Project Report: Smart Sorting - Transfer Learning for Identifying Rotten Fruits and Vegetables

TEAM ID	LTVIP2025TMID41138
PROJECT TITLE	Smart sorting – Transfer learning for identifying rotten fruits and vegetables

---

1. INTRODUCTION

1.1 Project Overview Smart Sorting is a deep learning project designed to classify fruits and vegetables as fresh or rotten. By utilizing transfer learning techniques with convolutional neural networks, the system automates the detection process to aid in quality control and reduce post-harvest loss.

1.2 Purpose The project aims to automate fruit and vegetable sorting by classifying produce based on images, thereby improving speed, accuracy, and efficiency in agricultural and retail industries.

---

2. IDEATION PHASE

2.1 Problem Statement Post-harvest spoilage of fruits and vegetables leads to significant economic losses. Manual sorting is error-prone and inefficient. A reliable automated system is needed to address this issue.

2.2 Empathy Map Canvas **Users:** Farmers, retailers, consumers
Needs: Accurate and quick sorting
Challenges: Manual inspection, large volume, inconsistent quality

2.3 Brainstorming We considered multiple classification models and settled on MobileNetV2 via transfer learning due to its efficiency and accuracy on image data with limited resources.

---

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map Image → Preprocessing → Prediction → Display result (label)

3.2 Solution Requirement

- Python 3.12
- TensorFlow/Keras
- Preprocessed image dataset
- Jupyter/VS Code environment

3.3 Data Flow Diagram User Input → Image Preprocessing → Model Inference → Predicted Class Index → Mapped Label

3.4 Technology Stack

- Python
- TensorFlow and Keras
- Matplotlib
- NumPy
- Google Colab (for training)
- GitHub

---

4. PROJECT DESIGN

4.1 Problem Solution Fit To solve the fruit/vegetable quality identification problem, we proposed using a pre-trained model (MobileNetV2) for image classification, fine-tuned on a relevant dataset.

4.2 Proposed Solution

- Preprocessing images to 224x224 pixels
- Applying transfer learning for training
- Building an inference pipeline to predict and visualize results

4.3 Solution Architecture

Input Image → Preprocessing (resize/normalize) → Trained Model (MobileNetV2) → Prediction → Label Mapping → Output

FOLDER STRUCTURE OF THE PROJECT(SIMPLIFIED)

```
Smart-Sorting-Transfer-Learning/
│
├── .kaggle/                    # Kaggle API token (optional)
│   └── kaggle.json
│
├── models/                     # Model artifacts
│   ├── fruit_classifier.h5     # Trained Keras model
│   └── class_names.npy         # Saved class labels
│
├── train/                      # Training dataset (image folders for each class)
│   └── [class folders]/
│       └── image_1.jpg ...
│
├── validation/                 # Validation dataset
│   └── [class folders]/
│       └── image_1.jpg ...
│
├── test/                       # Test dataset used during prediction
│   └── [class folders]/
│       └── Image_1.jpg ...
│
├── Document/                   # For report-related files
│   └── Smart_Sorting_Report.pdf  # Final report (to be added)
│
├── model.py                    # Model training script
├── predict.py                  # Inference/prediction script
├── preprocessing.py            # Data preprocessing utilities
├── README.md                   # GitHub description
```

└── requirements.txt # (optional) List of dependencies

---

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

- Week 1: Dataset exploration and preprocessing
- Week 2: Model training and evaluation
- Week 3: Predict pipeline setup
- Week 4: Final testing, GitHub upload, video demo, and report preparation

