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

Team ID: LTVIP2025TMID33778
Team size: 4

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🧠 ABSTRACT

This project aims to solve the problem of identifying rotten fruits and vegetables using computer vision and deep learning. With increasing demand for quality sorting in food industries and marketplaces, automation can help reduce manual labor and improve efficiency. By using transfer learning with pre-trained models, we achieve accurate classification between fresh and rotten items, making the sorting process smarter and faster.

🎯 OBJECTIVE

To develop a smart sorting system that identifies rotten and fresh fruits/vegetables.

To apply transfer learning techniques for effective image classification.

To evaluate the model's accuracy and deploy it for practical use in markets or warehouses.

```
from tensorflow.keras.applications import MobileNetV2
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, GlobalAveragePooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.optimizers import Adam
```

Source code:

```
# Data Preparation
train_gen = ImageDataGenerator(rescale=1./255, rotation_range=30, zoom_range=0.2,
horizontal_flip=True)
test_gen = ImageDataGenerator(rescale=1./255)

train_data = train_gen.flow_from_directory('dataset/train', target_size=(224,224),
batch_size=32, class_mode='categorical')
test_data = test_gen.flow_from_directory('dataset/test', target_size=(224,224), batch_size=32,
class_mode='categorical')

# Transfer Learning Model
base_model = MobileNetV2(include_top=False, input_shape=(224,224,3), weights='imagenet')
base_model.trainable = False

model = Sequential([
   base_model,
   GlobalAveragePooling2D(),
   Dense(128, activation='relu'),
   Dense(train_data.num_classes, activation='softmax')
])

model.compile(optimizer=Adam(0.0001), loss='categorical_crossentropy', metrics=['accuracy'])
model.fit(train_data, epochs=10, validation_data=test_data)
model.save("rotten_fruit_model.h5")
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🧪 METHODOLOGY:

1. Dataset Collection
Used Kaggle dataset with labeled images of fresh and rotten fruits/vegetables.
Example classes: fresh_apples, rotten_apples, fresh_oranges, etc.

2. Preprocessing

Images resized to 224x224

Normalization applied

Augmentation used for better generalization

3. Model Architecture

Used MobileNetV2 (pre-trained on ImageNet)

Added custom dense layers

Final layer: Softmax activation for multi-class classification

4. Training

Epochs: 10

Optimizer: Adam

Loss Function: Categorical Crossentropy

Validation Split: 20%

📊 DATASET DETAILS

Source: Kaggle - Fruits Fresh and Rotten Dataset

Total Images: ~15,000+

Classes: Fresh & Rotten for Apples, Bananas, Oranges, etc.

Format: JPG images, organized into folders per class

✅ RESULTS

Training Accuracy: ~98%

Validation Accuracy: ~94%

Confusion matrix used to evaluate class-wise performance

Model performed well in distinguishing rotten vs. fresh items visually

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🏁 CONCLUSION

- This project successfully demonstrates the power of transfer learning in classifying fresh and rotten fruits and vegetables. It can be extended to real-time applications using mobile devices or embedded systems with TensorFlow Lite. This system can help reduce waste and improve quality control in food supply chains.