

## Model Development Phase Template

|               |   |
|---------------|---|
| Date          | 4 July 2025   |
| TeamID        | SWTID1750180871   |
| Project Title | Mangonet: A Vgg16-Based Neural Network For Mango Classification |
| Maximum Marks | 4 Marks   |

### Initial Model Training Code, Model Validation and Evaluation Report:

#### Initial Model Training Code:

```
from tensorflow.keras.applications import VGG16
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.preprocessing.image import ImageDataGenerator

# Load base model
base_model = VGG16(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Freeze base layers
for layer in base_model.layers:
    layer.trainable = False

# Add custom classifier
x = base_model.output
x = Flatten()(x)
x = Dense(128, activation='relu')(x)
predictions = Dense(8, activation='softmax')(x)

model = Model(inputs=base_model.input, outputs=predictions)
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
```

```
# Data generator
datagen = ImageDataGenerator(rescale=1./255, validation_split=0.2)

train_data = datagen.flow_from_directory('mango_dataset', target_size=(224, 224),
                                         batch_size=32, class_mode='categorical',
                                         subset='training')

val_data = datagen.flow_from_directory('mango_dataset', target_size=(224, 224),
                                       batch_size=32, class_mode='categorical',
                                       subset='validation')

# Model Training
history = model.fit(train_data, validation_data=val_data, epochs=10)
```

### Model Validation and Evaluation Report:

| Metric   | Training Set | Validation Set |
|----------|--------------|----------------|
| Accuracy | 82.7%        | 80.6%          |
| Loss     | 0.4635       | 0.6356         |

### Training Progress (per epoch):

| Epoch | Training Accuracy | Validation Accuracy | Training Loss | Validation Loss |
|-------|-------------------|---------------------|---------------|-----------------|
| 1     | 20.7%             | 57.2%               | 3.35          | 1.42            |
| 2     | 52.1%             | 65.3%               | 1.34          | 1.14            |

|    |       |       |      |      |
|----|-------|-------|------|------|
| 3  | 66.2% | 78.1% | 0.98 | 0.87 |
| 4  | 70.1% | 79.4% | 0.78 | 0.71 |
| 5  | 70.6% | 80.0% | 0.75 | 0.66 |
| 6  | 76.7% | 80.6% | 0.62 | 0.71 |
| 7  | 76.8% | 84.7% | 0.63 | 0.60 |
| 8  | 78.2% | 82.2% | 0.58 | 0.63 |
| 9  | 80.3% | 85.0% | 0.50 | 0.52 |
| 10 | 82.7% | 80.6% | 0.46 | 0.64 |

### Model Summary (Key Layers):

| Layer | Output Shape      | Parameters | Trainable? |
|-------|-------------------|------------|------------|
| VGG16 | (None, 7, 7, 512) | 14,714,688 | No         |

|         |               |           |     |
|---------|---------------|-----------|-----|
| Flatten | (None, 25088) | 0         | Yes |
| Dense   | (None, 256)   | 6,422,784 | Yes |
| Dropout | (None, 256)   | 0         | Yes |
| Dense   | (None, 8)     | 2,056     | Yes |