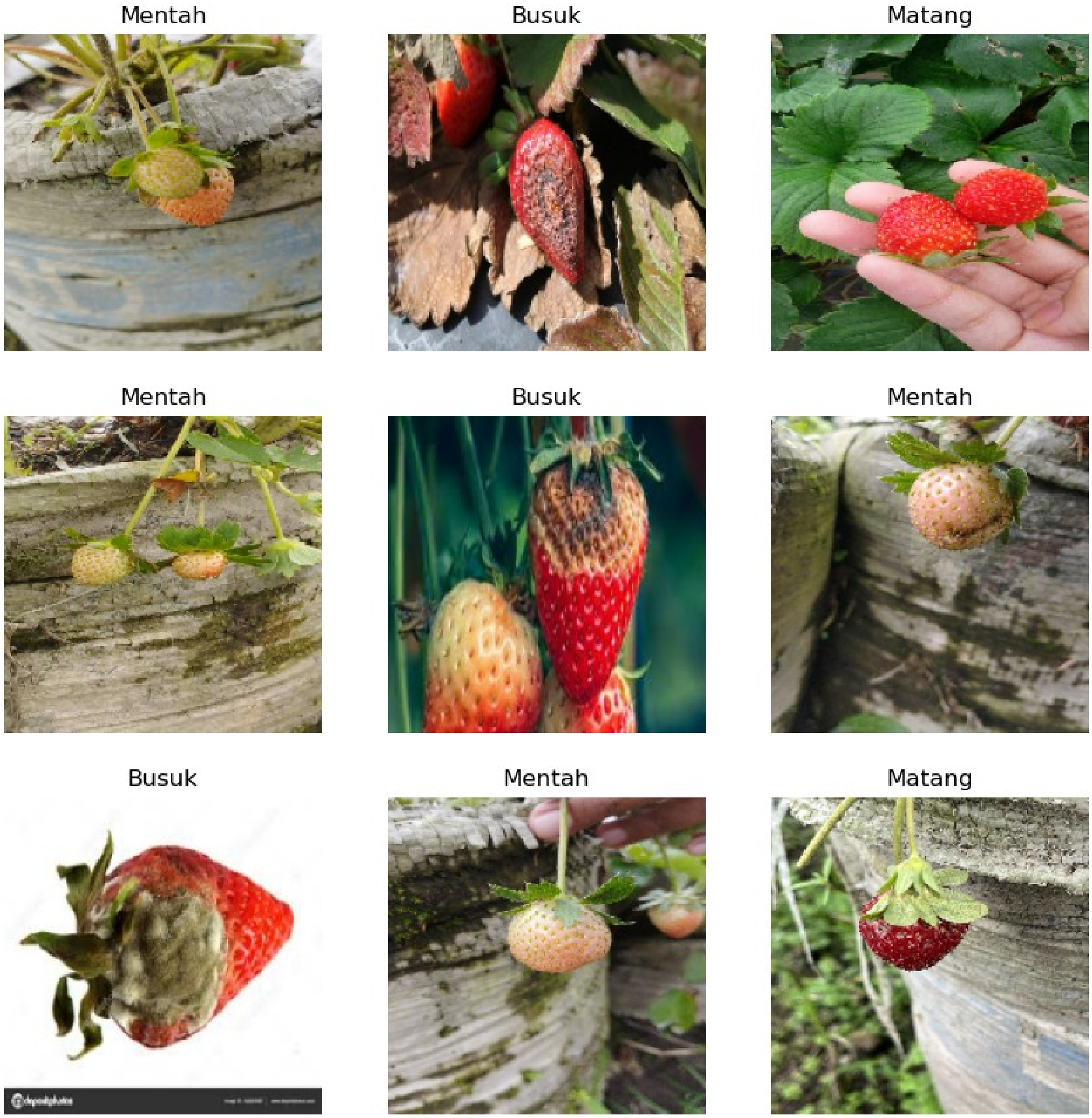
GOOGLE NET

```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras import layers, models

# Load data
data_dir = r"D:\coolyeah\semester5\ml\tubes_uas\train_data\train_data"
img_size = 180
batch = 32

# Load dataset
dataset = tf.keras.utils.image_dataset_from_directory(
    data_dir,
    seed=123,
    image_size=(img_size, img_size),
    batch_size=batch,
)

# Total images
total_count = len(dataset) * batch  # Hitung total gambar
print("Total Images: ", total_count)

# Calculate counts for train, validation, and test sets
train_count = int(total_count * 0.8)
val_count = int(total_count * 0.1)
test_count = total_count - train_count - val_count

print("Train Images: ", train_count)
print("Validation Images: ", val_count)
print("Test Images: ", test_count)

# Split dataset into train, validation, and test sets
train_ds = dataset.take(train_count // batch)
val_ds = dataset.skip(train_count // batch).take(val_count // batch)
test_ds = dataset.skip(train_count // batch + val_count //
batch).take(test_count // batch)

# Check class names
class_names = dataset.class_names
print("Class Names: ", class_names)
```

```
Found 301 files belonging to 3 classes.
Total Images:  320
Train Images:  256
Validation Images:  32
Test Images:  32
Class Names:  ['Busuk', 'Matang', 'Mentah']
```

```
import matplotlib.pyplot as plt
```

```
i = 0
plt.figure(figsize=(10,10))

for images, labels in train_ds.take(1):
    for i in range(9):
        plt.subplot(3,3, i+1)
        plt.imshow(images[i].numpy().astype('uint8'))
        plt.title(class_names[labels[i]])
        plt.axis('off')
```



```
for images, labels in train_ds.take(1):
    images_array = np.array(images)
    print(images_array.shape)

#loop untuk mengecek atribut gambar(jumlah, tinggi, lebar, dan
channel(RGB))
```

```
(32, 180, 180, 3)
```

```
import os
import numpy as np
import tensorflow as tf
from tensorflow.keras import layers, Sequential
from PIL import Image
import matplotlib.pyplot as plt

# If using Jupyter Notebook, uncomment the following line
# %matplotlib inline

# Define image size and batch size
img_size = 180  # Example image size
batch_size = 32  # Example batch size

# Define the path to your dataset
data_dir = r"D:\coolyeah\semester5\ml\tubes_uas\train_data\train_data"
# Replace with your dataset path

# Function to load images and labels
def load_images_from_directory(directory):
    images = []
    labels = []
    class_names = os.listdir(directory)  # Get class names from
directory
    for label, class_name in enumerate(class_names):
        class_dir = os.path.join(directory, class_name)
        if os.path.isdir(class_dir):
            for file_name in os.listdir(class_dir):
                if file_name.lower().endswith(('.png', '.jpg',
'.jpeg', '.gif', '.bmp')):
                    file_path = os.path.join(class_dir, file_name)
                    try:
                        img = Image.open(file_path).convert('RGB')  #
Open and convert to RGB
                        img = img.resize((img_size, img_size))  #
Resize image
                        images.append(np.array(img))  # Convert to
numpy array
                        labels.append(label)  # Append label
                    except Exception as e:
                        print(f"Error loading image {file_path}: {e}")
    return np.array(images), np.array(labels)

# Load images and labels
images, labels = load_images_from_directory(data_dir)

# Check the shape of the loaded images
print(f"Loaded {len(images)} images with shape: {images.shape}")

# Create a TensorFlow dataset
train_ds = tf.data.Dataset.from_tensor_slices((images, labels))

# Shuffle and batch the dataset
Tuner = tf.data.AUTOTUNE
train_ds =
train_ds.shuffle(buffer_size=1000).batch(batch_size).prefetch(buffer_s
ize=Tuner)

# Data augmentation using Sequential
data_augmentation = Sequential([
    layers.RandomFlip("horizontal", input_shape=(img_size, img_size,
3)),
    layers.RandomRotation(0.1),
    layers.RandomZoom(0.1)
])

# Visualize augmented images
plt.figure(figsize=(10, 10))
for images_batch, labels_batch in train_ds.take(1):
    augmented_images = data_augmentation(images_batch)  # Apply data
augmentation
    for i in range(min(9, augmented_images.shape[0])):  # Ensure we
don't exceed the number of images
        plt.subplot(3, 3, i + 1)
        plt.imshow(augmented_images[i].numpy().astype('uint8'))
        plt.axis('off')
plt.show()
```

```
Loaded 301 images with shape: (301, 180, 180, 3)

c:\Users\capsl\anaconda3\Lib\site-packages\keras\src\layers\
preprocessing\tf_data_layer.py:19: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
  super().__init__(**kwargs)
```

```
import tensorflow as tf
from tensorflow.keras import layers, models
from tensorflow.keras.layers import Input, Dense, Conv2D, Flatten,
MaxPooling2D, AveragePooling2D, Dropout, BatchNormalization
from tensorflow.keras import regularizers
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.callbacks import EarlyStopping,
ReduceLROnPlateau

def googlenet(input_shape, n_classes):

    def inception_block(x, filters):
        # 1x1 Convolution
        branch1x1 = Conv2D(filters[0], (1, 1), padding='same',
activation='relu')(x)
        branch1x1 = BatchNormalization()(branch1x1)

        # 1x1 Convolution followed by 3x3 Convolution
        branch3x3 = Conv2D(filters[1], (1, 1), padding='same',
activation='relu')(x)
        branch3x3 = BatchNormalization()(branch3x3)
        branch3x3 = Conv2D(filters[2], (3, 3), padding='same',
activation='relu')(branch3x3)
        branch3x3 = BatchNormalization()(branch3x3)

        # 1x1 Convolution followed by 5x5 Convolution
        branch5x5 = Conv2D(filters[3], (1, 1), padding='same',
activation='relu')(x)
        branch5x5 = BatchNormalization()(branch5x5)
        branch5x5 = Conv2D(filters[4], (5, 5), padding='same',
activation='relu')(branch5x5)
        branch5x5 = BatchNormalization()(branch5x5)

        # 3x3 MaxPooling followed by 1x1 Convolution
        branch_pool = MaxPooling2D((3, 3), strides=(1, 1),
padding='same')(x)
        branch_pool = Conv2D(filters[5], (1, 1), padding='same',
activation='relu')(branch_pool)
        branch_pool = BatchNormalization()(branch_pool)

        # Concatenate all branches
        outputs = layers.concatenate([branch1x1, branch3x3, branch5x5,
branch_pool], axis=-1)
        return outputs

    input = Input(shape=input_shape)

    # Initial Convolution Layer
    x = Conv2D(64, (7, 7), strides=(2, 2), padding='same',
activation='relu')(input)
    x = BatchNormalization()(x)
    x = MaxPooling2D((3, 3), strides=(2, 2))(x)

    # Inception Blocks
    x = inception_block(x, [64, 128, 128, 32, 32, 32])
    x = inception_block(x, [128, 128, 192, 96, 96, 64])
    x = MaxPooling2D((3, 3), strides=(2, 2))(x)

    x = inception_block(x, [192, 96, 208, 16, 48, 64])
    x = inception_block(x, [160, 112, 224, 24, 64, 64])
    x = inception_block(x, [128, 128, 256, 24, 64, 64])
    x = inception_block(x, [112, 144, 288, 32, 64, 64])
    x = inception_block(x, [256, 160, 320, 32, 128, 128])
    x = MaxPooling2D((3, 3), strides=(2, 2))(x)

    x = inception_block(x, [256, 160, 320, 32, 128, 128])
    x = inception_block(x, [384, 192, 384, 48, 128, 128])

    # Average Pooling and Fully Connected Layer
    x = AveragePooling2D((7, 7))(x)
    x = Flatten()(x)
    x = Dense(256, activation='relu',
kernel_regularizer=regularizers.l2(0.01))(x)
    x = Dropout(0.5)(x)
    output = Dense(n_classes, activation='softmax')(x)

    model = models.Model(inputs=input, outputs=output)
    return model

# Data Augmentation
datagen = ImageDataGenerator(
    rotation_range=40,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)

# Input shape and class names
input_shape = (180, 180, 3)
class_names = ['Busuk', 'Matang', 'Mentah']
n_classes = len(class_names)

# Clear Keras session
tf.keras.backend.clear_session()

# Create model
model = googlenet(input_shape, n_classes)
model.summary()
```

```
Model: "functional"

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━━━━━┓
┃ Layer (type)         ┃ Output Shape      ┃    Param # ┃ Connected to
┃
┡━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━╇━━━━━━━━━━━━━━
━━━━━┩
│ input_layer          │ (None, 180, 180,  │          0 │ -
│
```

```
│ (InputLayer)        │ 3)                │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d (Conv2D)     │ (None, 90, 90,    │      9,472 │
input_layer[0][0] │
│                     │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalization │ (None, 90, 90,    │        256 │ conv2d[0][0]
│
│ (BatchNormalizatio… │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ max_pooling2d       │ (None, 44, 44,    │          0 │
batch_normalizat… │
│ (MaxPooling2D)      │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_2 (Conv2D)   │ (None, 44, 44,    │      8,320 │
max_pooling2d[0]… │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_4 (Conv2D)   │ (None, 44, 44,    │      2,080 │
max_pooling2d[0]… │
│                     │ 32)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 44, 44,    │        512 │ conv2d_2[0]
[0]     │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 44, 44,    │        128 │ conv2d_4[0]
[0]     │
│ (BatchNormalizatio… │ 32)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ max_pooling2d_1     │ (None, 44, 44,    │          0 │
max_pooling2d[0]… │
│ (MaxPooling2D)      │ 64)               │            │
```

```
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_1 (Conv2D)   │ (None, 44, 44,    │      4,160 │
max_pooling2d[0]… │
│                     │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_3 (Conv2D)   │ (None, 44, 44,    │    147,584 │
batch_normalizat… │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_5 (Conv2D)   │ (None, 44, 44,    │     25,632 │
batch_normalizat… │
│                     │ 32)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_6 (Conv2D)   │ (None, 44, 44,    │      2,080 │
max_pooling2d_1[… │
│                     │ 32)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        256 │ conv2d_1[0]
[0]     │
│ (BatchNormalizatio… │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        512 │ conv2d_3[0]
[0]     │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        128 │ conv2d_5[0]
[0]     │
│ (BatchNormalizatio… │ 32)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        128 │ conv2d_6[0]
[0]     │
│ (BatchNormalizatio… │ 32)               │            │
│
```

```
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ concatenate         │ (None, 44, 44,    │          0 │
batch_normalizat… │
│ (Concatenate)       │ 256)              │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_8 (Conv2D)   │ (None, 44, 44,    │     32,896 │
concatenate[0][0] │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_10 (Conv2D)  │ (None, 44, 44,    │     24,672 │
concatenate[0][0] │
│                     │ 96)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 44, 44,    │        512 │ conv2d_8[0]
[0]     │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 44, 44,    │        384 │ conv2d_10[0]
[0]    │
│ (BatchNormalizatio… │ 96)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ max_pooling2d_2     │ (None, 44, 44,    │          0 │
concatenate[0][0] │
│ (MaxPooling2D)      │ 256)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_7 (Conv2D)   │ (None, 44, 44,    │     32,896 │
concatenate[0][0] │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_9 (Conv2D)   │ (None, 44, 44,    │    221,376 │
batch_normalizat… │
│                     │ 192)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_11 (Conv2D)  │ (None, 44, 44,    │    230,496 │
batch_normalizat… │
│                     │ 96)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_12 (Conv2D)  │ (None, 44, 44,    │     16,448 │
max_pooling2d_2[… │
│                     │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        512 │ conv2d_7[0]
[0]     │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        768 │ conv2d_9[0]
[0]     │
│ (BatchNormalizatio… │ 192)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        384 │ conv2d_11[0]
[0]    │
│ (BatchNormalizatio… │ 96)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 44, 44,    │        256 │ conv2d_12[0]
[0]    │
│ (BatchNormalizatio… │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ concatenate_1       │ (None, 44, 44,    │          0 │
batch_normalizat… │
│ (Concatenate)       │ 480)              │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
```

```
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ max_pooling2d_3      │ (None, 21, 21,     │           0 │
concatenate_1[0]… │
│ (MaxPooling2D)       │ 480)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ conv2d_14 (Conv2D)   │ (None, 21, 21,     │      46,176 │
max_pooling2d_3[… │
│                      │ 96)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ conv2d_16 (Conv2D)   │ (None, 21, 21,     │       7,696 │
max_pooling2d_3[… │
│                      │ 16)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ batch_normalizatio… │ (None, 21, 21,     │         384 │ conv2d_14[0]
[0]    │
│ (BatchNormalizatio… │ 96)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ batch_normalizatio… │ (None, 21, 21,     │          64 │ conv2d_16[0]
[0]    │
│ (BatchNormalizatio… │ 16)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ max_pooling2d_4      │ (None, 21, 21,     │           0 │
max_pooling2d_3[… │
│ (MaxPooling2D)       │ 480)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ conv2d_13 (Conv2D)   │ (None, 21, 21,     │      92,352 │
max_pooling2d_3[… │
│                      │ 192)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
───────┤
│ conv2d_15 (Conv2D)   │ (None, 21, 21,     │     179,920 │
batch_normalizat… │
│                      │ 208)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
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─────┤
│ conv2d_17 (Conv2D)  │ (None, 21, 21,     │     19,248 │
batch_normalizat… │
│                     │ 48)                │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ conv2d_18 (Conv2D)  │ (None, 21, 21,     │     30,784 │
max_pooling2d_4[… │
│                     │ 64)                │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │        768 │ conv2d_13[0]
[0]    │
│ (BatchNormalizatio… │ 192)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │        832 │ conv2d_15[0]
[0]    │
│ (BatchNormalizatio… │ 208)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │        192 │ conv2d_17[0]
[0]    │
│ (BatchNormalizatio… │ 48)                │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │        256 │ conv2d_18[0]
[0]    │
│ (BatchNormalizatio… │ 64)                │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ concatenate_2       │ (None, 21, 21,     │          0 │
batch_normalizat… │
│ (Concatenate)       │ 512)               │            │
batch_normalizat… │
│                     │                    │            │
batch_normalizat… │
│                     │                    │            │
batch_normalizat… │
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ conv2d_20 (Conv2D)  │ (None, 21, 21,     │     57,456 │
concatenate_2[0]… │
```

```
│                      │ 112)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv2d_22 (Conv2D)   │ (None, 21, 21,     │      12,312 │
concatenate_2[0]… │
│                      │ 24)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ batch_normalizatio…  │ (None, 21, 21,     │         448 │ conv2d_20[0]
[0]    │
│ (BatchNormalizatio…  │ 112)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ batch_normalizatio…  │ (None, 21, 21,     │          96 │ conv2d_22[0]
[0]    │
│ (BatchNormalizatio…  │ 24)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ max_pooling2d_5      │ (None, 21, 21,     │           0 │
concatenate_2[0]… │
│ (MaxPooling2D)       │ 512)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv2d_19 (Conv2D)   │ (None, 21, 21,     │      82,080 │
concatenate_2[0]… │
│                      │ 160)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv2d_21 (Conv2D)   │ (None, 21, 21,     │     226,016 │
batch_normalizat… │
│                      │ 224)               │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv2d_23 (Conv2D)   │ (None, 21, 21,     │      38,464 │
batch_normalizat… │
│                      │ 64)                │             │
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv2d_24 (Conv2D)   │ (None, 21, 21,     │      32,832 │
max_pooling2d_5[… │
│                      │ 64)                │             │
```

```
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │        640 │ conv2d_19[0]
[0]   │
│ (BatchNormalizatio… │ 160)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │        896 │ conv2d_21[0]
[0]   │
│ (BatchNormalizatio… │ 224)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │        256 │ conv2d_23[0]
[0]   │
│ (BatchNormalizatio… │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │        256 │ conv2d_24[0]
[0]   │
│ (BatchNormalizatio… │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ concatenate_3       │ (None, 21, 21,    │          0 │
batch_normalizat… │
│ (Concatenate)       │ 512)              │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
│                     │                   │            │
batch_normalizat… │
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_26 (Conv2D)  │ (None, 21, 21,    │     65,664 │
concatenate_3[0]… │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_28 (Conv2D)  │ (None, 21, 21,    │     12,312 │
concatenate_3[0]… │
│                     │ 24)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
```

```
│ batch_normalizatio… │ (None, 21, 21,    │        512 │ conv2d_26[0]
[0]    │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,    │         96 │ conv2d_28[0]
[0]    │
│ (BatchNormalizatio… │ 24)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ max_pooling2d_6     │ (None, 21, 21,    │          0 │
concatenate_3[0]… │
│ (MaxPooling2D)      │ 512)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_25 (Conv2D)  │ (None, 21, 21,    │     65,664 │
concatenate_3[0]… │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_27 (Conv2D)  │ (None, 21, 21,    │    295,168 │
batch_normalizat… │
│                     │ 256)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_29 (Conv2D)  │ (None, 21, 21,    │     38,464 │
batch_normalizat… │
│                     │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_30 (Conv2D)  │ (None, 21, 21,    │     32,832 │
max_pooling2d_6[… │
│                     │ 64)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,    │        512 │ conv2d_25[0]
[0]    │
│ (BatchNormalizatio… │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,    │      1,024 │ conv2d_27[0]
[0]    │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │         256 │ conv2d_29[0]
[0]    │
│ (BatchNormalizatio… │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │         256 │ conv2d_30[0]
[0]    │
│ (BatchNormalizatio… │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ concatenate_4       │ (None, 21, 21,     │           0 │
batch_normalizat… │
│ (Concatenate)       │ 512)               │             │
batch_normalizat… │
│                     │                    │             │
batch_normalizat… │
│                     │                    │             │
batch_normalizat… │
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_32 (Conv2D)  │ (None, 21, 21,     │      73,872 │
concatenate_4[0]… │
│                     │ 144)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_34 (Conv2D)  │ (None, 21, 21,     │      16,416 │
concatenate_4[0]… │
│                     │ 32)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │         576 │ conv2d_32[0]
[0]    │
│ (BatchNormalizatio… │ 144)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,     │         128 │ conv2d_34[0]
[0]    │
│ (BatchNormalizatio… │ 32)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
```

```
─────┤
│ max_pooling2d_7     │ (None, 21, 21,    │           0 │
concatenate_4[0]… │
│ (MaxPooling2D)      │ 512)              │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ conv2d_31 (Conv2D)  │ (None, 21, 21,    │      57,456 │
concatenate_4[0]… │
│                     │ 112)              │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ conv2d_33 (Conv2D)  │ (None, 21, 21,    │     373,536 │
batch_normalizat… │
│                     │ 288)              │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ conv2d_35 (Conv2D)  │ (None, 21, 21,    │      51,264 │
batch_normalizat… │
│                     │ 64)               │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ conv2d_36 (Conv2D)  │ (None, 21, 21,    │      32,832 │
max_pooling2d_7[… │
│                     │ 64)               │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │         448 │ conv2d_31[0]
[0]   │
│ (BatchNormalizatio… │ 112)              │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │       1,152 │ conv2d_33[0]
[0]   │
│ (BatchNormalizatio… │ 288)              │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 21, 21,    │         256 │ conv2d_35[0]
[0]   │
│ (BatchNormalizatio… │ 64)               │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────
─────┤
```

```
│ batch_normalizatio… │ (None, 21, 21,      │         256 │ conv2d_36[0]
[0]    │
│ (BatchNormalizatio… │ 64)                 │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ concatenate_5       │ (None, 21, 21,      │           0 │
batch_normalizat… │
│ (Concatenate)       │ 528)                │             │
batch_normalizat… │
│                     │                     │             │
batch_normalizat… │
│                     │                     │             │
batch_normalizat… │
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_38 (Conv2D)  │ (None, 21, 21,      │      84,640 │
concatenate_5[0]… │
│                     │ 160)                │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_40 (Conv2D)  │ (None, 21, 21,      │      16,928 │
concatenate_5[0]… │
│                     │ 32)                 │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,      │         640 │ conv2d_38[0]
[0]    │
│ (BatchNormalizatio… │ 160)                │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,      │         128 │ conv2d_40[0]
[0]    │
│ (BatchNormalizatio… │ 32)                 │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ max_pooling2d_8     │ (None, 21, 21,      │           0 │
concatenate_5[0]… │
│ (MaxPooling2D)      │ 528)                │             │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ conv2d_37 (Conv2D)  │ (None, 21, 21,      │     135,424 │
concatenate_5[0]… │
│                     │ 256)                │             │
```

```
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ conv2d_39 (Conv2D)    │ (None, 21, 21,       │       461,120 │
batch_normalizat… │
│                       │ 320)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ conv2d_41 (Conv2D)    │ (None, 21, 21,       │       102,528 │
batch_normalizat… │
│                       │ 128)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ conv2d_42 (Conv2D)    │ (None, 21, 21,       │        67,712 │
max_pooling2d_8[… │
│                       │ 128)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,       │         1,024 │ conv2d_37[0]
[0]    │
│ (BatchNormalizatio… │ 256)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,       │         1,280 │ conv2d_39[0]
[0]    │
│ (BatchNormalizatio… │ 320)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,       │           512 │ conv2d_41[0]
[0]    │
│ (BatchNormalizatio… │ 128)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ batch_normalizatio… │ (None, 21, 21,       │           512 │ conv2d_42[0]
[0]    │
│ (BatchNormalizatio… │ 128)                 │               │
│
├───────────────────────┼──────────────────────┼───────────────┼──────────────
──────┤
│ concatenate_6         │ (None, 21, 21,       │             0 │
batch_normalizat… │
│ (Concatenate)         │ 832)                 │               │
batch_normalizat… │
```

```
│                     │                    │             │
batch_normalizat… │
│                     │                    │             │
batch_normalizat… │
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ max_pooling2d_9     │ (None, 10, 10,     │           0 │
concatenate_6[0]… │
│ (MaxPooling2D)      │ 832)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_44 (Conv2D)  │ (None, 10, 10,     │     133,280 │
max_pooling2d_9[… │
│                     │ 160)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_46 (Conv2D)  │ (None, 10, 10,     │      26,656 │
max_pooling2d_9[… │
│                     │ 32)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │         640 │ conv2d_44[0]
[0]    │
│ (BatchNormalizatio… │ 160)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │         128 │ conv2d_46[0]
[0]    │
│ (BatchNormalizatio… │ 32)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ max_pooling2d_10    │ (None, 10, 10,     │           0 │
max_pooling2d_9[… │
│ (MaxPooling2D)      │ 832)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_43 (Conv2D)  │ (None, 10, 10,     │     213,248 │
max_pooling2d_9[… │
│                     │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_45 (Conv2D)  │ (None, 10, 10,     │     461,120 │
batch_normalizat… │
│                     │ 320)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_47 (Conv2D)  │ (None, 10, 10,     │     102,528 │
batch_normalizat… │
│                     │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ conv2d_48 (Conv2D)  │ (None, 10, 10,     │     106,624 │
max_pooling2d_10… │
│                     │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │       1,024 │ conv2d_43[0]
[0]   │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │       1,280 │ conv2d_45[0]
[0]   │
│ (BatchNormalizatio… │ 320)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │         512 │ conv2d_47[0]
[0]   │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │         512 │ conv2d_48[0]
[0]   │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
─────┤
│ concatenate_7       │ (None, 10, 10,     │           0 │
batch_normalizat… │
│ (Concatenate)       │ 832)               │             │
batch_normalizat… │
│                     │                    │             │
batch_normalizat… │
│                     │                    │             │
batch_normalizat… │
```

```
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_50 (Conv2D)  │ (None, 10, 10,    │    159,936 │
concatenate_7[0]… │
│                     │ 192)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_52 (Conv2D)  │ (None, 10, 10,    │     39,984 │
concatenate_7[0]… │
│                     │ 48)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,    │        768 │ conv2d_50[0]
[0]    │
│ (BatchNormalizatio… │ 192)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,    │        192 │ conv2d_52[0]
[0]    │
│ (BatchNormalizatio… │ 48)               │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ max_pooling2d_11    │ (None, 10, 10,    │          0 │
concatenate_7[0]… │
│ (MaxPooling2D)      │ 832)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_49 (Conv2D)  │ (None, 10, 10,    │    319,872 │
concatenate_7[0]… │
│                     │ 384)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_51 (Conv2D)  │ (None, 10, 10,    │    663,936 │
batch_normalizat… │
│                     │ 384)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ conv2d_53 (Conv2D)  │ (None, 10, 10,    │    153,728 │
batch_normalizat… │
│                     │ 128)              │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
```