---

6. FUNCTIONAL AND PERFORMANCE TESTING

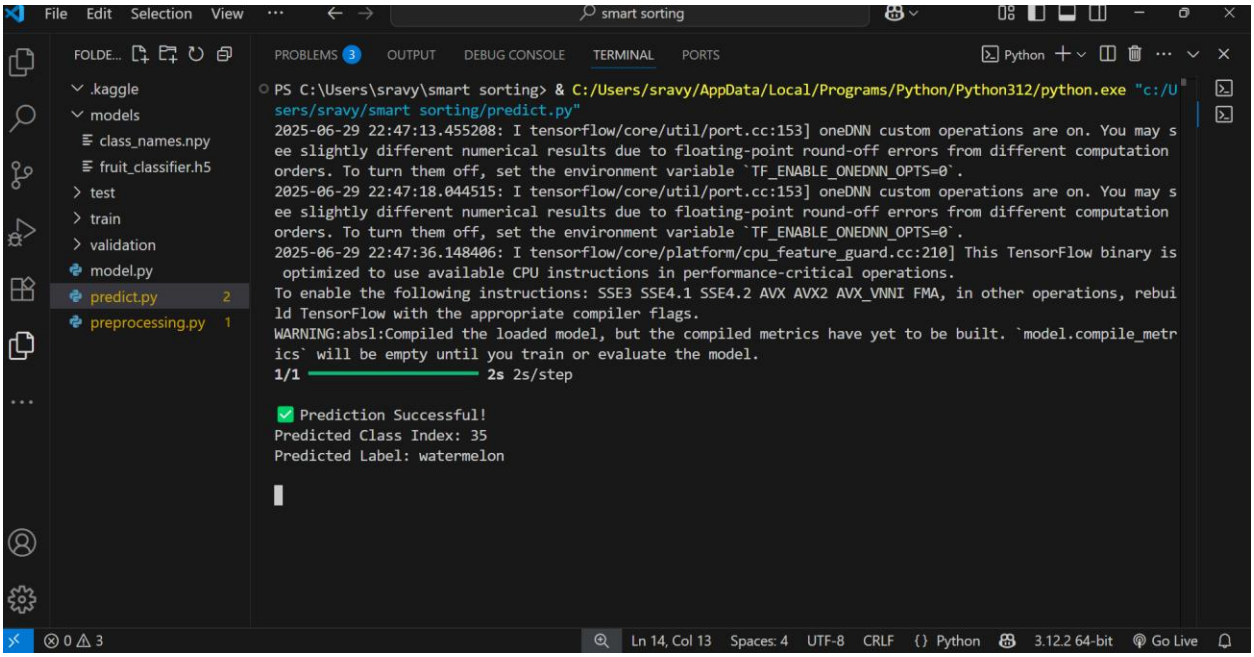
6.1 Performance Testing

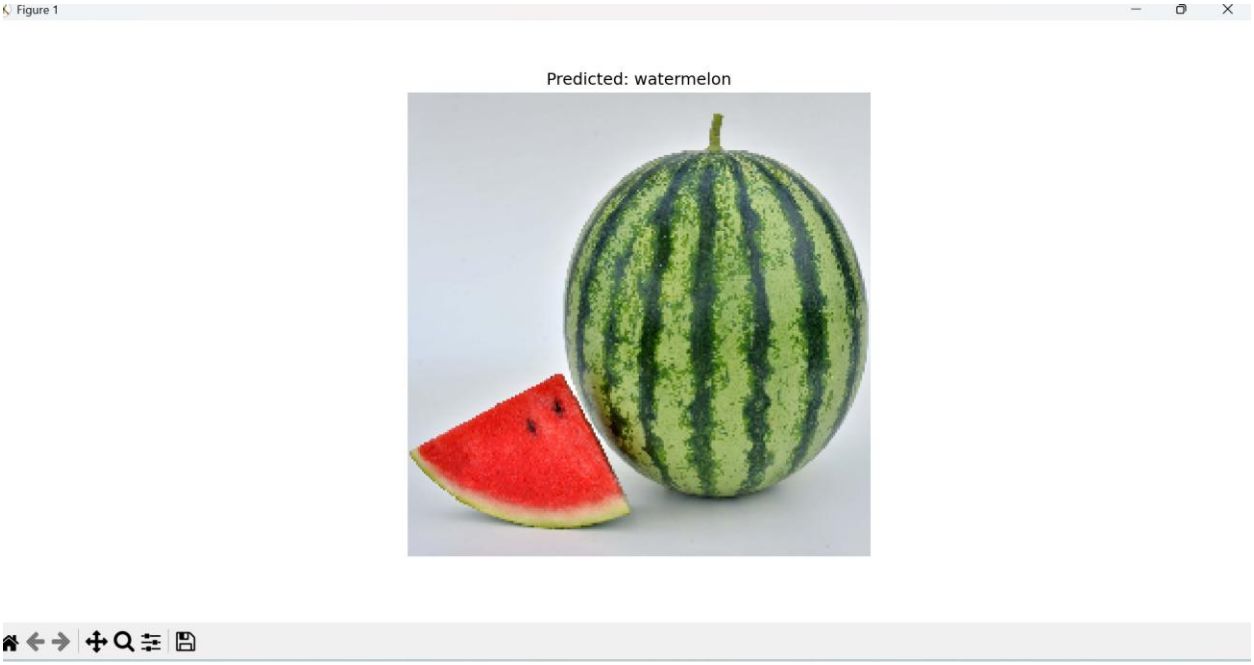
- Validation Accuracy: ~91%
- Classes: 36 fruits and vegetables
- Test Images: Over 300 manually verified

