

```
In [1]: !pip install tensorflow
```

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Requirement already satisfied: tensorflow in /usr/local/lib/python3.10/dist-packages (2.15.0)
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.4.0)
Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=23.5.26 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (24.3.25)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (0.2.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (3.11.0)
Requirement already satisfied: libclang>=13.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (18.1.1)
Requirement already satisfied: ml-dtypes~=0.2.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (0.2.0)
Requirement already satisfied: numpy<2.0.0,>=1.23.5 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.26.4)
Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (3.3.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-packages (from tensorflow) (24.1)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (3.20.3)
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (from tensorflow) (71.0.4)
Requirement already satisfied: six>=1.12.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (4.12.2)
Requirement already satisfied: wrapt<1.15,>=1.11.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.14.1)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (0.37.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (1.64.1)
Requirement already satisfied: tensorboard<2.16,>=2.15 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (2.15.2)
Requirement already satisfied: tensorflow-estimator<2.16,>=2.15.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (2.15.0)
Requirement already satisfied: keras<2.16,>=2.15.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (2.15.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.10/dist-packages (from astunparse>=1.6.0->tensorflow) (0.43.0)
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (2.27.0)
Requirement already satisfied: google-auth-oauthlib<2,>=0.5 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (1.2.1)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (3.6)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (2.31.0)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (3.0.3)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-
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packages (from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (5.4.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.10/dist-packages (from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (0.4.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from google-auth-oauthlib<2,>=0.5->tensorboard<2.16,>=2.15->tensorflow) (1.3.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (2024.7.4)
Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10/dist-packages (from werkzeug>=1.0.1->tensorboard<2.16,>=2.15->tensorflow) (2.1.5)
Requirement already satisfied: pyasn1<0.7.0,>=0.4.6 in /usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (0.6.0)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.10/dist-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<2,>=0.5->tensorboard<2.16,>=2.15->tensorflow) (3.2.2)

```
In [6]: from tensorflow.compat.v1 import ConfigProto
from tensorflow.compat.v1 import InteractiveSession

config = ConfigProto()
config.gpu_options.per_process_gpu_memory_fraction = 0.5
config.gpu_options.allow_growth = True
session = InteractiveSession(config=config)
# import the libraries as shown below

from tensorflow.keras.layers import Input, Lambda, Dense, Flatten
from tensorflow.keras.models import Model
from tensorflow.keras.applications.vgg16 import VGG16, preprocess_input
#from keras.applications.vgg16 import VGG16
from tensorflow.keras.applications.inception_v3 import preprocess_input
from tensorflow.keras.preprocessing import image
from tensorflow.keras.preprocessing.image import ImageDataGenerator, load_img
from tensorflow.keras.models import Sequential
import numpy as np
from glob import glob
```

```
/usr/local/lib/python3.10/dist-packages/tensorflow/python/client/session.py:1793: UserWarning: An interactive session is already active. This can cause out-of-memory errors in some cases. You must explicitly call `InteractiveSession.close()` to release resources held by the other session(s).
warnings.warn('An interactive session is already active. This can '
```

```
In [4]: IMAGE_SIZE = [224, 224]

train_path = '/content/drive/MyDrive/Datasets/train'
valid_path = '/content/drive/MyDrive/Datasets/test'
```

```
In [7]: vgg = VGG16(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)

Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/inception_v3/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5
87910968/87910968 [=====] - 1s 0us/step
```

```
In [9]: for layer in vgg.layers:
        layer.trainable = False
```

```
In [13]: # useful for getting number of output classes
folders = glob('/content/drive/MyDrive/Datasets/train/*')
folders

Out[13]: ['/content/drive/MyDrive/Datasets/train/diseased cotton leaf',
'/content/drive/MyDrive/Datasets/train/fresh cotton plant',
'/content/drive/MyDrive/Datasets/train/diseased cotton plant',
'/content/drive/MyDrive/Datasets/train/fresh cotton leaf']

In [14]: # our layers - you can add more if you want
x = Flatten()(vgg.output)

In [15]: prediction = Dense(len(folders), activation='softmax')(x)

# create a model object
model = Model(inputs=inception.input, outputs=prediction)

In [16]: model.summary()
```