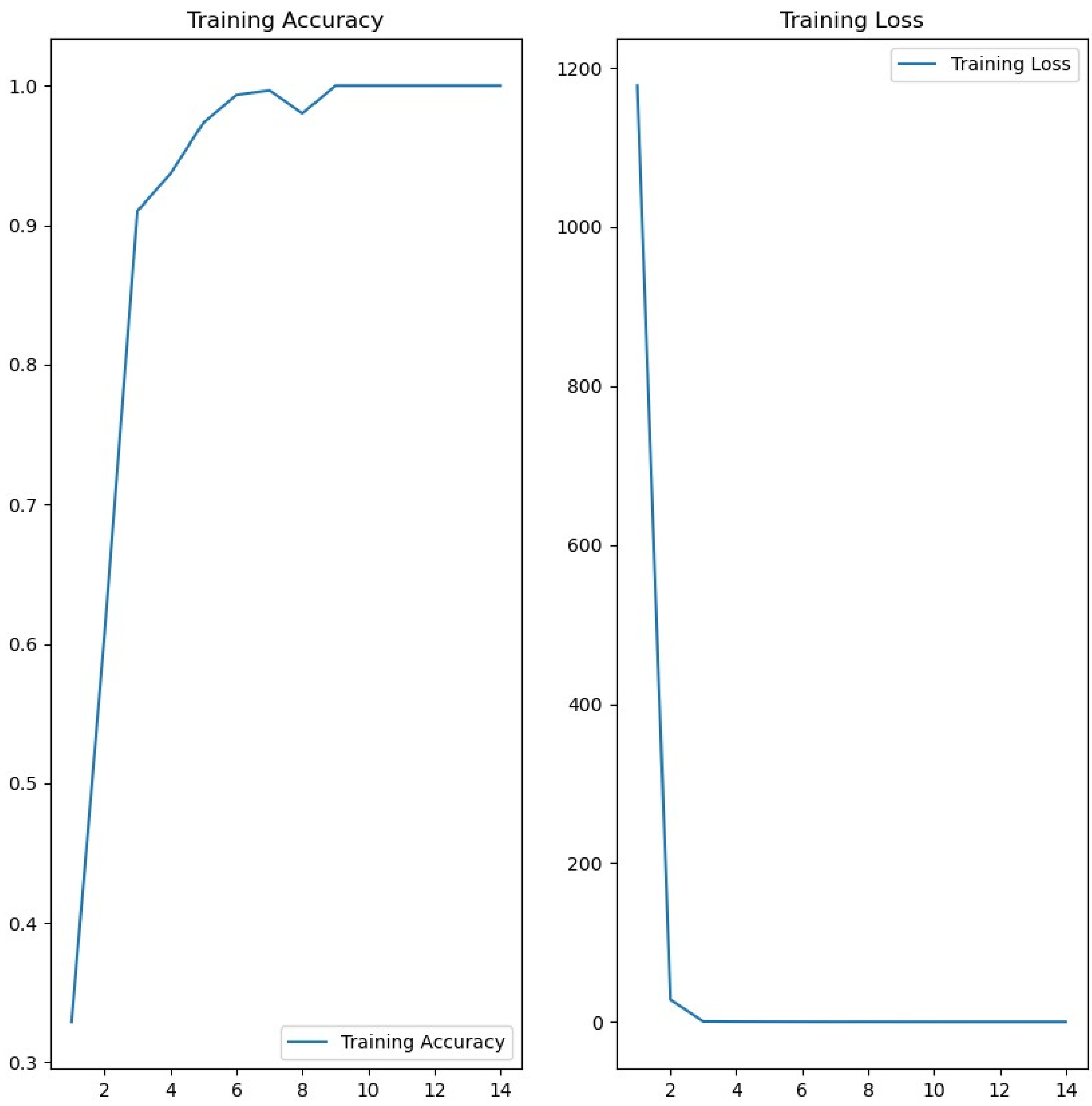
```
─────┤
│ conv2d_54 (Conv2D)  │ (None, 10, 10,     │    106,624 │
max_pooling2d_11… │
│                     │ 128)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │      1,536 │ conv2d_49[0]
[0]    │
│ (BatchNormalizatio… │ 384)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │      1,536 │ conv2d_51[0]
[0]    │
│ (BatchNormalizatio… │ 384)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │        512 │ conv2d_53[0]
[0]    │
│ (BatchNormalizatio… │ 128)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ batch_normalizatio… │ (None, 10, 10,     │        512 │ conv2d_54[0]
[0]    │
│ (BatchNormalizatio… │ 128)               │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ concatenate_8       │ (None, 10, 10,     │          0 │
batch_normalizat… │
│ (Concatenate)       │ 1024)              │            │
batch_normalizat… │
│                     │                    │            │
batch_normalizat… │
│                     │                    │            │
batch_normalizat… │
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ average_pooling2d   │ (None, 1, 1,       │          0 │
concatenate_8[0]… │
│ (AveragePooling2D)  │ 1024)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────
─────┤
│ flatten (Flatten)   │ (None, 1024)       │          0 │
average_pooling2… │
```

```
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ dense (Dense)        │ (None, 256)        │     262,400 │ flatten[0][0]
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ dropout (Dropout)    │ (None, 256)        │           0 │ dense[0][0]
│
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ dense_1 (Dense)      │ (None, 3)          │         771 │ dropout[0][0]
│
└──────────────────────┴────────────────────┴─────────────┴──────────────
──────┘

 Total params: 6,346,531 (24.21 MB)

 Trainable params: 6,332,259 (24.16 MB)

 Non-trainable params: 14,272 (55.75 KB)
```

```python
import os
import numpy as np
import tensorflow as tf
from tensorflow.keras import layers, models
from tensorflow.keras.callbacks import EarlyStopping
from tensorflow.keras.optimizers import Adam
from PIL import Image
import matplotlib.pyplot as plt

# Define image size and batch size
img_size = 180  # Ukuran gambar
batch_size = 32  # Ukuran batch
num_classes = 10  # Ganti dengan jumlah kelas yang sesuai

# Define the path to your dataset
data_dir = r"D:\coolyeah\semester5\ml\tubes_uas\train_data\train_data"
# Ganti dengan path dataset Anda

# Function to load images and labels
def load_images_from_directory(directory):
    images = []
    labels = []
    class_names = os.listdir(directory)  # Mendapatkan nama kelas dari
direktori
    for label, class_name in enumerate(class_names):
        class_dir = os.path.join(directory, class_name)
        if os.path.isdir(class_dir):
            for file_name in os.listdir(class_dir):
                if file_name.lower().endswith(('.png', '.jpg',
'.jpeg', '.gif', '.bmp')):
                    file_path = os.path.join(class_dir, file_name)
                    try:
                        img = Image.open(file_path).convert('RGB')  #
Buka dan konversi ke RGB
                        img = img.resize((img_size, img_size))  # Ubah
ukuran gambar ke (180, 180)
                        images.append(np.array(img))  # Konversi ke
numpy array
                        labels.append(label)  # Tambahkan label
                    except Exception as e:
                        print(f"Error loading image {file_path}: {e}")
    return np.array(images), np.array(labels)

# Load training images and labels
images, labels = load_images_from_directory(data_dir)

# Create a TensorFlow dataset for training
train_ds = tf.data.Dataset.from_tensor_slices((images, labels))  #
Gunakan labels asli
train_ds =
train_ds.shuffle(buffer_size=1000).batch(batch_size).prefetch(tf.data.
AUTOTUNE)

# Define a simple CNN model
model = tf.keras.Sequential([
    layers.Input(shape=(img_size, img_size, 3)),  # Input layer untuk
gambar
    layers.Conv2D(32, (3, 3), activation='relu'),
    layers.MaxPooling2D(pool_size=(2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D(pool_size=(2, 2)),
    layers.Flatten(),  # Flatten the output
    layers.Dense(512, activation='relu'),  # Dense layer
    layers.Dense(num_classes, activation='softmax')  # Output layer
untuk num_classes
])

# Compile dengan optimizer Adam
model.compile(
    optimizer=Adam(),
    loss='sparse_categorical_crossentropy',  # Gunakan
sparse_categorical_crossentropy
    metrics=['accuracy']
)

# Buat early stopping
early_stopping = EarlyStopping(monitor='accuracy', patience=5,
mode='max')
```

```
# Fit model tanpa validation_data
history = model.fit(train_ds,
                    epochs=30,
                    callbacks=[early_stopping])

# Buat plot dengan menggunakan history supaya jumlahnya sesuai epoch
yang dilakukan
epochs_range = range(1, len(history.history['loss']) + 1)
plt.figure(figsize=(10, 10))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, history.history['accuracy'], label='Training
Accuracy')
plt.legend(loc='lower right')
plt.title('Training Accuracy')

plt.subplot(1, 2, 2)
plt.plot(epochs_range, history.history['loss'], label='Training Loss')
plt.legend(loc='upper right')
plt.title('Training Loss')
plt.show()

Epoch 1/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 7s 506ms/step - accuracy: 0.2643 - loss:
1206.0455
Epoch 2/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 497ms/step - accuracy: 0.5002 - loss:
60.9073
Epoch 3/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 503ms/step - accuracy: 0.8891 - loss:
0.8052
Epoch 4/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 495ms/step - accuracy: 0.9375 - loss:
0.2679
Epoch 5/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 505ms/step - accuracy: 0.9636 - loss:
0.2360
Epoch 6/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 490ms/step - accuracy: 0.9962 - loss:
0.0685
Epoch 7/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 499ms/step - accuracy: 0.9991 - loss:
0.0143
Epoch 8/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 502ms/step - accuracy: 0.9794 - loss:
0.0800
Epoch 9/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 498ms/step - accuracy: 1.0000 - loss:
0.0292
Epoch 10/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 500ms/step - accuracy: 1.0000 - loss:
```

```
0.0104
Epoch 11/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 499ms/step - accuracy: 1.0000 - loss:
0.0121
Epoch 12/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 499ms/step - accuracy: 1.0000 - loss:
0.0019
Epoch 13/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 499ms/step - accuracy: 1.0000 - loss:
0.0019
Epoch 14/30
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 495ms/step - accuracy: 1.0000 - loss:
0.0026
```



```
model.save('gNet5.h5')
```

```
WARNING:absl:You are saving your model as an HDF5 file via
`model.save()` or `keras.saving.save_model(model)`. This file format
is considered legacy. We recommend using instead the native Keras
format, e.g. `model.save('my_model.keras')` or
`keras.saving.save_model(model, 'my_model.keras')`.
```

