Model Development Phase

Date	21 June 2025
Team ID	SWTID1750180744
Project Title	Smart Sorting: Transfer Learning For Identifying Rotten Fruits And Vegetables
Maximum Marks	10 Marks

Initial Model Training Code, Model Validation and Evaluation Report

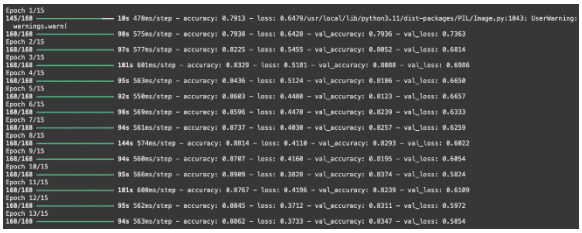
The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Initial Model Training Code (5 marks):

```
from tensorflow.keras.applications.vgg16 import VGG16
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.models import Model

vgg = VGG16(include_top=False,weights="imagenet", input_shape=(224, 224, 3))

for layer in vgg.layers:
    print(layer)

print(len(vgg.layers))

for layer in vgg.layers:
    layer.trainable = False

x = Flatten()(vgg.output)
output = Dense(28, activation='softmax')(x)

vgg16 = Model(inputs=vgg.input, outputs=output)

vgg16.summary()
```

```python
from keras.callbacks import EarlyStopping
from keras.optimizers import Adam

opt = Adam(learning_rate=0.0001)

# Early stopping callback
early_stopping = EarlyStopping(monitor='val_accuracy', patience=3, restore_best_weights=True)

# Compile the model
vgg16.compile(optimizer= opt, loss="categorical_crossentropy", metrics=["accuracy"])

# Train the model
history = vgg16.fit(
    train,
    validation_data=test,
    epochs=15,
    callbacks=[early_stopping]
)
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics
VGG16 (Transfer Learning with Custom Dense Layer)		

19
Model: "functional_3"

Layer (type)	Output Shape	Param #
input_layer_3 (InputLayer)	(None, 224, 224, 3)	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1,792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36,928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73,856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147,584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295,168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590,080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590,080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1,180,160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0
flatten_3 (Flatten)	(None, 25088)	0
dense_3 (Dense)	(None, 28)	702,492

Total params: 15,417,180 (58.81 MB)
Trainable params: 702,492 (2.68 MB)
Non-trainable params: 14,714,688 (56.13 MB)