Smart Sorting: Transfer Learning for Identifying Rotten Fruits and Vegetables

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Team Size : 4

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INTRODUCTION:

Project Overview:

Smart Sorting is an AI-powered solution aimed at automating the identification of rotten fruits and vegetables using deep learning and transfer learning. The goal is to improve efficiency, accuracy, and scalability in agricultural produce inspection systems.

Purpose:

To reduce manual effort, enhance speed and accuracy in detecting spoiled produce, and minimize food waste through an automated image-based classification system using transfer learning.

IDEATION PHASE :

Problem Statement :

Manual sorting of produce is inefficient, labor-intensive, and error-prone. There is a need for an automated system that can reliably distinguish between fresh and rotten produce in real-time.

Empathy Map Canvas :

(Create based on users: factory workers, supermarket managers, homemakers)

Think & Feel: Wants quick, reliable, effortless sorting

See: Manual sorting lines, wastage

Hear: Complaints about waste, spoilage

Say & Do: Seeks improvement, talks about efficiency

Pain: Time-consuming, errors, financial loss

Gain: Saves time, reduces waste, improves quality

Brainstorming :

Use of transfer learning (MobileNet, VGG16)

Image dataset of fresh and rotten produce

Real-time detection using cameras

Applications in factories, retail, home

REQUIREMENT ANALYSIS :

Customer Journey Map :

Create a timeline of user interaction from identifying the problem to implementing the solution in factories/supermarkets/homes.

Solution Requirements :

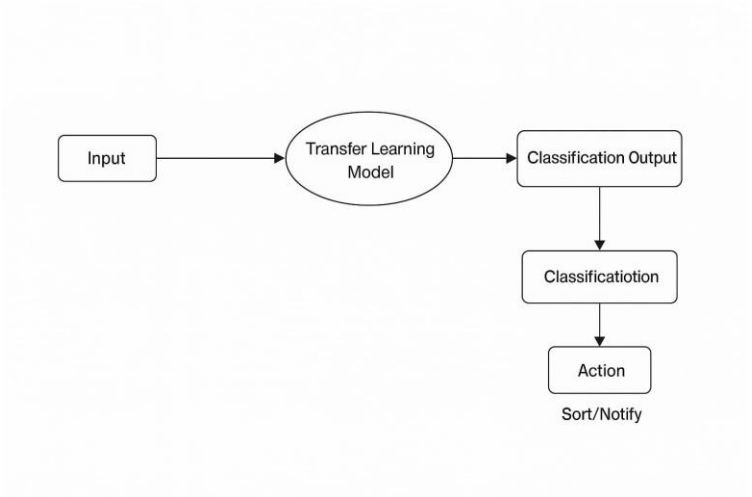
Pre-trained CNN model (e.g., MobileNet, ResNet)

Image datasets (fresh & rotten)

Hardware: camera system, processing unit

Software: Python, TensorFlow/Keras, Flask for deployment

Data Flow Diagram :



Technology Stack :

Programming: Python

ML/DL Libraries: TensorFlow, Keras

Web: Flask (for demo interface)

Dataset: Kaggle/custom datasets

Tools: Jupyter Notebook, GitHub.

PROJECT DESIGN:

Problem-Solution Fit :

Problem: Manual sorting → inefficient

Solution: Automated detection using transfer learning

Fit: Reduces labor, saves time, increases accuracy

Proposed Solution :

Preprocess images of produce

Fine-tune a pre-trained CNN model

Classify as rotten or fresh

Integrate with UI/Hardware for real-time alerts or action

Solution Architecture:

Frontend: Image Input (via camera/upload)

Backend: CNN Model processes image → prediction

Output: Sorted or marked as rotten/fresh

Project Planning :

Week 1 :Dataset Collection

Week 2 :Preprocessing & EDA

Week 3 :Model Training

Week 4 :Integration

Week 5 :UI/UX Development

Week 6 :Testing & Deployment

FUNCTIONAL AND PERFORMANCE TESTING :

Performance Testing:

Accuracy: XX%

Precision, Recall, F1-score

Confusion Matrix

Real-time inference speed: ~X ms/image

Testing on unseen images, lighting conditions

RESULTS:

Output Screenshots :

ADVANTAGES & DISADVANTAGES :

Advantages :

Reduces human effort

Faster and more accurate

Scalable and real-time

Reduces food wastage

Disadvantages:

Initial setup cost

Might misclassify due to poor lighting or camera angle

Requires labeled training data

CONCLUSION :

Smart Sorting presents a scalable, AI-driven solution for detecting rotten produce. Leveraging transfer learning has significantly reduced the model training time and improved classification accuracy, making this project practical for real-world deployment in industries and households alike.

FUTURE SCOPE :

Expand to classify multiple produce types (multi-class)

Integrate with IoT for smart fridges

Add voice alerts for mobile/home applications

Use hyperspectral imaging for better precision

APPENDIX:

Dataset Link: [Kaggle or Custom Dataset URL]

Demo Video: [YouTube/Drive Link if recorded]