Model: "model"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_1 (InputLayer)	[(None, 224, 224, 3)]	0	[]
conv2d (Conv2D)	(None, 111, 111, 32)	864	['input_1[0][0]']
batch_normalization (Batch Normalization)	(None, 111, 111, 32)	96	['conv2d[0][0]']
activation (Activation)	(None, 111, 111, 32)	0	['batch_normalization[0][0]']
conv2d_1 (Conv2D)	(None, 109, 109, 32)	9216	['activation[0][0]']
batch_normalization_1 (Batch Normalization)	(None, 109, 109, 32)	96	['conv2d_1[0][0]']
activation_1 (Activation)	(None, 109, 109, 32)	0	['batch_normalization_1[0][0]']
conv2d_2 (Conv2D)	(None, 109, 109, 64)	18432	['activation_1[0][0]']
batch_normalization_2 (Batch Normalization)	(None, 109, 109, 64)	192	['conv2d_2[0][0]']

chNormalization)			
activation_2 (Activation) n_2[0][0]'	(None, 109, 109, 64)	0	['batch_normalizatio n_2[0][0]']
max_pooling2d (MaxPooling2 D)	(None, 54, 54, 64)	0	['activation_2[0]
conv2d_3 (Conv2D) [0]']	(None, 54, 54, 80)	5120	['max_pooling2d[0]
batch_normalization_3 (Bat chNormalization)	(None, 54, 54, 80)	240	['conv2d_3[0][0]']
activation_3 (Activation) n_3[0][0]'	(None, 54, 54, 80)	0	['batch_normalizatio n_3[0][0]']
conv2d_4 (Conv2D) [0]']	(None, 52, 52, 192)	138240	['activation_3[0]
batch_normalization_4 (Bat chNormalization)	(None, 52, 52, 192)	576	['conv2d_4[0][0]']
activation_4 (Activation) n_4[0][0]'	(None, 52, 52, 192)	0	['batch_normalizatio n_4[0][0]']
max_pooling2d_1 (MaxPoolin g2D)	(None, 25, 25, 192)	0	['activation_4[0]
conv2d_8 (Conv2D) [0]']	(None, 25, 25, 64)	12288	['max_pooling2d_1[0]
batch_normalization_8 (Bat chNormalization)	(None, 25, 25, 64)	192	['conv2d_8[0][0]']
activation_8 (Activation)	(None, 25, 25, 64)	0	['batch_normalizatio

n_8[0][0]']
conv2d_6 (Conv2D) [0]'	(None, 25, 25, 48)	9216	['max_pooling2d_1[0]
conv2d_9 (Conv2D) [0]'	(None, 25, 25, 96)	55296	['activation_8[0]
batch_normalization_6 (Batch Normalization)	(None, 25, 25, 48)	144	['conv2d_6[0][0]']
batch_normalization_9 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_9[0][0]']
activation_6 (Activation) n_6[0][0]'	(None, 25, 25, 48)	0	['batch_normalization_6[0][0]']
activation_9 (Activation) n_9[0][0]'	(None, 25, 25, 96)	0	['batch_normalization_9[0][0]']
average_pooling2d (Average Pooling2D) [0]'	(None, 25, 25, 192)	0	['max_pooling2d_1[0]
conv2d_5 (Conv2D) [0]'	(None, 25, 25, 64)	12288	['max_pooling2d_1[0]
conv2d_7 (Conv2D) [0]'	(None, 25, 25, 64)	76800	['activation_6[0]
conv2d_10 (Conv2D) [0]'	(None, 25, 25, 96)	82944	['activation_9[0]
conv2d_11 (Conv2D) [0][0]'	(None, 25, 25, 32)	6144	['average_pooling2d_1[0][0]']
batch_normalization_5 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_5[0][0]']
batch_normalization_7 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_7[0][0]']