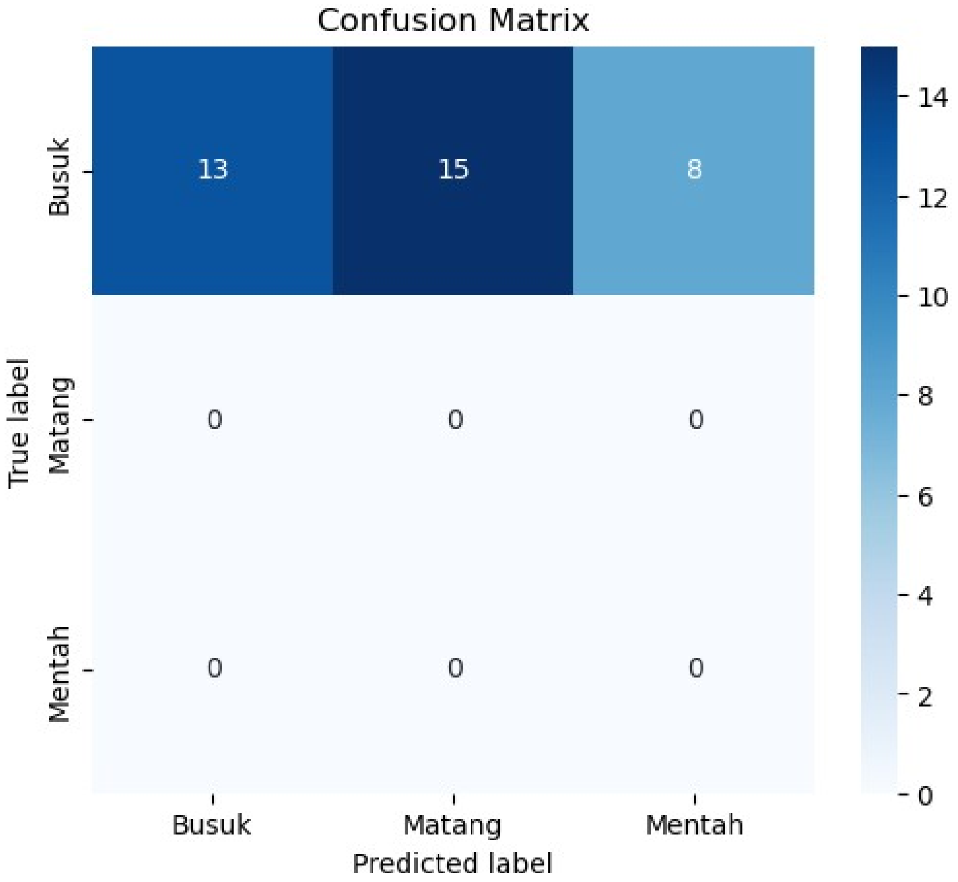
```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras.models import load_model
from PIL import Image

# Load the trained model
model = load_model(r'D:\coolyeah\semester5\ml\tubes_uas\
BestModel_GoogleNet_Matplotlib.h5')  # Ganti dengan path model Anda
class_names = ['Busuk', 'Matang', 'Mentah']

# Function to classify images and save the original image
def classify_images(image_path, save_path='predicted_image.jpg'):
    try:
        # Load and preprocess the image
        input_image = tf.keras.utils.load_img(image_path,
target_size=(180, 180))
        input_image_array = tf.keras.utils.img_to_array(input_image)
        input_image_exp_dim = tf.expand_dims(input_image_array, 0)  #
Add batch dimension

        # Predict
        predictions = model.predict(input_image_exp_dim)
        result = tf.nn.softmax(predictions[0])
        class_idx = np.argmax(result)
        confidence = np.max(result) * 100

        # Display prediction and confidence in notebook
        print(f"Prediksi: {class_names[class_idx]}")
        print(f"Confidence: {confidence:.2f}%")

        # Save the original image (without text)
        input_image = Image.open(image_path)
        input_image.save(save_path)

        return f"Prediksi: {class_names[class_idx]} dengan confidence
{confidence:.2f}%. Gambar asli disimpan di {save_path}."
    except Exception as e:
        return f"Terjadi kesalahan: {e}"

# Contoh penggunaan fungsi
###Terdapat code yang hilang disini! lihat modul untuk menemukanya
result = classify_images(r'D:\coolyeah\semester5\ml\tubes_uas\
test_data\test_data\Busuk\busuk_02.jpg', save_path='busuk_01.jpg')
result = classify_images(r'D:\coolyeah\semester5\ml\tubes_uas\
test_data\test_data\Matang\matang_05.jpg', save_path='matang_01.jpg')
result = classify_images(r'D:\coolyeah\semester5\ml\tubes_uas\
test_data\test_data\Mentah\mentah_04.jpg', save_path='mentah_01.jpg')
print(result)
```

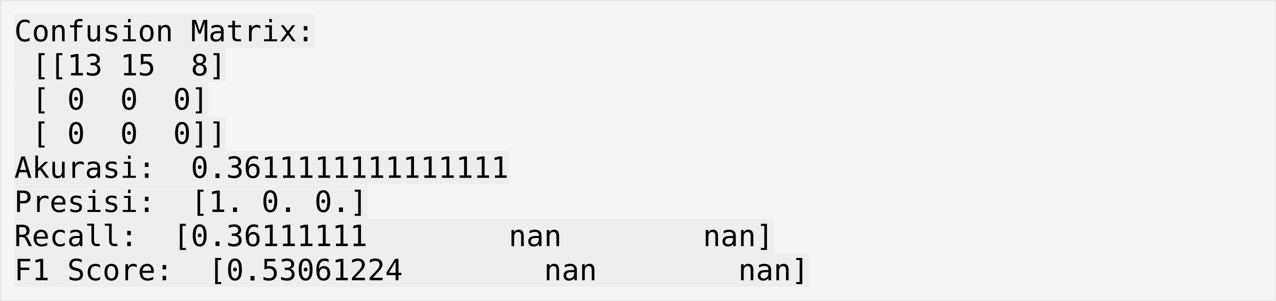
```
WARNING:absl:Compiled the loaded model, but the compiled metrics have
yet to be built. `model.compile_metrics` will be empty until you train
or evaluate the model.
```

```
WARNING:tensorflow:5 out of the last 11 calls to <function
TensorFlowTrainer.make_predict_function.<locals>.one_step_on_data_dist
ributed at 0x00000211B144D580> triggered tf.function retracing.
Tracing is expensive and the excessive number of tracings could be due
to (1) creating @tf.function repeatedly in a loop, (2) passing tensors
with different shapes, (3) passing Python objects instead of tensors.
For (1), please define your @tf.function outside of the loop. For (2),
@tf.function has reduce_retracing=True option that can avoid
unnecessary retracing. For (3), please refer to
https://www.tensorflow.org/guide/function#controlling_retracing and
https://www.tensorflow.org/api_docs/python/tf/function for  more
details.

WARNING:tensorflow:5 out of the last 11 calls to <function
TensorFlowTrainer.make_predict_function.<locals>.one_step_on_data_dist
ributed at 0x00000211B144D580> triggered tf.function retracing.
Tracing is expensive and the excessive number of tracings could be due
to (1) creating @tf.function repeatedly in a loop, (2) passing tensors
with different shapes, (3) passing Python objects instead of tensors.
For (1), please define your @tf.function outside of the loop. For (2),
@tf.function has reduce_retracing=True option that can avoid
unnecessary retracing. For (3), please refer to
https://www.tensorflow.org/guide/function#controlling_retracing and
https://www.tensorflow.org/api_docs/python/tf/function for  more
details.

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 94ms/step
Prediksi: Busuk
Confidence: 23.20%
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 46ms/step
Prediksi: Matang
Confidence: 23.20%
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 26ms/step
Prediksi: Mentah
Confidence: 23.20%
Prediksi: Mentah dengan confidence 23.20%. Gambar asli disimpan di
mentah_01.jpg.
```

```python
import tensorflow as tf
from tensorflow.keras.models import load_model
import seaborn as sns
import matplotlib.pyplot as plt

# Muat data test yang sebenarnya
test_data = tf.keras.preprocessing.image_dataset_from_directory(
    r'test_data',
    labels='inferred',
    label_mode='categorical',  # Menghasilkan label dalam bentuk one-
hot encoding
    batch_size=32,
    image_size=(180, 180)
)

# Prediksi model
y_pred = model.predict(test_data)
y_pred_class = tf.argmax(y_pred, axis=1)  # Konversi ke kelas prediksi

# Ekstrak label sebenarnya dari test_data dan konversi ke bentuk
indeks kelas
true_labels = []
for _, labels in test_data:
    true_labels.extend(tf.argmax(labels, axis=1).numpy())  # Konversi
one-hot ke indeks kelas
true_labels = tf.convert_to_tensor(true_labels)

# Membuat matriks kebingungan
conf_mat = tf.math.confusion_matrix(true_labels, y_pred_class)

# Menghitung akurasi
accuracy = tf.reduce_sum(tf.linalg.diag_part(conf_mat)) /
tf.reduce_sum(conf_mat)

# Menghitung presisi dan recall
precision = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=0)
recall = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=1)

# Menghitung F1 Score
f1_score = 2 * (precision * recall) / (precision + recall)

# Visualisasi Confusion Matrix
plt.figure(figsize=(6, 5))
sns.heatmap(conf_mat.numpy(), annot=True, fmt='d', cmap='Blues',
            xticklabels=["Busuk", "Matang", "Mentah"],
yticklabels=["Busuk", "Matang", "Mentah"])
plt.title('Confusion Matrix')
plt.xlabel('Predicted label')
plt.ylabel('True label')
plt.show()

# Menampilkan hasil
print("Confusion Matrix: \n", conf_mat.numpy())
print("Akurasi: ", accuracy.numpy())
print("Presisi: ", precision.numpy())
print("Recall: ", recall.numpy())
print("F1 Score: ", f1_score.numpy())
```

```
Found 36 files belonging to 1 classes.
2/2 ━━━━━━━━━━━━━━━━━━━━ 0s 93ms/step
```





```
Confusion Matrix:
 [[13 15  8]
 [ 0  0  0]
 [ 0  0  0]]
Akurasi:  0.3611111111111111
Presisi:  [1. 0. 0.]
Recall:  [0.36111111        nan        nan]
F1 Score:  [0.53061224        nan        nan]
```

