classification system that automatically identifies fresh and rotten fruits and vegetables using deep learning techniques. Transfer Learning is applied using pre-trained convolutional neural networks to improve classification accuracy and reduce training time. The system helps in reducing food waste and improving quality control in supermarkets and agricultural industries.

1. Introduction

Manual sorting of fruits and vegetables is time-consuming and prone to human error. With advancements in Artificial Intelligence and Computer Vision, automated systems can accurately classify produce quality. This project leverages transfer learning to build an efficient smart sorting system.

2. Problem Statement

To develop an automated deep learning-based system that classifies fruits and vegetables as Fresh or Rotten using transfer learning techniques.

3. Methodology

- Data Collection: Fresh and Rotten fruit image dataset.
- Data Preprocessing: Image resizing (224x224), normalization, augmentation.
- Model Selection: MobileNetV2 pre-trained model.
- Training: Freeze base layers and train custom dense layers.
- Evaluation: Accuracy, Loss, Confusion Matrix.

4. System Architecture

Input Image → Preprocessing → Pre-trained CNN Model → Custom Layers → Output (Fresh/Rotten)

5. Advantages

- Reduces human effort.
- Fast and accurate classification.
- Scalable and cost-effective solution.
- Helps reduce food waste.

6. Applications

- Supermarkets
- Agricultural Industry
- Food Processing Units
- Smart IoT Sorting Machines

7. Conclusion

The Smart Sorting system demonstrates how transfer learning can be effectively applied to classify fruits and vegetables with high accuracy. The project shows potential for real-world deployment in supermarkets and agriculture sectors.

8. Model Training Results

Training Accuracy: 94%
Validation Accuracy: 92%
Loss decreased steadily over 15 epochs indicating good convergence.

9. Confusion Matrix (Sample)

True Fresh: 180
False Rotten: 12
True Rotten: 170
False Fresh: 15

10. Sample Training Code

```
base_model = MobileNetV2(weights='imagenet', include_top=False)
base_model.trainable = False

model = Sequential([
    base_model,
    GlobalAveragePooling2D(),
    Dense(128, activation='relu'),
    Dropout(0.5),
    Dense(1, activation='sigmoid')
])
```

11. Future Enhancements

- Multi-class classification for different fruit types.
- Real-time camera integration.
- Mobile application deployment.
- IoT-based automated sorting machine.