chNormalization)			
batch_normalization_10 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_10[0][0]']
tchNormalization)			
batch_normalization_11 (Batch Normalization)	(None, 25, 25, 32)	96	['conv2d_11[0][0]']
tchNormalization)			
activation_5 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_5[0][0]']
n_5[0][0]'			
activation_7 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_7[0][0]']
n_7[0][0]'			
activation_10 (Activation)	(None, 25, 25, 96)	0	['batch_normalization_10[0][0]']
n_10[0][0]'			
activation_11 (Activation)	(None, 25, 25, 32)	0	['batch_normalization_11[0][0]']
n_11[0][0]'			
mixed0 (Concatenate)	(None, 25, 25, 256)	0	['activation_5[0][0]', 'activation_7[0][0]', 'activation_10[0][0]', 'activation_11[0][0]']
conv2d_15 (Conv2D)	(None, 25, 25, 64)	16384	['mixed0[0][0]']
batch_normalization_15 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_15[0][0]']
tchNormalization)			
activation_15 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_15[0][0]']
n_15[0][0]'			

conv2d_13 (Conv2D)	(None, 25, 25, 48)	12288	['mixed0[0][0]']
conv2d_16 (Conv2D) [0]']	(None, 25, 25, 96)	55296	['activation_15[0]
batch_normalization_13 (Batch Normalization)	(None, 25, 25, 48)	144	['conv2d_13[0][0]']
batch_normalization_16 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_16[0][0]']
activation_13 (Activation) n_13[0][0]	(None, 25, 25, 48)	0	['batch_normalization_13[0][0]']
activation_16 (Activation) n_16[0][0]	(None, 25, 25, 96)	0	['batch_normalization_16[0][0]']
average_pooling2d_1 (Average Pooling2D)	(None, 25, 25, 256)	0	['mixed0[0][0]']
conv2d_12 (Conv2D)	(None, 25, 25, 64)	16384	['mixed0[0][0]']
conv2d_14 (Conv2D) [0]']	(None, 25, 25, 64)	76800	['activation_13[0]
conv2d_17 (Conv2D) [0]']	(None, 25, 25, 96)	82944	['activation_16[0]
conv2d_18 (Conv2D) 1[0][0]']	(None, 25, 25, 64)	16384	['average_pooling2d_1[0][0]']
batch_normalization_12 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_12[0][0]']
batch_normalization_14 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_14[0][0]']

batch_normalization_17 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_17[0][0]']
batch_normalization_18 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_18[0][0]']
activation_12 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_12[0][0]']
activation_14 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_14[0][0]']
activation_17 (Activation)	(None, 25, 25, 96)	0	['batch_normalization_17[0][0]']
activation_18 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_18[0][0]']
mixed1 (Concatenate)	(None, 25, 25, 288)	0	['activation_12[0][0]', 'activation_14[0][0]', 'activation_17[0][0]', 'activation_18[0][0]']
conv2d_22 (Conv2D)	(None, 25, 25, 64)	18432	['mixed1[0][0]']
batch_normalization_22 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_22[0][0]']
activation_22 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_22[0][0]']
conv2d_20 (Conv2D)	(None, 25, 25, 48)	13824	['mixed1[0][0]']

conv2d_23 (Conv2D) [0]']	(None, 25, 25, 96)	55296	['activation_22[0]
batch_normalization_20 (Batch Normalization)	(None, 25, 25, 48)	144	['conv2d_20[0][0]']
batch_normalization_23 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_23[0][0]']
activation_20 (Activation) n_20[0][0]	(None, 25, 25, 48)	0	['batch_normalization_20[0][0]']
activation_23 (Activation) n_23[0][0]	(None, 25, 25, 96)	0	['batch_normalization_23[0][0]']
average_pooling2d_2 (Average Pooling2D)	(None, 25, 25, 288)	0	['mixed1[0][0]']
conv2d_19 (Conv2D)	(None, 25, 25, 64)	18432	['mixed1[0][0]']
conv2d_21 (Conv2D) [0]']	(None, 25, 25, 64)	76800	['activation_20[0]
conv2d_24 (Conv2D) [0]']	(None, 25, 25, 96)	82944	['activation_23[0]
conv2d_25 (Conv2D) 2[0][0]']	(None, 25, 25, 64)	18432	['average_pooling2d_2[0][0]']
batch_normalization_19 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_19[0][0]']
batch_normalization_21 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_21[0][0]']
batch_normalization_24 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_24[0][0]']