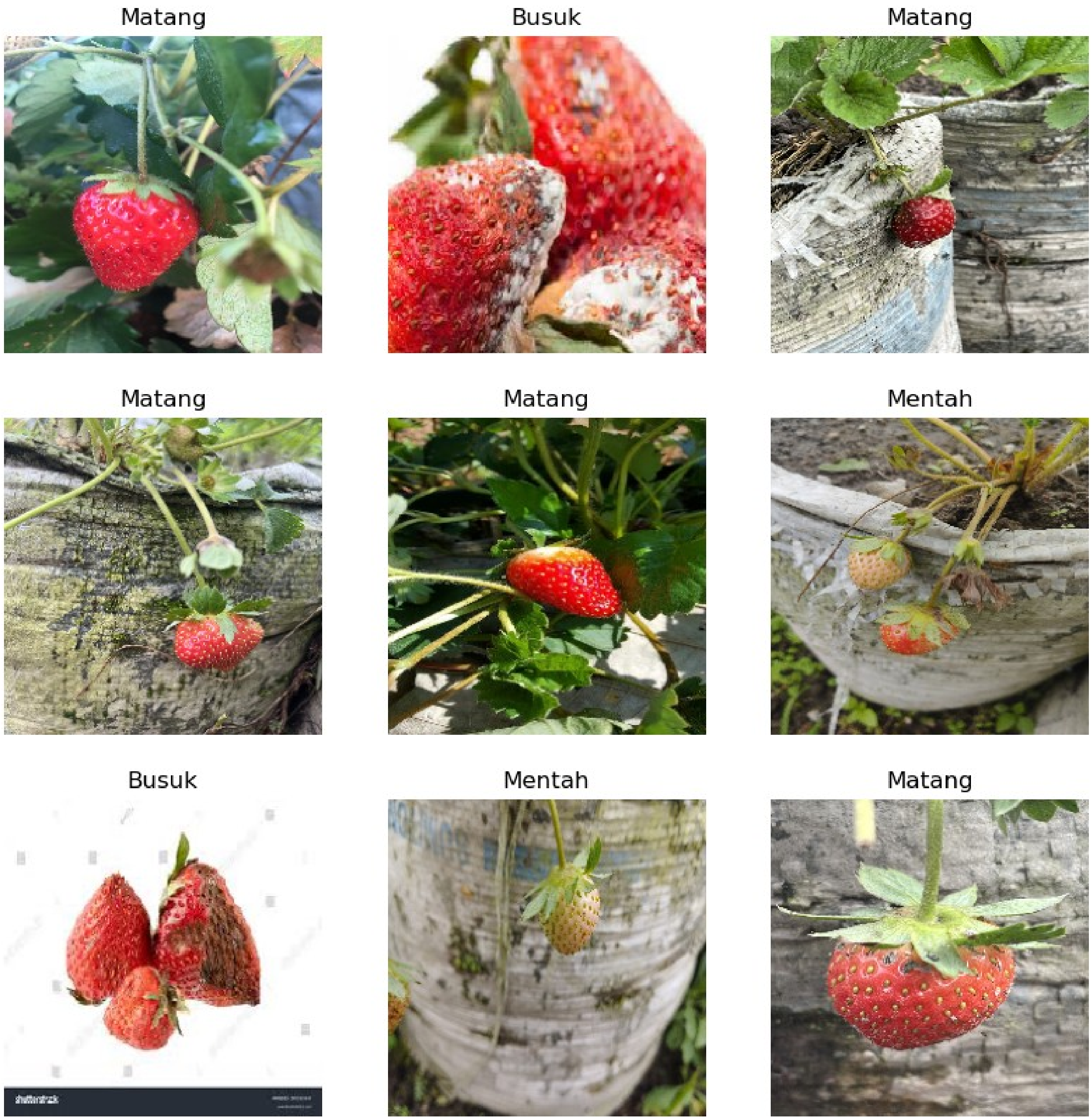
MOBILE NET

```
import tensorflow as tf
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix, classification_report
import os
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dense,
Flatten, Dropout
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint
from tensorflow.keras import models, layers


data_dir = r'/Users/saktiyoga/Development/PMDPM/train_data'

def load_data(data_dir, img_size=(224, 224), batch_size=32,
augment=False):
    if augment:
        data_gen = ImageDataGenerator(
            rescale=1./255,
            rotation_range=30,
            width_shift_range=0.2,
            height_shift_range=0.2,
            shear_range=0.2,
            zoom_range=0.2,
            horizontal_flip=True
        )
    else:
        data_gen = ImageDataGenerator(rescale=1./255)

    dataset = data_gen.flow_from_directory(
        data_dir,
        target_size=img_size,
        batch_size=batch_size,
        class_mode='categorical'
    )
    return dataset

train_data = load_data(os.path.join(data_dir), augment=True)
val_data = load_data(os.path.join(data_dir))
```

```
Found 301 images belonging to 3 classes.
```

```
Found 301 images belonging to 3 classes.
```

```
def visualize_images(dataset, num_images=9):
    plt.figure(figsize=(10, 10))
    images, labels = [], []
    for batch_images, batch_labels in dataset:
        images.extend(batch_images)
        labels.extend(batch_labels)
        if len(images) >= num_images:
            break

    images = np.array(images[:num_images])
    labels = np.array(labels[:num_images])

    for i in range(num_images):
        plt.subplot(3, 3, i + 1)
        plt.imshow(images[i])
        plt.title(list(dataset.class_indices.keys())
[np.argmax(labels[i])])
        plt.axis('off')
    plt.show()


visualize_images(train_data_example)
```



```
def prepare_data(data_dir, img_size=(224, 224), batch_size=32):
    train_dir = os.path.join(data_dir)
    val_dir = os.path.join(data_dir)
    test_dir =
os.path.join('/Users/saktiyoga/Development/PMDPM/test_data')

    train_data = load_data(train_dir, img_size, batch_size)
    val_data = load_data(val_dir, img_size, batch_size)
    test_data = load_data(test_dir, img_size, batch_size)

    print(f"Train data size: {train_data.samples}")
    print(f"Validation data size: {val_data.samples}")
    print(f"Test data size: {test_data.samples}")

    return train_data, val_data, test_data

data_dir = r'/Users/saktiyoga/Development/PMDPM/train_data'
train_data, val_data, test_data = prepare_data(data_dir)
```

```
Found 301 images belonging to 3 classes.
Found 301 images belonging to 3 classes.
Found 301 images belonging to 3 classes.
Train data size: 301
Validation data size: 301
Test data size: 301
```

```
def create_model(input_shape=(224, 224, 3), num_classes=3):
    base_model = 
tf.keras.applications.MobileNetV2(input_shape=input_shape,
                                                   include_top=False,
                                                   weights=None)

    model = tf.keras.Sequential([
        base_model,
        tf.keras.layers.GlobalAveragePooling2D(),
        tf.keras.layers.Dense(num_classes, activation='softmax')
    ])

    model.compile(optimizer='adam',
                  loss='categorical_crossentropy',
                  metrics=['accuracy'])

    model.summary()
    return model

model = create_model()
```

```
Model: "sequential_5"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━
━━━━━┓
┃ Layer (type)                     ┃ Output Shape            ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━
━━━━━┩
│ mobilenetv2_1.00_224             │ (None, 7, 7, 1280)      │
2,257,984 │
│ (Functional)                     │                         │
│
├──────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ global_average_pooling2d_2       │ (None, 1280)            │
```

```
0 │
│ (GlobalAveragePooling2D)          │                         │
│
├──────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ dense_12 (Dense)                  │ (None, 3)               │
3,843 │
└──────────────────────────────────┴─────────────────────────┴──────────
─────┘

 Total params: 2,261,827 (8.63 MB)

 Trainable params: 2,227,715 (8.50 MB)

 Non-trainable params: 34,112 (133.25 KB)
```

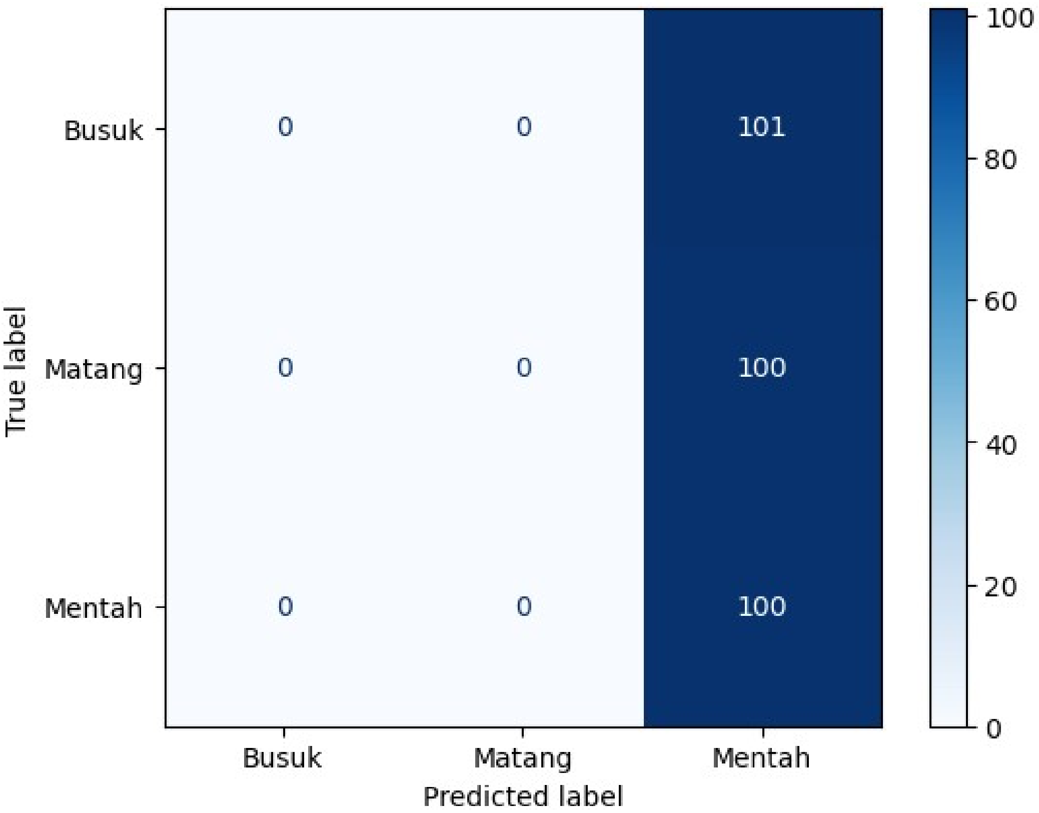
```
from tensorflow.keras.callbacks import EarlyStopping

def train_model(model, train_data, val_data, epochs=20):
    early_stopping = EarlyStopping(monitor='val_loss', patience=5,
restore_best_weights=True)
    history = model.fit(train_data,
                        validation_data=val_data,
                        epochs=epochs,
                        callbacks=[early_stopping])
    return history

history = train_model(model, train_data, val_data, epochs=20)
```

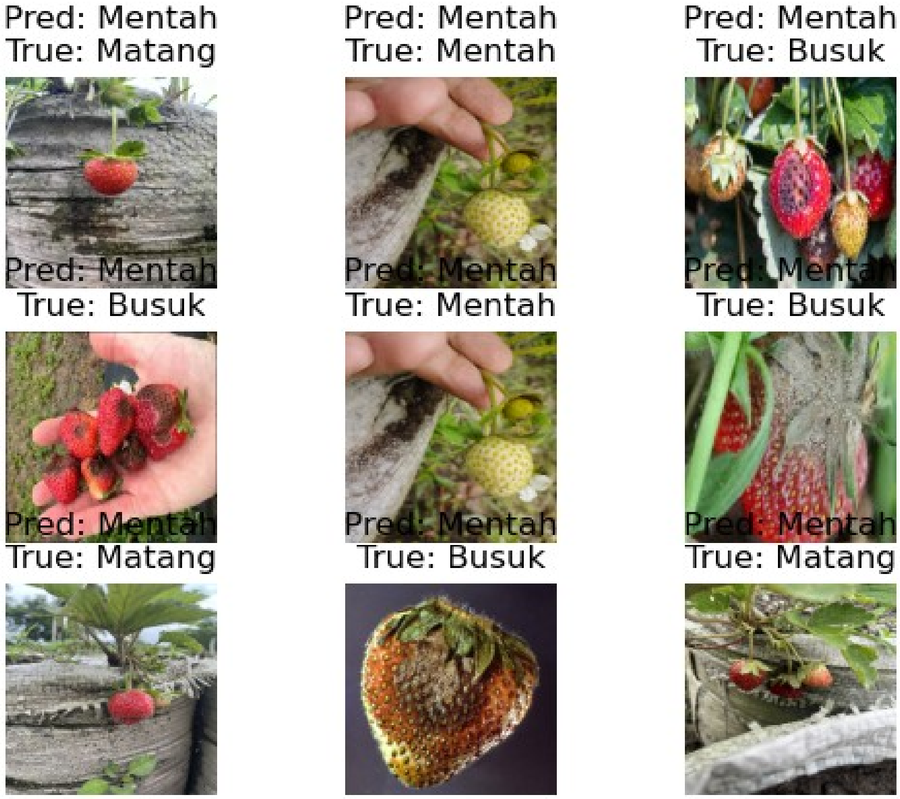
```
Epoch 1/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 55s 6s/step - accuracy: 0.6752 - loss:
0.8182 - val_accuracy: 0.3355 - val_loss: 1.0988
Epoch 2/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 51s 5s/step - accuracy: 0.7641 - loss:
0.5618 - val_accuracy: 0.3322 - val_loss: 1.0987
Epoch 3/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 50s 5s/step - accuracy: 0.8241 - loss:
0.3878 - val_accuracy: 0.3322 - val_loss: 1.0987
Epoch 4/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 51s 5s/step - accuracy: 0.9352 - loss:
0.1967 - val_accuracy: 0.3322 - val_loss: 1.0996
Epoch 5/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 50s 5s/step - accuracy: 0.9479 - loss:
0.1539 - val_accuracy: 0.3322 - val_loss: 1.1026
Epoch 6/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 50s 5s/step - accuracy: 0.9825 - loss:
0.0700 - val_accuracy: 0.3322 - val_loss: 1.1044
Epoch 7/20
10/10 ━━━━━━━━━━━━━━━━━━━━ 51s 5s/step - accuracy: 0.9610 - loss:
0.0807 - val_accuracy: 0.3322 - val_loss: 1.1163
Epoch 8/20
```

```
10/10 ━━━━━━━━━━━━━━━━━━━━ 78s 8s/step - accuracy: 0.9251 - loss:
0.1287 - val_accuracy: 0.3322 - val_loss: 1.1185
```