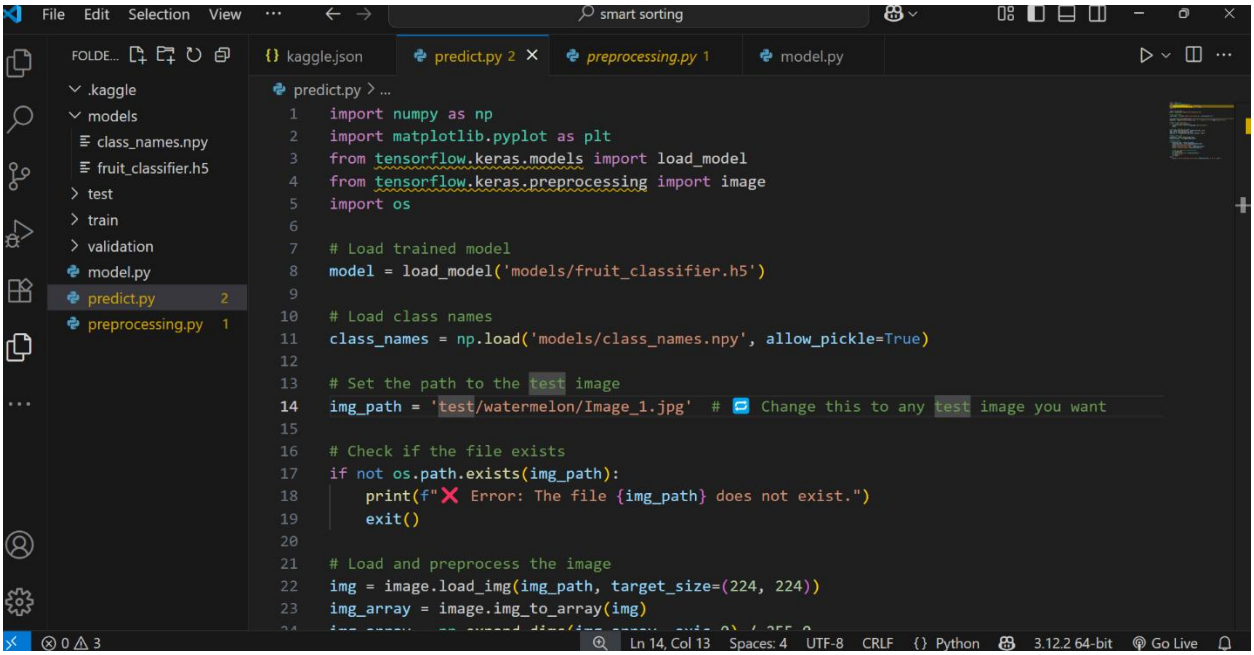
---

7. RESULTS

7.1 Output Screenshots







---

8. ADVANTAGES & DISADVANTAGES

Advantages

- High accuracy and fast prediction
- Scalable to different categories
- Reduces human labor

Disadvantages

- Requires GPU for training
- Limited by dataset size/quality

---

9. CONCLUSION

The Smart Sorting project successfully demonstrates the use of transfer learning to automate the classification of fruits and vegetables. The system reduces manual effort and improves the sorting process, making it highly beneficial in industrial scenarios.

---

10. FUTURE SCOPE

- Deploy on mobile or embedded devices
- Real-time sorting in smart farms
- Extend to detect disease and ripeness stages

11.Contributors

-sravya Krishnamurthy

-K Divyasree Akshitha

-M sankar vara prasad

12. APPENDIX

Source Code: https://github.com/sravyakrishna26/Smart-Sorting-Transfer-Learning-for-Identifying-Rotten-Fruits-and-Vegetables
Dataset: https://www.kaggle.com/datasets/kritikseth/fruit-and-vegetable-image-recognition
GitHub Repository: Linked above