batch_normalization_25 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_25[0][0]']
activation_19 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_19[0][0]']
activation_21 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_21[0][0]']
activation_24 (Activation)	(None, 25, 25, 96)	0	['batch_normalization_24[0][0]']
activation_25 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_25[0][0]']
mixed2 (Concatenate)	(None, 25, 25, 288)	0	['activation_19[0][0]', 'activation_21[0][0]', 'activation_24[0][0]', 'activation_25[0][0]']
conv2d_27 (Conv2D)	(None, 25, 25, 64)	18432	['mixed2[0][0]']
batch_normalization_27 (Batch Normalization)	(None, 25, 25, 64)	192	['conv2d_27[0][0]']
activation_27 (Activation)	(None, 25, 25, 64)	0	['batch_normalization_27[0][0]']
conv2d_28 (Conv2D)	(None, 25, 25, 96)	55296	['activation_27[0][0]']
batch_normalization_28 (Batch Normalization)	(None, 25, 25, 96)	288	['conv2d_28[0][0]']

activation_28 (Activation)	(None, 25, 25, 96)	0	['batch_normalizatio n_28[0][0]
conv2d_26 (Conv2D)	(None, 12, 12, 384)	995328	['mixed2[0][0]']
conv2d_29 (Conv2D)	(None, 12, 12, 96)	82944	['activation_28[0] [0]']
batch_normalization_26 (Ba tchNormalization)	(None, 12, 12, 384)	1152	['conv2d_26[0][0]']
batch_normalization_29 (Ba tchNormalization)	(None, 12, 12, 96)	288	['conv2d_29[0][0]']
activation_26 (Activation)	(None, 12, 12, 384)	0	['batch_normalizatio n_26[0][0]
activation_29 (Activation)	(None, 12, 12, 96)	0	['batch_normalizatio n_29[0][0]
max_pooling2d_2 (MaxPoolin g2D)	(None, 12, 12, 288)	0	['mixed2[0][0]']
mixed3 (Concatenate)	(None, 12, 12, 768)	0	['activation_26[0] [0]', [0]', [0]']
conv2d_34 (Conv2D)	(None, 12, 12, 128)	98304	['mixed3[0][0]']
batch_normalization_34 (Ba tchNormalization)	(None, 12, 12, 128)	384	['conv2d_34[0][0]']
activation_34 (Activation)	(None, 12, 12, 128)	0	['batch_normalizatio

n_34[0][0]			']
conv2d_35 (Conv2D) [0]']	(None, 12, 12, 128)	114688	['activation_34[0]
batch_normalization_35 (Batch Normalization)	(None, 12, 12, 128)	384	['conv2d_35[0][0]']
activation_35 (Activation) n_35[0][0]	(None, 12, 12, 128)	0	['batch_normalization_35[0][0]']
conv2d_31 (Conv2D)	(None, 12, 12, 128)	98304	['mixed3[0][0]']
conv2d_36 (Conv2D) [0]']	(None, 12, 12, 128)	114688	['activation_35[0]
batch_normalization_31 (Batch Normalization)	(None, 12, 12, 128)	384	['conv2d_31[0][0]']
batch_normalization_36 (Batch Normalization)	(None, 12, 12, 128)	384	['conv2d_36[0][0]']
activation_31 (Activation) n_31[0][0]	(None, 12, 12, 128)	0	['batch_normalization_31[0][0]']
activation_36 (Activation) n_36[0][0]	(None, 12, 12, 128)	0	['batch_normalization_36[0][0]']
conv2d_32 (Conv2D) [0]']	(None, 12, 12, 128)	114688	['activation_31[0]
conv2d_37 (Conv2D) [0]']	(None, 12, 12, 128)	114688	['activation_36[0]
batch_normalization_32 (Batch Normalization)	(None, 12, 12, 128)	384	['conv2d_32[0][0]']