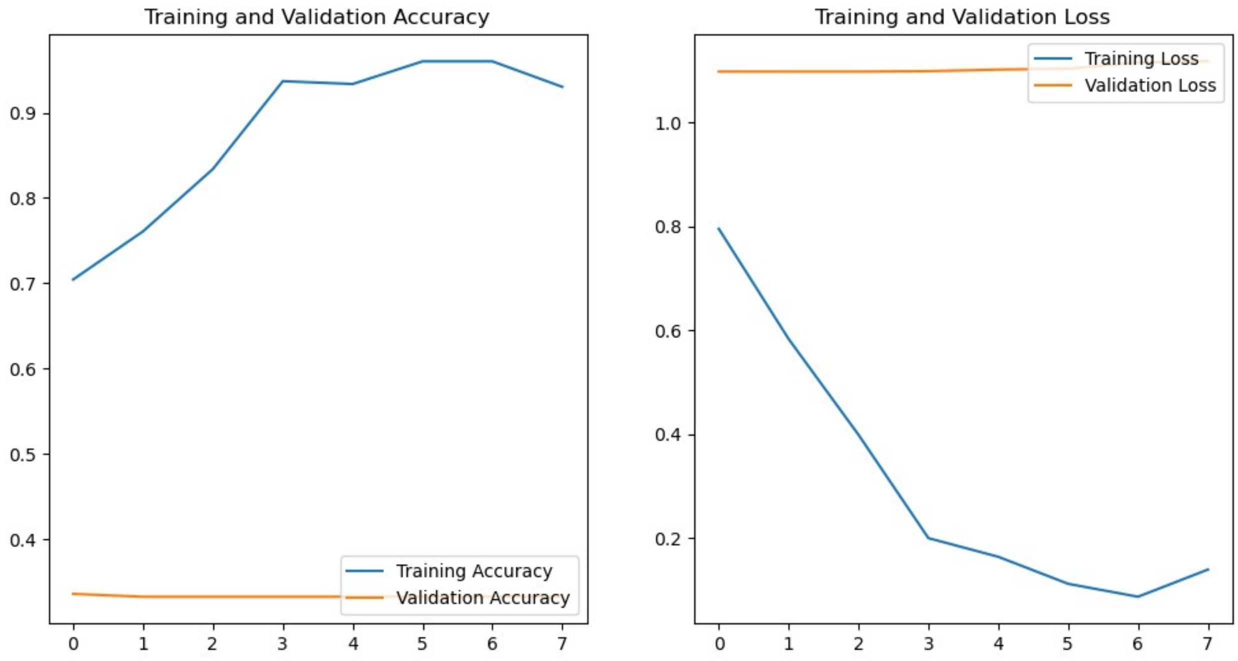
```python
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay

def evaluate_model(model, test_data):
    predictions = model.predict(test_data)
    y_pred = np.argmax(predictions, axis=1)
    y_true = test_data.classes

    cm = confusion_matrix(y_true, y_pred)
    disp = ConfusionMatrixDisplay(confusion_matrix=cm,

display_labels=list(test_data.class_indices.keys()))
    disp.plot(cmap=plt.cm.Blues)
    plt.show()

    test_data.reset()
    images, labels = next(test_data)
    for i in range(min(9, len(images))):
        plt.subplot(3, 3, i + 1)
        plt.imshow(images[i])
        pred_label = list(test_data.class_indices.keys())
[np.argmax(predictions[i])]
        true_label = list(test_data.class_indices.keys())
[np.argmax(labels[i])]
        plt.title(f"Pred: {pred_label}\nTrue: {true_label}")
        plt.axis('off')
    plt.show()


evaluate_model(model, test_data)
```

```
10/10 ━━━━━━━━━━━━━━━━━━━━ 44s 4s/step
```


Busuk
Matang
Mentah
True label
0
0
101
0
0
100
0
0
100
Busuk
Matang
Mentah
Predicted label
100
80
60
40
20
0

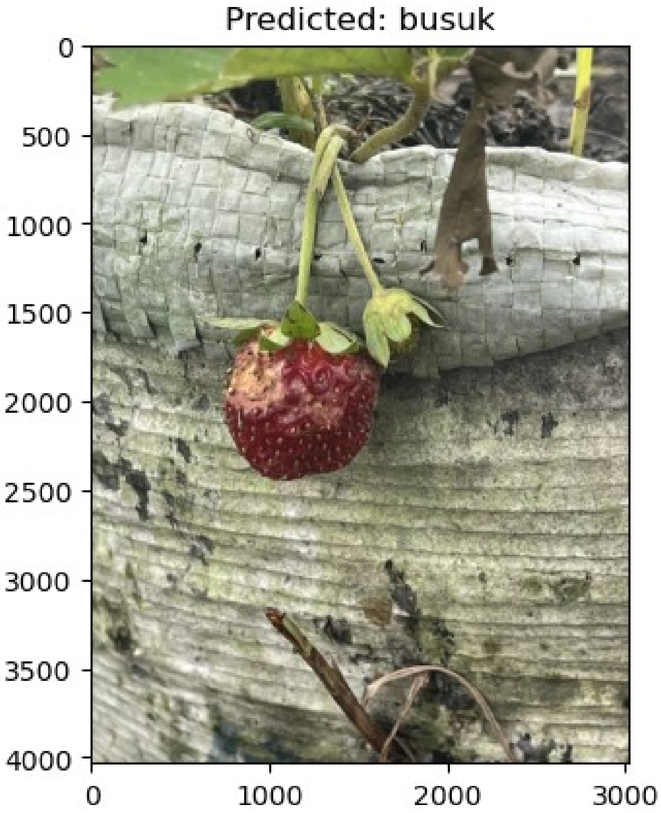

Pred: Mentah
True: Matang
Pred: Mentah
True: Mentah
Pred: Mentah
True: Busuk
Pred: Mentah
True: Busuk
Pred: Mentah
True: Mentah
Pred: Mentah
True: Busuk
Pred: Mentah
True: Matang
Pred: Mentah
True: Busuk
Pred: Mentah
True: Matang

```
def plot_metrics(history):
    acc = history.history['accuracy']
    val_acc = history.history['val_accuracy']
    loss = history.history['loss']
    val_loss = history.history['val_loss']

    epochs_range = range(len(acc))

    plt.figure(figsize=(12, 6))

    plt.subplot(1, 2, 1)
    plt.plot(epochs_range, acc, label='Training Accuracy')
    plt.plot(epochs_range, val_acc, label='Validation Accuracy')
    plt.legend(loc='lower right')
    plt.title('Training and Validation Accuracy')

    plt.subplot(1, 2, 2)
    plt.plot(epochs_range, loss, label='Training Loss')
    plt.plot(epochs_range, val_loss, label='Validation Loss')
    plt.legend(loc='upper right')
    plt.title('Training and Validation Loss')

    plt.show()

plot_metrics(history)
```



```
def predict_strawberry(image_path, model):
    img = tf.keras.preprocessing.image.load_img(
        image_path,
        target_size=(224, 224)
    )
    img_array = tf.keras.preprocessing.image.img_to_array(img)
    img_array = tf.expand_dims(img_array, 0) / 255.0


    predictions = model.predict(img_array)
    predicted_class = categories[np.argmax(predictions[0])]

    print(f'Predicted Strawberry Condition: {predicted_class}')
    plt.imshow(plt.imread(image_path))
    plt.title(f'Predicted: {predicted_class}')
    plt.show()


predict_strawberry('/Users/saktiyoga/Development/PMDPM/test_data/Busuk/busuk_07.jpg', model)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 245ms/step
Predicted Strawberry Condition: busuk
```



VGG

```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras import layers, models

import os
from PIL import Image

input_folder = r'C:\Users\vina qhurotu aini\Documents\KULIAH\SEMESTER
5\ML\Tubes\train_data'
output_folder = r'C:\Users\vina qhurotu aini\Documents\KULIAH\SEMESTER
5\ML\Tubes\train_data_konversi'

os.makedirs(output_folder, exist_ok=True)

def convert_images(input_folder, output_folder, target_format="JPEG"):
    for root, _, files in os.walk(input_folder):
        for filename in files:
            input_path = os.path.join(root, filename)
            relative_path = os.path.relpath(root, input_folder)
            output_subfolder = os.path.join(output_folder,
relative_path)
            os.makedirs(output_subfolder, exist_ok=True)

            try:
                with Image.open(input_path) as img:
                    if img.mode != "RGB":
                        img = img.convert("RGB")

                    new_filename = os.path.splitext(filename)[0] + f".
{target_format.lower()}"
                    output_path = os.path.join(output_subfolder,
new_filename)

                    img.save(output_path, target_format)
                    print(f"Berhasil mengonversi: {input_path} ->
{output_path}")
            except Exception as e:
                print(f"Error saat mengonversi {input_path}: {e}")

convert_images(input_folder, output_folder, target_format="JPEG")
```

```
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_01.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_01.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_02.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_02.jpeg
```

```
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_03.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_03.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_04.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_04.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_05.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_05.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_06.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_06.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_07.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_07.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_08.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_08.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_09.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_09.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_10.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_10.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_100.png -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_100.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_11.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_11.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_12.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_12.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_13.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_13.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_14.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_14.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_15.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_15.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_16.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_16.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_17.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_17.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_18.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_18.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_19.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_19.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_20.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_20.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_21.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_21.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_22.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_22.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_23.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_23.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_24.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_24.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_25.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_25.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_26.jpg -> C:\Users\vina
```

```
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_26.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_27.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_27.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_28.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_28.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_29.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_29.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_30.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_30.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_31.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_31.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_32.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_32.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_33.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_33.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_34.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_34.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_35.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_35.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_36.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_36.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_37.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_37.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_38.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_38.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_39.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_39.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_40.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_40.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_41.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_41.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_42.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_42.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_43.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_43.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_44.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_44.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_45.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_45.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_46.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_46.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_47.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_47.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_48.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_48.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_49.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_49.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_50.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_50.jpeg
```

```
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_51.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_51.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_52.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_52.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_53.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_53.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_54.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_54.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_55.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_55.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Busuk\busuk_56.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Busuk\busuk_56.jpeg
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qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_09.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_10.jpg -> C:\Users\vina
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Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
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Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
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Mentah\mentah_78.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_79.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_79.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_80.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_80.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_81.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_81.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_82.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_82.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_83.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_83.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_84.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_84.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_85.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_85.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_86.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_86.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_87.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_87.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_88.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_88.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_89.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_89.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_90.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_90.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_91.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_91.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_92.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_92.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_93.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_93.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_94.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_94.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_95.jpg -> C:\Users\vina
```
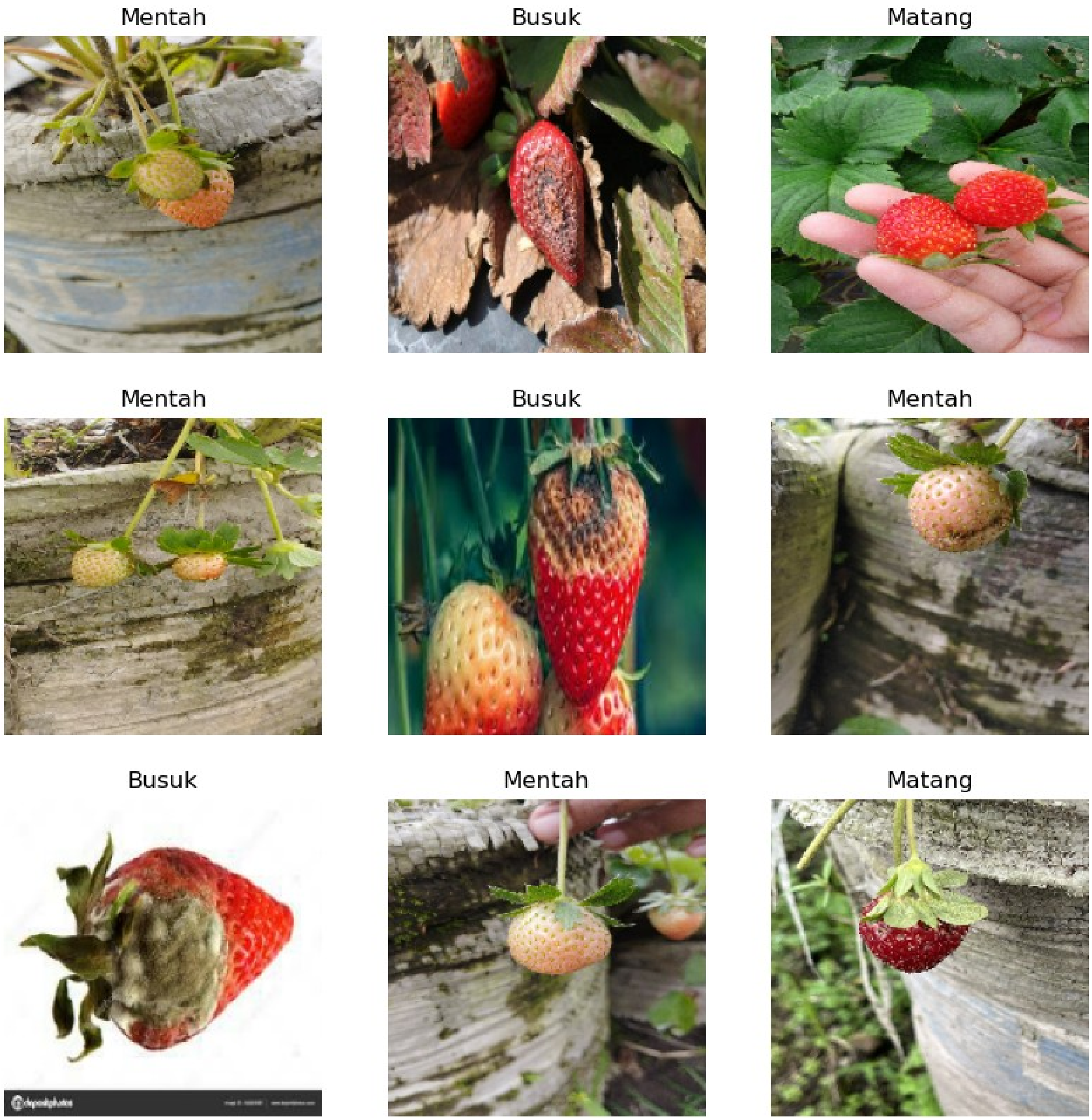

```
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_95.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_96.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_96.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_97.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_97.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_98.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_98.jpeg
Berhasil mengonversi: C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\train_data\Mentah\mentah_99.jpg -> C:\Users\vina
qhurotu aini\Documents\KULIAH\SEMESTER 5\ML\Tubes\train_data_konversi\
Mentah\mentah_99.jpeg
```

```
data_dir = r"C:\Users\vina qhurotu aini\Documents\KULIAH\SEMESTER 5\
ML\Tubes\train_data_konversi"
img_size = 180
batch = 32

dataset = tf.keras.utils.image_dataset_from_directory(
    data_dir,
    seed=123,
    image_size=(img_size, img_size),
    batch_size=batch,
)

total_count = len(dataset) * batch
print("Total Images: ", total_count)

train_count = int(total_count * 0.8)
val_count = int(total_count * 0.1)
test_count = total_count - train_count - val_count

print("Train Images: ", train_count)
print("Validation Images: ", val_count)
print("Test Images: ", test_count)

train_ds = dataset.take(train_count // batch)
val_ds = dataset.skip(train_count // batch).take(val_count // batch)
test_ds = dataset.skip(train_count // batch + val_count //
batch).take(test_count // batch)

class_names = dataset.class_names
print("Class Names: ", class_names)
```