batch_normalization_37 (Batch Normalization)	(None, 12, 12, 128)	384	['conv2d_37[0][0]']
activation_32 (Activation)	(None, 12, 12, 128)	0	['batch_normalization_32[0][0]']
activation_37 (Activation)	(None, 12, 12, 128)	0	['batch_normalization_37[0][0]']
average_pooling2d_3 (Average Pooling2D)	(None, 12, 12, 768)	0	['mixed3[0][0]']
conv2d_30 (Conv2D)	(None, 12, 12, 192)	147456	['mixed3[0][0]']
conv2d_33 (Conv2D)	(None, 12, 12, 192)	172032	['activation_32[0][0]']
conv2d_38 (Conv2D)	(None, 12, 12, 192)	172032	['activation_37[0][0]']
conv2d_39 (Conv2D)	(None, 12, 12, 192)	147456	['average_pooling2d_3[0][0]']
batch_normalization_30 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_30[0][0]']
batch_normalization_33 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_33[0][0]']
batch_normalization_38 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_38[0][0]']
batch_normalization_39 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_39[0][0]']
activation_30 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_30[0][0]']

n_30[0][0]			']
activation_33 (Activation) n_33[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_38 (Activation) n_38[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_39 (Activation) n_39[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
mixed4 (Concatenate) [0]', [0]', [0]', [0]']	(None, 12, 12, 768)	0	['activation_30[0] 'activation_33[0] 'activation_38[0] 'activation_39[0]
conv2d_44 (Conv2D)	(None, 12, 12, 160)	122880	['mixed4[0][0]']
batch_normalization_44 (Ba tchNormalization)	(None, 12, 12, 160)	480	['conv2d_44[0][0]']
activation_44 (Activation) n_44[0][0]	(None, 12, 12, 160)	0	['batch_normalizatio '']
conv2d_45 (Conv2D) [0]']	(None, 12, 12, 160)	179200	['activation_44[0]
batch_normalization_45 (Ba tchNormalization)	(None, 12, 12, 160)	480	['conv2d_45[0][0]']
activation_45 (Activation) n_45[0][0]	(None, 12, 12, 160)	0	['batch_normalizatio '']
conv2d_41 (Conv2D)	(None, 12, 12, 160)	122880	['mixed4[0][0]']

conv2d_46 (Conv2D)	(None, 12, 12, 160)	179200	['activation_45[0][0]']
batch_normalization_41 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_41[0][0]']
batch_normalization_46 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_46[0][0]']
activation_41 (Activation)	(None, 12, 12, 160)	0	['batch_normalization_41[0][0]']
activation_46 (Activation)	(None, 12, 12, 160)	0	['batch_normalization_46[0][0]']
conv2d_42 (Conv2D)	(None, 12, 12, 160)	179200	['activation_41[0][0]']
conv2d_47 (Conv2D)	(None, 12, 12, 160)	179200	['activation_46[0][0]']
batch_normalization_42 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_42[0][0]']
batch_normalization_47 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_47[0][0]']
activation_42 (Activation)	(None, 12, 12, 160)	0	['batch_normalization_42[0][0]']
activation_47 (Activation)	(None, 12, 12, 160)	0	['batch_normalization_47[0][0]']
average_pooling2d_4 (Average Pooling2D)	(None, 12, 12, 768)	0	['mixed4[0][0]']

conv2d_40 (Conv2D)	(None, 12, 12, 192)	147456	['mixed4[0][0]']
conv2d_43 (Conv2D) [0]']	(None, 12, 12, 192)	215040	['activation_42[0]
conv2d_48 (Conv2D) [0]']	(None, 12, 12, 192)	215040	['activation_47[0]
conv2d_49 (Conv2D) 4[0][0]']	(None, 12, 12, 192)	147456	['average_pooling2d_
batch_normalization_40 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_40[0][0]']
batch_normalization_43 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_43[0][0]']
batch_normalization_48 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_48[0][0]']
batch_normalization_49 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_49[0][0]']
activation_40 (Activation) n_40[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_43 (Activation) n_43[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_48 (Activation) n_48[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_49 (Activation) n_49[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']