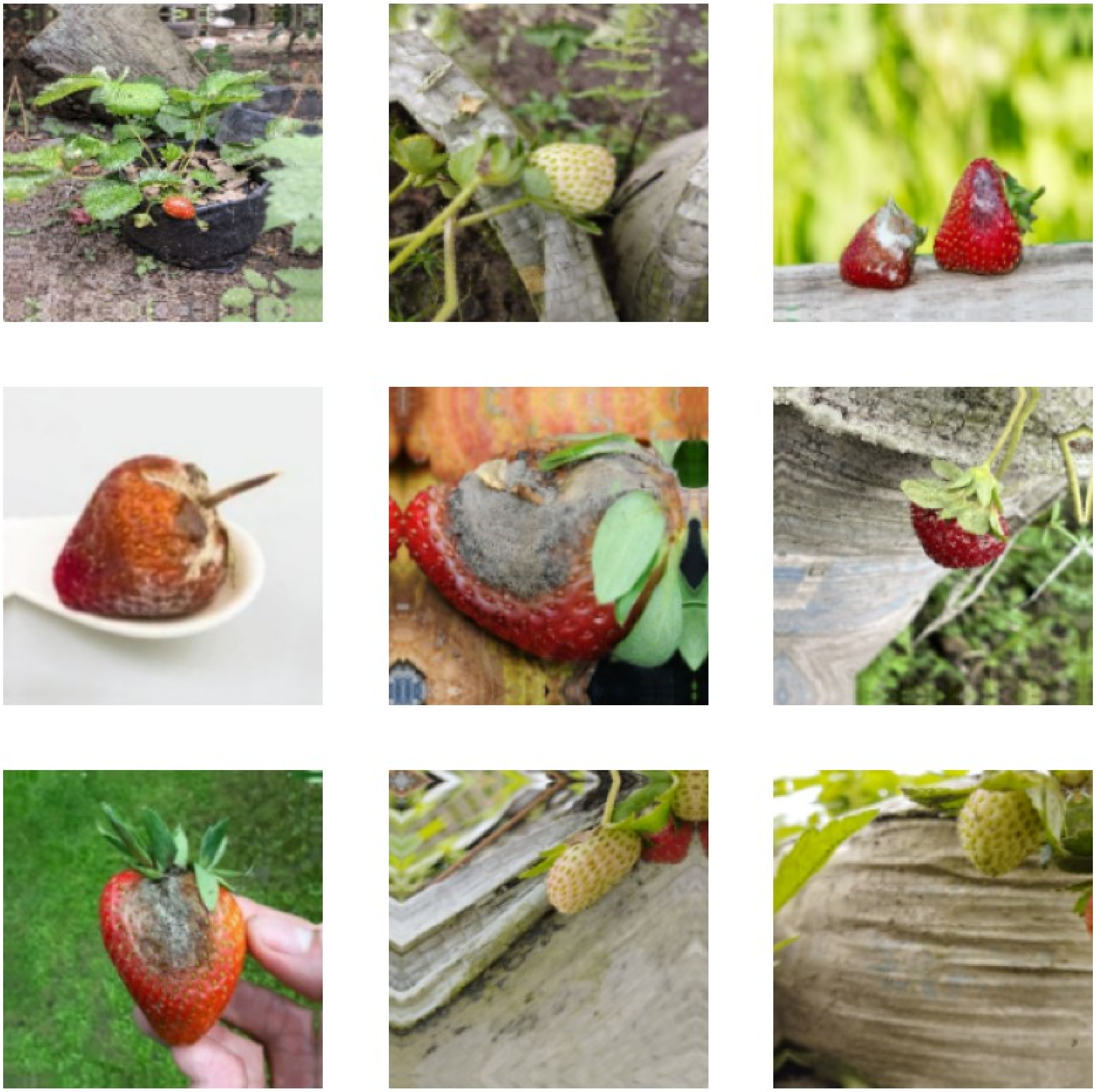
```
Found 301 files belonging to 3 classes.

Total Images:  320
Train Images:  256
Validation Images:  32
Test Images:  32
Class Names:  ['Busuk', 'Matang', 'Mentah']

i = 0
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    for i in range(9):
        plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype('uint8'))
        plt.title(class_names[labels[i]])
        plt.axis('off')
```



```
for images, labels in train_ds.take(1):
    images_array = np.array(images)
    print(images_array.shape)
```

```
(32, 180, 180, 3)
```

```
Tuner = tf.data.AUTOTUNE
train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size=Tuner)
val_ds = val_ds.cache().shuffle(1000).prefetch(buffer_size=Tuner)

data_augmentation = models.Sequential([
    layers.RandomFlip("horizontal", input_shape=(img_size, img_size,
3)),
    layers.RandomRotation(0.1),
    layers.RandomZoom(0.1)
])

i = 0
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    for i in range(9):
        augmented_images = data_augmentation(images)
        plt.subplot(3, 3, i + 1)
        plt.imshow(augmented_images[i].numpy().astype('uint8'))
        plt.axis('off')
```



```python
import tensorflow as tf
from tensorflow.keras import layers, models

def vgg16(input_shape, n_classes):
    base_model = tf.keras.applications.VGG16(weights='imagenet',
include_top=False, input_shape=input_shape)
    base_model.trainable = False

    model = models.Sequential()
    model.add(base_model)
    model.add(layers.Flatten())
    model.add(layers.Dense(256, activation='relu'))
    model.add(layers.BatchNormalization())
    model.add(layers.Dropout(0.5))
    model.add(layers.Dense(n_classes, activation='softmax'))

    # Compile the model

model.compile(optimizer=tf.keras.optimizers.Adam(learning_rate=0.0001)
,
                  loss='sparse_categorical_crossentropy',
                  metrics=['accuracy'])

    return model

input_shape = (180, 180, 3)
n_classes = len(class_names)  # 3 classes: ['Busuk', 'Matang',
'Mentah']

tf.keras.backend.clear_session()

model = vgg16(input_shape, n_classes)
model.summary()
```

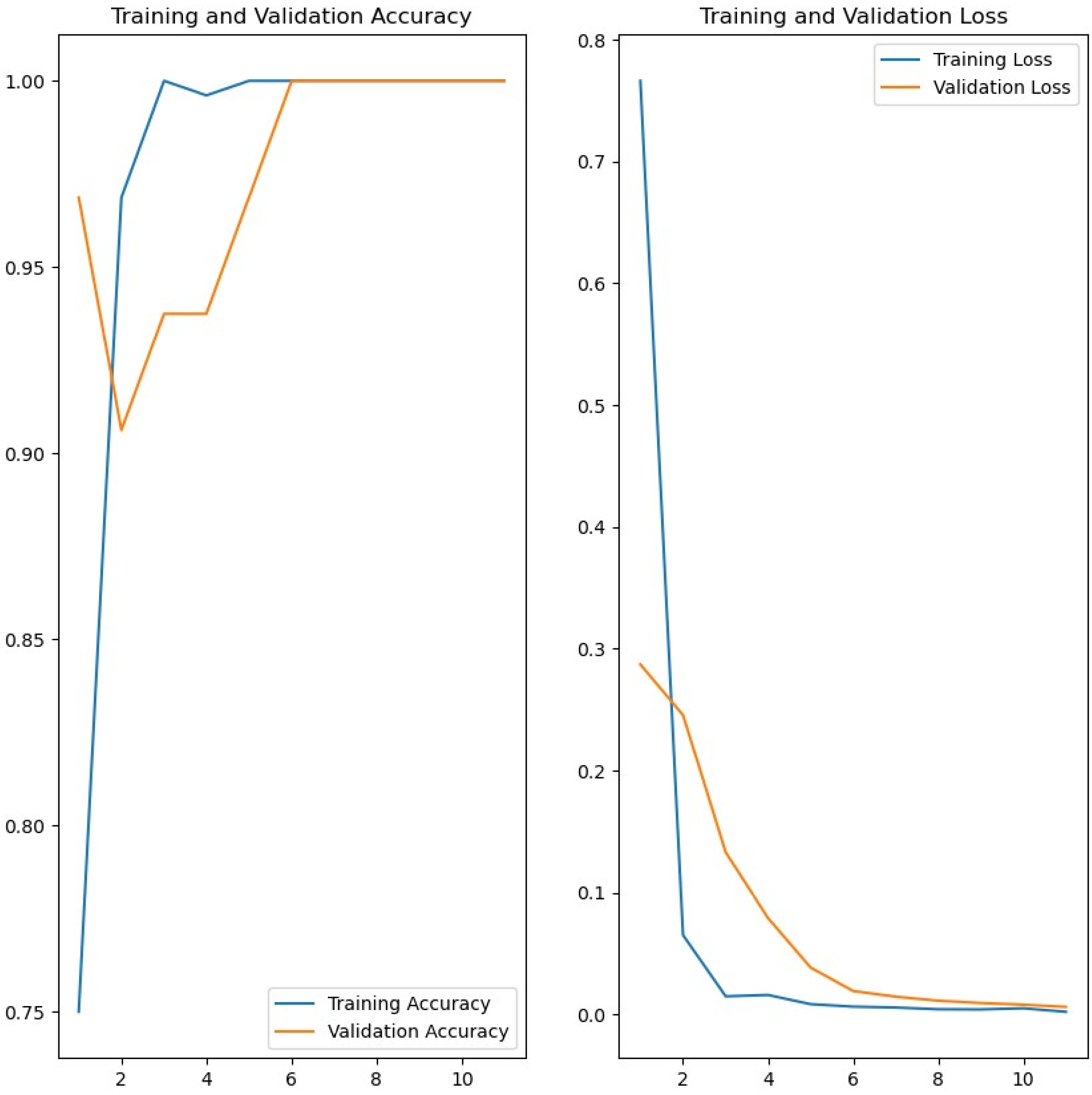
```
Model: "sequential"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━
━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━
━━━━━┩
│ vgg16 (Functional)              │ (None, 5, 5, 512)      │
14,714,688 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ flatten (Flatten)               │ (None, 12800)          │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense (Dense)                   │ (None, 256)            │
3,277,056 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization             │ (None, 256)            │
1,024 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout (Dropout)               │ (None, 256)            │
0 │
```

```
├──────────────────────────────────┼─────────────────────────┼───────
──────┤
│ dense_1 (Dense)                  │ (None, 3)               │
771 │
└──────────────────────────────────┴─────────────────────────┴───────
──────┘

 Total params: 17,993,539 (68.64 MB)

 Trainable params: 3,278,339 (12.51 MB)

 Non-trainable params: 14,715,200 (56.13 MB)
```

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

model.compile(
    optimizer=Adam(),
    loss='sparse_categorical_crossentropy',
    metrics=['accuracy']
)

early_stopping = EarlyStopping(monitor='val_accuracy', patience=5,
mode='max')

history = model.fit(train_ds,
                    epochs=30,
                    validation_data=val_ds,
                    callbacks=[early_stopping])

epochs_range = range(1, len(history.history['loss']) + 1)
plt.figure(figsize=(10, 10))
plt.subplot(1, 2, 1)
plt.plot(epochs_range, history.history['accuracy'], label='Training
Accuracy')
plt.plot(epochs_range, history.history['val_accuracy'],
label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')

plt.subplot(1, 2, 2)
plt.plot(epochs_range, history.history['loss'], label='Training Loss')
plt.plot(epochs_range, history.history ['val_loss'], label='Validation
Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```

```
Epoch 1/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 10s 1s/step - accuracy: 0.6639 - loss: 1.0554
- val_accuracy: 0.9688 - val_loss: 0.2871
```

```
Epoch 2/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 8s 1s/step - accuracy: 0.9583 - loss: 0.0799
- val_accuracy: 0.9062 - val_loss: 0.2457
Epoch 3/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0220
- val_accuracy: 0.9375 - val_loss: 0.1331
Epoch 4/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 0.9965 - loss: 0.0141
- val_accuracy: 0.9375 - val_loss: 0.0790
Epoch 5/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0092
- val_accuracy: 0.9688 - val_loss: 0.0385
Epoch 6/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0051
- val_accuracy: 1.0000 - val_loss: 0.0192
Epoch 7/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0076
- val_accuracy: 1.0000 - val_loss: 0.0147
Epoch 8/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0057
- val_accuracy: 1.0000 - val_loss: 0.0113
Epoch 9/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0036
- val_accuracy: 1.0000 - val_loss: 0.0095
Epoch 10/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0038
- val_accuracy: 1.0000 - val_loss: 0.0081
Epoch 11/30
8/8 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 1.0000 - loss: 0.0017
- val_accuracy: 1.0000 - val_loss: 0.0063
```



```
model.save('VGG CNN_Matplotlib.h5')

WARNING:absl:You are saving your model as an HDF5 file via
`model.save()` or `keras.saving.save_model(model)`. This file format
is considered legacy. We recommend using instead the native Keras
format, e.g. `model.save('my_model.keras')` or
`keras.saving.save_model(model, 'my_model.keras')`.

import tensorflow as tf
from tensorflow.keras.models import load_model

model = load_model(r'C:\Users\vina qhurotu aini\Documents\KULIAH\
SEMESTER 5\ML\Tubes\VGG CNN_Matplotlib.h5')  # Ganti dengan path model
```

```
Anda
class_names = ['Busuk', 'Matang', 'Mentah']
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have
yet to be built. `model.compile_metrics` will be empty until you train
or evaluate the model.
```

```
def classify_images(image_path, save_path='predicted_image.jpg'):
    try:
        input_image = tf.keras.utils.load_img(image_path,
target_size=(180, 180))  # Sesuaikan ukuran jika perlu
        input_image_array = tf.keras.utils.img_to_array(input_image)
        input_image_exp_dim = tf.expand_dims(input_image_array, 0)  #
Add batch dimension

        predictions = model.predict(input_image_exp_dim)
        result = tf.nn.softmax(predictions[0])
        class_idx = np.argmax(result)
        confidence = np.max(result) * 100

        print(f"Prediksi: {class_names[class_idx]}")
        print(f"Confidence: {confidence:.2f}%")

        input_image.save(save_path)

        return f"Prediksi: {class_names[class_idx]} dengan confidence
{confidence:.2f}%. Gambar asli disimpan di {save_path}."
    except Exception as e:
        return f"Terjadi kesalahan: {e}"

result = classify_images(r'C:\Users\vina qhurotu aini\Documents\
KULIAH\SEMESTER 5\ML\Tubes\test_data\Busuk\busuk_09.jpg',
save_path='busuk9.jpg')
print(result)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 213ms/step
Prediksi: Busuk
Confidence: 57.55%
Prediksi: Busuk dengan confidence 57.55%. Gambar asli disimpan di
busuk9.jpg.
```

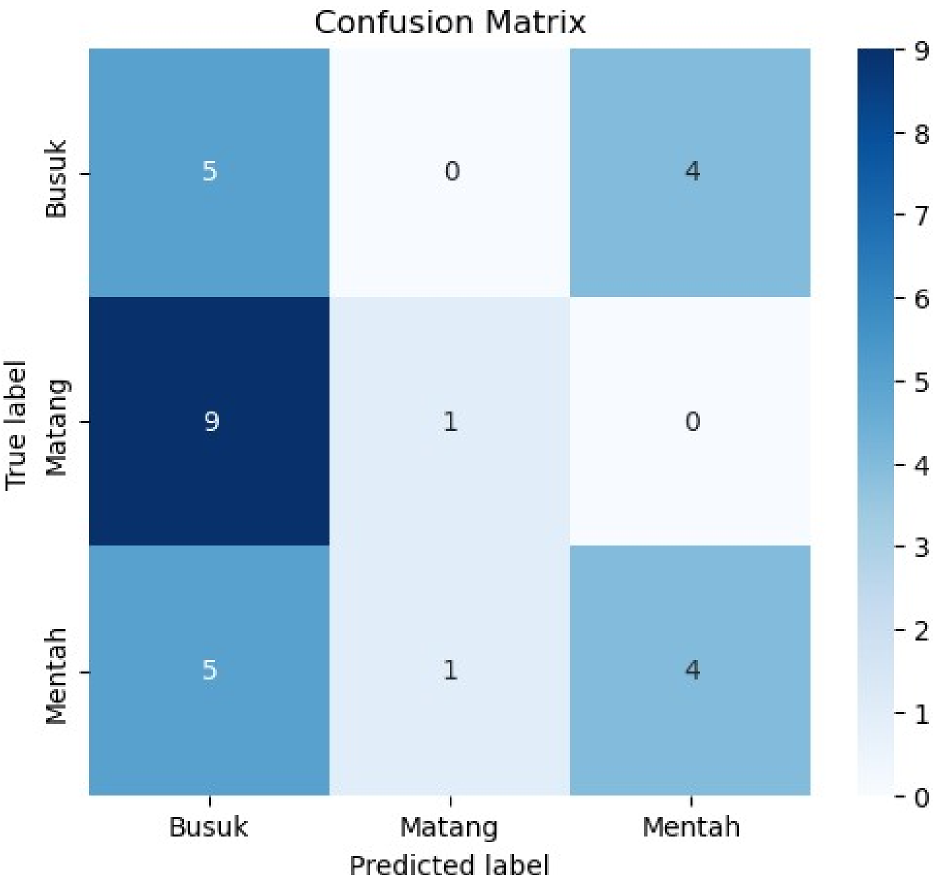
```
import tensorflow as tf
from tensorflow.keras.models import load_model
import seaborn as sns
import matplotlib.pyplot as plt

test_data = tf.keras.preprocessing.image_dataset_from_directory(
    r'test_data',
    labels='inferred',
    label_mode='categorical',
    batch_size=32,
    image_size=(180, 180)
)
```

```
Found 29 files belonging to 3 classes.
```

```
y_pred = model.predict(test_data)
y_pred_class = tf.argmax(y_pred, axis=1)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 1s/step
```

```
true_labels = []
for _, labels in test_data:
    true_labels.extend(tf.argmax(labels, axis=1).numpy())  # Konversi
one-hot ke indeks kelas
true_labels = tf.convert_to_tensor(true_labels)

conf_mat = tf.math.confusion_matrix(true_labels, y_pred_class)

accuracy = tf.reduce_sum(tf.linalg.diag_part(conf_mat)) /
tf.reduce_sum(conf_mat)

precision = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=0)
recall = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=1)

f1_score = 2 * (precision * recall) / (precision + recall)

# Visualisasi Confusion Matrix
plt.figure(figsize=(6, 5))
sns.heatmap(conf_mat.numpy(), annot=True, fmt='d', cmap='Blues',
            xticklabels=["Busuk", "Matang", "Mentah"],
yticklabels=["Busuk", "Matang", "Mentah"])
plt.title('Confusion Matrix')
plt.xlabel('Predicted label')
plt.ylabel('True label')
plt.show()
```



```
print("Confusion Matrix: \n", conf_mat.numpy())
print("Akurasi: ", accuracy.numpy())
print("Presisi: ", precision.numpy())
print("Recall: ", recall.numpy())
print("F1 Score: ", f1_score.numpy())
```

```
Confusion Matrix:
 [[5 0 4]
 [9 1 0]
 [5 1 4]]
Akurasi:  0.3448275862068966
Presisi:  [0.26315789 0.5        0.5       ]
Recall:  [0.55555556 0.1        0.4       ]
F1 Score:  [0.35714286 0.16666667 0.44444444]
```