mixed5 (Concatenate) [0]', [0]', [0]', [0]']	(None, 12, 12, 768)	0	['activation_40[0] 'activation_43[0] 'activation_48[0] 'activation_49[0]
conv2d_54 (Conv2D)	(None, 12, 12, 160)	122880	['mixed5[0][0]']
batch_normalization_54 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_54[0][0]']
activation_54 (Activation) n_54[0][0]	(None, 12, 12, 160)	0	['batch_normalization_54[0][0]']
conv2d_55 (Conv2D) [0]']	(None, 12, 12, 160)	179200	['activation_54[0] [0]']
batch_normalization_55 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_55[0][0]']
activation_55 (Activation) n_55[0][0]	(None, 12, 12, 160)	0	['batch_normalization_55[0][0]']
conv2d_51 (Conv2D)	(None, 12, 12, 160)	122880	['mixed5[0][0]']
conv2d_56 (Conv2D) [0]']	(None, 12, 12, 160)	179200	['activation_55[0] [0]']
batch_normalization_51 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_51[0][0]']
batch_normalization_56 (Batch Normalization)	(None, 12, 12, 160)	480	['conv2d_56[0][0]']
activation_51 (Activation) n_51[0][0]	(None, 12, 12, 160)	0	['batch_normalization_51[0][0]']

activation_56 (Activation)	(None, 12, 12, 160)	0	['batch_normalizatio n_56[0][0]
conv2d_52 (Conv2D)	(None, 12, 12, 160)	179200	['activation_51[0] [0]']
conv2d_57 (Conv2D)	(None, 12, 12, 160)	179200	['activation_56[0] [0]']
batch_normalization_52 (Ba tchNormalization)	(None, 12, 12, 160)	480	['conv2d_52[0][0]']
batch_normalization_57 (Ba tchNormalization)	(None, 12, 12, 160)	480	['conv2d_57[0][0]']
activation_52 (Activation)	(None, 12, 12, 160)	0	['batch_normalizatio n_52[0][0]
activation_57 (Activation)	(None, 12, 12, 160)	0	['batch_normalizatio n_57[0][0]
average_pooling2d_5 (Avera gePooling2D)	(None, 12, 12, 768)	0	['mixed5[0][0]']
conv2d_50 (Conv2D)	(None, 12, 12, 192)	147456	['mixed5[0][0]']
conv2d_53 (Conv2D)	(None, 12, 12, 192)	215040	['activation_52[0] [0]']
conv2d_58 (Conv2D)	(None, 12, 12, 192)	215040	['activation_57[0] [0]']
conv2d_59 (Conv2D)	(None, 12, 12, 192)	147456	['average_pooling2d_ 5[0][0]']
batch_normalization_50 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_50[0][0]']

batch_normalization_53 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_53[0][0]']
batch_normalization_58 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_58[0][0]']
batch_normalization_59 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_59[0][0]']
activation_50 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_50[0][0]']
activation_53 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_53[0][0]']
activation_58 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_58[0][0]']
activation_59 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_59[0][0]']
mixed6 (Concatenate)	(None, 12, 12, 768)	0	['activation_50[0][0]', 'activation_53[0][0]', 'activation_58[0][0]', 'activation_59[0][0]']
conv2d_64 (Conv2D)	(None, 12, 12, 192)	147456	['mixed6[0][0]']
batch_normalization_64 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_64[0][0]']
activation_64 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_64[0][0]']

n_64[0][0]