ALEX NET

```python
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras import layers, models

# Load data
data_dir = r"C:\Users\Sherlyna Alfelia\Documents\KULIAH\SMT 5\ML\
TUBES_UAS\train_data"
data = tf.keras.utils.image_dataset_from_directory(data_dir, seed=123,
image_size=(180, 180))

print(data.class_names)

class_names = data.class_names  # ['Busuk', 'Matang', 'Mentah']
```

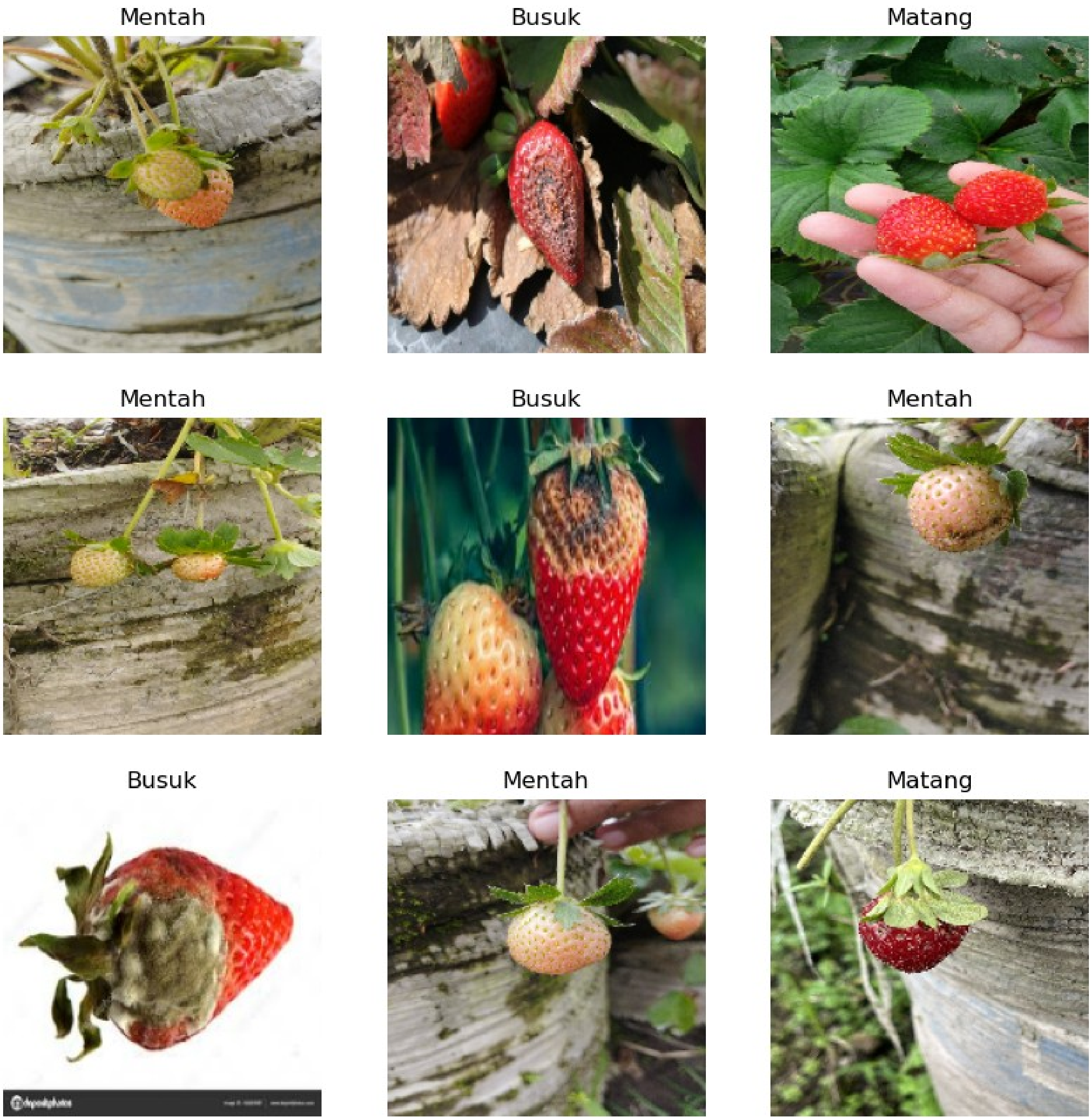
```
Found 301 files belonging to 3 classes.
['Busuk', 'Matang', 'Mentah']
```

```python
data_dir = r"C:\Users\Sherlyna Alfelia\Documents\KULIAH\SMT 5\ML\
TUBES_UAS\train_data"
img_size = 180
batch = 32
validation_split = 0.1

# Membagi dataset menjadi train dan validation
train_ds = tf.keras.utils.image_dataset_from_directory(
    data_dir,
    seed=123,
    image_size=(img_size, img_size),
    batch_size=batch,
    validation_split=validation_split,
    subset="training"
)

val_ds = tf.keras.utils.image_dataset_from_directory(
    data_dir,
    seed=123,
    image_size=(img_size, img_size),
    batch_size=batch,
    validation_split=validation_split,
    subset="validation"
)

# Cek jumlah gambar
print("Total Images: ", len(train_ds) * batch + len(val_ds) * batch)
print("Train Images: ", len(train_ds) * batch)
print("Validation Images: ", len(val_ds) * batch)
```

```
Found 301 files belonging to 3 classes.
Using 271 files for training.
```

```
Found 301 files belonging to 3 classes.
Using 30 files for validation.
Total Images:  320
Train Images:  288
Validation Images:  32
```

```python
# Visualisasi data
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    for i in range(9):
        plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype('uint8'))
        plt.title(class_names[labels[i]])
        plt.axis('off')
plt.show()
```



```
# Preprocessing dataset
Tuner = tf.data.AUTOTUNE
train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size=Tuner)
val_ds = val_ds.cache().shuffle(1000).prefetch(buffer_size=Tuner)

# Augmentasi data
data_augmentation = models.Sequential([
    layers.RandomFlip("horizontal", input_shape=(img_size, img_size,
3)),
    layers.RandomRotation(0.1),
    layers.RandomZoom(0.1)
```

```python
])

# Lihat data setelah di augmentasi
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    augmented_images = data_augmentation(images)
    for i in range(9):
        plt.subplot(3, 3, i + 1)
        plt.imshow(augmented_images[i].numpy().astype('uint8'))
        plt.axis('off')
plt.show()
```

```
c:\anac\Lib\site-packages\keras\src\layers\preprocessing\
tf_data_layer.py:19: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
  super().__init__(**kwargs)
```

```
from tensorflow.keras import layers, models

# Membuat model AlexNet dengan Batch Normalization
def alexnet(input_shape, n_classes):
    model = models.Sequential()

    # Layer 1
    model.add(layers.Conv2D(96, (11, 11), strides=(4, 4),
activation='relu', input_shape=input_shape))
    model.add(layers.BatchNormalization())
    model.add(layers.MaxPooling2D(pool_size=(3, 3), strides=(2, 2)))
    # Layer 2
    model.add(layers.Conv2D(256, (5, 5), padding='same',
activation='relu'))
    model.add(layers.BatchNormalization())
    model.add(layers.MaxPooling2D(pool_size=(3, 3), strides=(2, 2)))

    # Layer 3
    model.add(layers.Conv2D(384, (3, 3), padding='same',
activation='relu'))
    model.add(layers.BatchNormalization())

    # Layer 4
    model.add(layers.Conv2D(384, (3, 3), padding='same',
activation='relu'))
    model.add(layers.BatchNormalization())

    # Layer 5
    model.add(layers.Conv2D(256, (3, 3), padding='same',
activation='relu'))
    model.add(layers.BatchNormalization())
    model.add(layers.MaxPooling2D(pool_size=(3, 3), strides=(2, 2)))

    # Flatten dan Dense Layers
    model.add(layers.Flatten())
    model.add(layers.Dense(4096, activation='relu',
kernel_regularizer=tf.keras.regularizers.l2(0.01)))
    model.add(layers.Dropout(0.5))
    model.add(layers.Dense(4096, activation='relu',
kernel_regularizer=tf.keras.regularizers.l2(0.01)))
    model.add(layers.Dropout(0.5))
    model.add(layers.Dense(n_classes, activation='softmax'))

    return model

# Pastikan input shape dan jumlah kelas sesuai
input_shape = (180, 180, 3)
n_classes = len(class_names)

# Clear Cache Keras menggunakan clear session
tf.keras.backend.clear_session()

# Buat model
model = alexnet(input_shape, n_classes)
model.summary()
```

```
c:\anac\Lib\site-packages\keras\src\layers\convolutional\
base_conv.py:107: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
```

```
  super().__init__(activity_regularizer=activity_regularizer,
**kwargs)

Model: "sequential"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━
━━━━━┓
┃ Layer (type)                    ┃ Output Shape            ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━
━━━━━┩
│ conv2d (Conv2D)                 │ (None, 43, 43, 96)      │
34,944 │
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ batch_normalization             │ (None, 43, 43, 96)      │
384 │
│ (BatchNormalization)            │                         │
│
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ max_pooling2d (MaxPooling2D)    │ (None, 21, 21, 96)      │
0 │
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ conv2d_1 (Conv2D)               │ (None, 21, 21, 256)     │
614,656 │
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ batch_normalization_1           │ (None, 21, 21, 256)     │
1,024 │
│ (BatchNormalization)            │                         │
│
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ max_pooling2d_1 (MaxPooling2D)  │ (None, 10, 10, 256)     │
0 │
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ conv2d_2 (Conv2D)               │ (None, 10, 10, 384)     │
885,120 │
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ batch_normalization_2           │ (None, 10, 10, 384)     │
1,536 │
│ (BatchNormalization)            │                         │
│
├─────────────────────────────────┼─────────────────────────┼──────────
─────┤
│ conv2d_3 (Conv2D)               │ (None, 10, 10, 384)     │
```

```
1,327,488 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_3           │ (None, 10, 10, 384)    │
1,536 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ conv2d_4 (Conv2D)               │ (None, 10, 10, 256)    │
884,992 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_4           │ (None, 10, 10, 256)    │
1,024 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_2 (MaxPooling2D)  │ (None, 4, 4, 256)      │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ flatten (Flatten)               │ (None, 4096)           │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense (Dense)                   │ (None, 4096)           │
16,781,312 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout (Dropout)               │ (None, 4096)           │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_1 (Dense)                 │ (None, 4096)           │
16,781,312 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_1 (Dropout)             │ (None, 4096)           │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_2 (Dense)                 │ (None, 3)              │
12,291 │
└─────────────────────────────────┴────────────────────────┴──────────
─────┘

 Total params: 37,327,619 (142.39 MB)
 Trainable params: 37,324,867 (142.38 MB)

 Non-trainable params: 2,752 (10.75 KB)
```

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

# Compile dengan optimizer Adam
model.compile(
    optimizer=Adam(),
    loss='sparse_categorical_crossentropy',
    metrics=['accuracy']
)

# Buat early stopping
early_stopping = EarlyStopping(monitor='val_accuracy', patience=5,
mode='max')

# Fit validation data ke dalam model
history = model.fit(train_ds,
                    epochs=30,
                    validation_data=val_ds,
                    callbacks=[early_stopping])
```

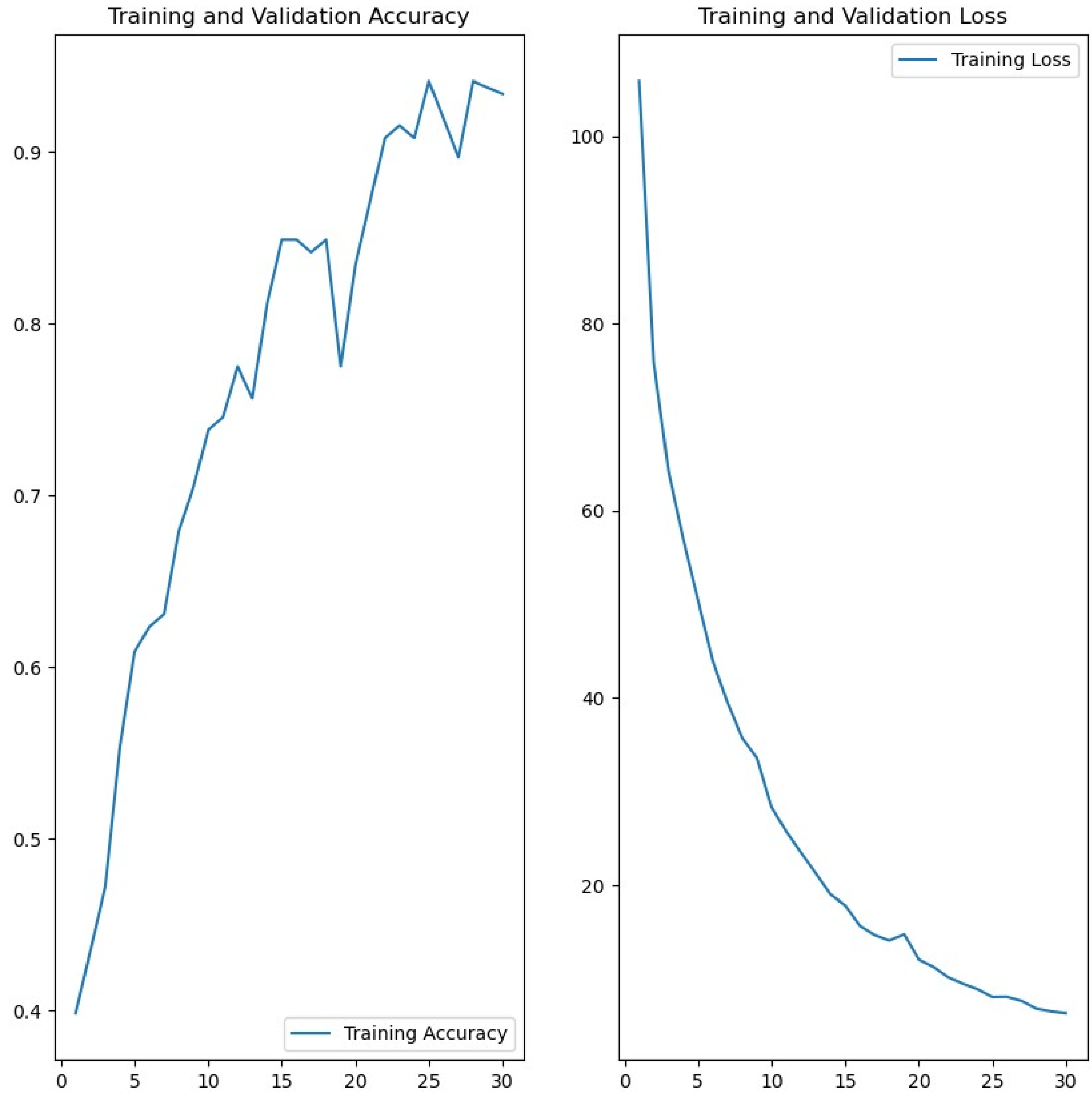
```
Epoch 1/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 23s 1s/step - accuracy: 0.4080 - loss:
109.9298
Epoch 2/30

c:\anac\Lib\contextlib.py:158: UserWarning: Your input ran out of
data; interrupting training. Make sure that your dataset or generator
can generate at least `steps_per_epoch * epochs` batches. You may need
to use the `.repeat()` function when building your dataset.
  self.gen.throw(value)
c:\anac\Lib\site-packages\keras\src\callbacks\early_stopping.py:155:
UserWarning: Early stopping conditioned on metric `val_accuracy` which
is not available. Available metrics are: accuracy,loss
  current = self.get_monitor_value(logs)

9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 894ms/step - accuracy: 0.4332 - loss:
78.5367
Epoch 3/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 872ms/step - accuracy: 0.5318 - loss:
64.9256
Epoch 4/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 824ms/step - accuracy: 0.5239 - loss:
58.5072
Epoch 5/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 842ms/step - accuracy: 0.6050 - loss:
51.3457
Epoch 6/30
```

```
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 855ms/step - accuracy: 0.6548 - loss:
45.0703
Epoch 7/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 906ms/step - accuracy: 0.6395 - loss:
41.0658
Epoch 8/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 9s 963ms/step - accuracy: 0.6824 - loss:
36.7263
Epoch 9/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 855ms/step - accuracy: 0.6978 - loss:
33.6807
Epoch 10/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 864ms/step - accuracy: 0.7614 - loss:
28.9888
Epoch 11/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 847ms/step - accuracy: 0.7177 - loss:
25.9854
Epoch 12/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 9s 960ms/step - accuracy: 0.7938 - loss:
23.6791
Epoch 13/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 844ms/step - accuracy: 0.7513 - loss:
21.5451
Epoch 14/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 820ms/step - accuracy: 0.7914 - loss:
19.2834
Epoch 15/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 9s 967ms/step - accuracy: 0.8574 - loss:
17.9925
Epoch 16/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 855ms/step - accuracy: 0.8658 - loss:
15.8844
Epoch 17/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 877ms/step - accuracy: 0.8551 - loss:
14.8671
Epoch 18/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 853ms/step - accuracy: 0.8893 - loss:
14.3423
Epoch 19/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 904ms/step - accuracy: 0.7516 - loss:
14.3587
Epoch 20/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 833ms/step - accuracy: 0.8515 - loss:
12.0668
Epoch 21/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 828ms/step - accuracy: 0.8450 - loss:
11.2583
Epoch 22/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 845ms/step - accuracy: 0.9205 - loss:
```

```
10.2116
Epoch 23/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 841ms/step - accuracy: 0.9442 - loss:
9.4293
Epoch 24/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 869ms/step - accuracy: 0.9140 - loss:
8.8839
Epoch 25/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 864ms/step - accuracy: 0.9533 - loss:
8.0947
Epoch 26/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 891ms/step - accuracy: 0.9307 - loss:
8.2085
Epoch 27/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 869ms/step - accuracy: 0.9046 - loss:
7.5800
Epoch 28/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 850ms/step - accuracy: 0.9596 - loss:
6.8011
Epoch 29/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 7s 831ms/step - accuracy: 0.9357 - loss:
6.5429
Epoch 30/30
9/9 ━━━━━━━━━━━━━━━━━━━━ 8s 839ms/step - accuracy: 0.9490 - loss:
6.1547

# Cek kunci dalam history
print(history.history.keys())

# Rentang epoch
epochs_range = range(1, len(history.history['loss']) + 1)

plt.figure(figsize=(10, 10))

# Subplot untuk akurasi
plt.subplot(1, 2, 1)
plt.plot(epochs_range, history.history['accuracy'], label='Training
Accuracy')

# Sesuaikan berdasarkan kunci yang ditemukan
if 'val_accuracy' in history.history:
    plt.plot(epochs_range, history.history['val_accuracy'],
label='Validation Accuracy')
elif 'val_acc' in history.history:
    plt.plot(epochs_range, history.history['val_acc'],
label='Validation Accuracy')

plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')
```

```
# Subplot untuk loss
plt.subplot(1, 2, 2)
plt.plot(epochs_range, history.history['loss'], label='Training Loss')

# Sesuaikan untuk loss validasi
if 'val_loss' in history.history:
    plt.plot(epochs_range, history.history['val_loss'],
label='Validation Loss')
elif 'val_loss' in history.history:
    plt.plot(epochs_range, history.history['val_loss'],
label='Validation Loss')

plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```

```
dict_keys(['accuracy', 'loss'])
```



```python
model.save('BestModel_AlexNet_Matplotlib.h5')
```

```
WARNING:absl:You are saving your model as an HDF5 file via
`model.save()` or `keras.saving.save_model(model)`. This file format
is considered legacy. We recommend using instead the native Keras
format, e.g. `model.save('my_model.keras')` or
`keras.saving.save_model(model, 'my_model.keras')`.
```

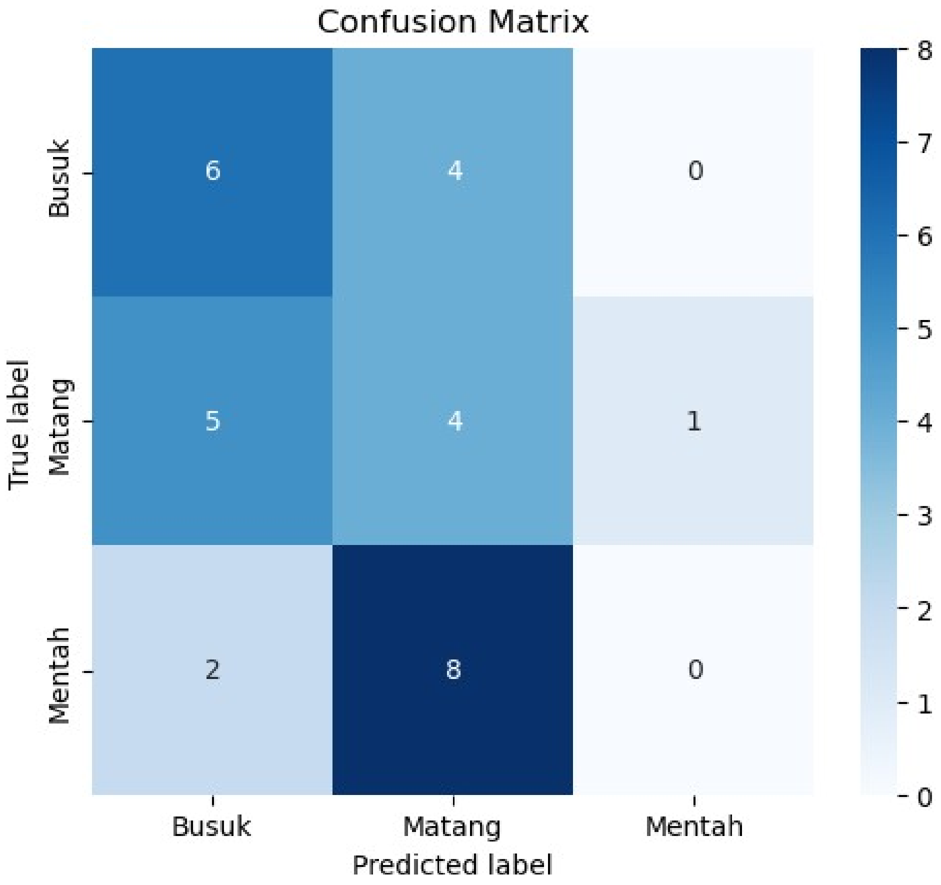
```python
from tensorflow.keras.models import load_model
from PIL import Image

# Load the trained model
```

```python
model = load_model(r'C:\Users\Sherlyna Alfelia\Documents\KULIAH\SMT 5\
ML\TUBES_UAS\BestModel_AlexNet_Matplotlib.h5')  # Ganti dengan path
model Anda
class_names = ['Busuk', 'Matang', 'Mentah']

# Function to classify images and save the original image
def classify_images(image_path, save_path='predicted_image.jpg'):
    try:
        # Load and preprocess the image
        input_image = tf.keras.utils.load_img(image_path,
target_size=(180, 180))
        input_image_array = tf.keras.utils.img_to_array(input_image)
        input_image_exp_dim = tf.expand_dims(input_image_array, 0)  #
Add batch dimension

        # Predict
        predictions = model.predict(input_image_exp_dim)
        result = tf.nn.softmax(predictions[0])
        class_idx = np.argmax(result)
        confidence = np.max(result) * 100

        # Display prediction and confidence in notebook
        print(f"Prediksi: {class_names[class_idx]}")
        print(f"Confidence: {confidence:.2f}%")

        # Save the original image (without text)
        input_image = Image.open(image_path)
        input_image.save(save_path)

        return f"Prediksi: {class_names[class_idx]} dengan confidence
{confidence:.2f}%. Gambar asli disimpan di {save_path}."
    except Exception as e:
        return f"Terjadi kesalahan: {e}"

# Contoh penggunaan fungsi
result = classify_images(r'C:\Users\Sherlyna Alfelia\Documents\KULIAH\
SMT 5\ML\TUBES_UAS\test_data\Matang\matang_06.jpg',
save_path='matang_06.jpg')
print(result)
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have
yet to be built. `model.compile_metrics` will be empty until you train
or evaluate the model.

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 480ms/step
Prediksi: Matang
Confidence: 57.61%
Prediksi: Matang dengan confidence 57.61%. Gambar asli disimpan di
matang_06.jpg.
```

```python
import seaborn as sns

# Muat data test yang sebenarnya
test_data = tf.keras.preprocessing.image_dataset_from_directory(
    r'test_data',
    labels='inferred',
    label_mode='categorical',  # Menghasilkan label dalam bentuk one-
hot encoding
    batch_size=32,
    image_size=(180, 180)
)

# Prediksi model
y_pred = model.predict(test_data)
y_pred_class = tf.argmax(y_pred, axis=1)  # Konversi ke kelas prediksi

# Ekstrak label sebenarnya dari test_data dan konversi ke bentuk
indeks kelas
true_labels = []
for _, labels in test_data:
    true_labels.extend(tf.argmax(labels, axis=1).numpy())  # Konversi
one-hot ke indeks kelas
true_labels = tf.convert_to_tensor(true_labels)

# Membuat matriks kebingungan
conf_mat = tf.math.confusion_matrix(true_labels, y_pred_class)

# Menghitung akurasi
accuracy = tf.reduce_sum(tf.linalg.diag_part(conf_mat)) /
tf.reduce_sum(conf_mat)

# Menghitung presisi dan recall
precision = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=0)
recall = tf.linalg.diag_part(conf_mat) / tf.reduce_sum(conf_mat,
axis=1)

# Menghitung F1 Score
f1_score = 2 * (precision * recall) / (precision + recall)

# Visualisasi Confusion Matrix
plt.figure(figsize=(6, 5))
sns.heatmap(conf_mat.numpy(), annot=True, fmt='d', cmap='Blues',
            xticklabels=["Busuk", "Matang", "Mentah"],
yticklabels=["Busuk", "Matang", "Mentah"])
plt.title('Confusion Matrix')
plt.xlabel('Predicted label')
plt.ylabel('True label')
plt.show()
```

```
# Menampilkan hasil
print("Confusion Matrix: \n", conf_mat.numpy())
print("Akurasi: ", accuracy.numpy())
print("Presisi: ", precision.numpy())
print("Recall: ", recall.numpy())
print("F1 Score: ", f1_score.numpy())

Found 30 files belonging to 3 classes.
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 955ms/step
```



```
Confusion Matrix:
 [[6 4 0]
 [5 4 1]
 [2 8 0]]
Akurasi:  0.3333333333333333
Presisi:  [0.46153846 0.25       0.        ]
Recall:  [0.6 0.4 0. ]
F1 Score:  [0.52173913 0.30769231        nan]
```

```
import streamlit as st
import tensorflow as tf
import numpy as np
from tensorflow.keras.models import load_model
from PIL import Image

# Load the pre-trained model
model = load_model(r'D:\coolyeah\semester5\ml\tubes_uas\gNet5.h5')  # Adjust the
path to your model
class_names = ['Busuk', 'Matang', 'Mentah']

# Function to preprocess and classify image
def classify_image(image):
    try:
        # Preprocess the image
        input_image = image.resize((180, 180))  # Resize to match model input
        input_image_array = np.array(input_image)  # Convert to numpy array
        input_image_exp_dim = np.expand_dims(input_image_array, axis=0)  # Add
batch dimension

        # Predict using the model
        predictions = model.predict(input_image_exp_dim)
        result = tf.nn.softmax(predictions[0])  # Apply softmax for probability

        # Get class with highest confidence
        class_idx = np.argmax(result)
        confidence_scores = result.numpy()
        return class_names[class_idx], confidence_scores
    except Exception as e:
        return "Error", str(e)

# Function to create a custom progress bar
def custom_progress_bar(confidence, color1, color2):
    percentage1 = confidence[0] * 100  # Confidence for class 0 (Busuk)
    percentage2 = confidence[1] * 100  # Confidence for class 1 (Matang)
    percentage3 = confidence[2] * 100  # Confidence for class 2 (Mentah)
    progress_html = f"""
    <div style="border: 1px solid #ddd; border-radius: 5px; overflow: hidden;
width: 100%; font-size: 14px;">
        <div style="width: {percentage1:.2f}%; background: #FF4136; color: white;
text-align: center; height: 24px; float: left;">
            {percentage1:.2f}% Busuk
        </div>
        <div style="width: {percentage2:.2f}%; background: #007BFF; color: white;
text-align: center; height: 24px; float: left;">
            {percentage2:.2f}% Matang
        </div>
        <div style="width: {percentage3:.2f}%; background: #2ECC40; color: white;
text-align: center; height: 24px; float: left;">
            {percentage3:.2f}% Mentah
        </div>
    </div>
    """
    st.sidebar.markdown(progress_html, unsafe_allow_html=True)

# Streamlit UI
st.title("Prediksi Strawberry")  # 4 digit npm terakhir

# Upload multiple files in the main page
```

```
uploaded_files = st.file_uploader("Unggah Gambar (Beberapa diperbolehkan)",
type=["jpg", "png", "jpeg"], accept_multiple_files=True)

# Sidebar for prediction button and results
if st.sidebar.button("Prediksi"):
    if uploaded_files:
        st.sidebar.write("### Hasil Prediksi")
        for uploaded_file in uploaded_files:
            image = Image.open(uploaded_file)  # Open the uploaded image

            # Perform prediction
            label, confidence = classify_image(image)

            if label != "Error":
                # Display prediction results
                st.sidebar.write(f"**Nama File:** {uploaded_file.name}")
                st.sidebar.markdown(f"<h4 style='color: #007BFF;'>Prediksi: {label}
</h4>", unsafe_allow_html=True)

                # Display confidence scores
                st.sidebar.write("**Confidence:**")
                for i, class_name in enumerate(class_names):
                    st.sidebar.write(f"- {class_name}: {confidence[i] * 100:.2f}%")

                # Display custom progress bar
                custom_progress_bar(confidence, "#FF4136", "#007BFF")

                st.sidebar.write("---")
            else:
                st.sidebar.error(f"Kesalahan saat memproses gambar
{uploaded_file.name}: {confidence}")
    else:
        st.sidebar.error("Silakan unggah setidaknya satu gambar untuk diprediksi.")

# Preview images in the main page
if uploaded_files:
    st.write("### Preview Gambar")
    for uploaded_file in uploaded_files:
        image = Image.open(uploaded_file)
        st.image(image, caption=f"{uploaded_file.name}", use_column_width=True)
```