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conv2d_65 (Conv2D)	(None, 12, 12, 192)	258048	['activation_64[0][0]']
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batch_normalization_65 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_65[0][0]']
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activation_65 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_65[0][0]']
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conv2d_61 (Conv2D)	(None, 12, 12, 192)	147456	['mixed6[0][0]']
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conv2d_66 (Conv2D)	(None, 12, 12, 192)	258048	['activation_65[0][0]']
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batch_normalization_61 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_61[0][0]']
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batch_normalization_66 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_66[0][0]']
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activation_61 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_61[0][0]']
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activation_66 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_66[0][0]']
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conv2d_62 (Conv2D)	(None, 12, 12, 192)	258048	['activation_61[0][0]']
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conv2d_67 (Conv2D)	(None, 12, 12, 192)	258048	['activation_66[0][0]']
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batch_normalization_62 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_62[0][0]']
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batch_normalization_67 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_67[0][0]']
activation_62 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_62[0][0]']
activation_67 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_67[0][0]']
average_pooling2d_6 (Average Pooling2D)	(None, 12, 12, 768)	0	['mixed6[0][0]']
conv2d_60 (Conv2D)	(None, 12, 12, 192)	147456	['mixed6[0][0]']
conv2d_63 (Conv2D)	(None, 12, 12, 192)	258048	['activation_62[0][0]']
conv2d_68 (Conv2D)	(None, 12, 12, 192)	258048	['activation_67[0][0]']
conv2d_69 (Conv2D)	(None, 12, 12, 192)	147456	['average_pooling2d_6[0][0]']
batch_normalization_60 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_60[0][0]']
batch_normalization_63 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_63[0][0]']
batch_normalization_68 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_68[0][0]']
batch_normalization_69 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_69[0][0]']
activation_60 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_60[0][0]']

n_60[0][0]			']
activation_63 (Activation) n_63[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_68 (Activation) n_68[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
activation_69 (Activation) n_69[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
mixed7 (Concatenate) [0]', [0]', [0]', [0]']	(None, 12, 12, 768)	0	['activation_60[0] 'activation_63[0] 'activation_68[0] 'activation_69[0]
conv2d_72 (Conv2D)	(None, 12, 12, 192)	147456	['mixed7[0][0]']
batch_normalization_72 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_72[0][0]']
activation_72 (Activation) n_72[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
conv2d_73 (Conv2D) [0]']	(None, 12, 12, 192)	258048	['activation_72[0]
batch_normalization_73 (Ba tchNormalization)	(None, 12, 12, 192)	576	['conv2d_73[0][0]']
activation_73 (Activation) n_73[0][0]	(None, 12, 12, 192)	0	['batch_normalizatio '']
conv2d_70 (Conv2D)	(None, 12, 12, 192)	147456	['mixed7[0][0]']

conv2d_74 (Conv2D)	(None, 12, 12, 192)	258048	['activation_73[0][0]']
batch_normalization_70 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_70[0][0]']
batch_normalization_74 (Batch Normalization)	(None, 12, 12, 192)	576	['conv2d_74[0][0]']
activation_70 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_70[0][0]']
activation_74 (Activation)	(None, 12, 12, 192)	0	['batch_normalization_74[0][0]']
conv2d_71 (Conv2D)	(None, 5, 5, 320)	552960	['activation_70[0][0]']
conv2d_75 (Conv2D)	(None, 5, 5, 192)	331776	['activation_74[0][0]']
batch_normalization_71 (Batch Normalization)	(None, 5, 5, 320)	960	['conv2d_71[0][0]']
batch_normalization_75 (Batch Normalization)	(None, 5, 5, 192)	576	['conv2d_75[0][0]']
activation_71 (Activation)	(None, 5, 5, 320)	0	['batch_normalization_71[0][0]']
activation_75 (Activation)	(None, 5, 5, 192)	0	['batch_normalization_75[0][0]']
max_pooling2d_3 (MaxPooling2D)	(None, 5, 5, 768)	0	['mixed7[0][0]']

mixed8 (Concatenate) [0]', [0]', [0]']	(None, 5, 5, 1280)	0	['activation_71[0] 'activation_75[0] 'max_pooling2d_3[0]
conv2d_80 (Conv2D)	(None, 5, 5, 448)	573440	['mixed8[0][0]']
batch_normalization_80 (Batch Normalization)	(None, 5, 5, 448)	1344	['conv2d_80[0][0]']
activation_80 (Activation) n_80[0][0]	(None, 5, 5, 448)	0	['batch_normalization_80[0][0]']
conv2d_77 (Conv2D)	(None, 5, 5, 384)	491520	['mixed8[0][0]']
conv2d_81 (Conv2D) [0]']	(None, 5, 5, 384)	1548288	['activation_80[0][0]']
batch_normalization_77 (Batch Normalization)	(None, 5, 5, 384)	1152	['conv2d_77[0][0]']
batch_normalization_81 (Batch Normalization)	(None, 5, 5, 384)	1152	['conv2d_81[0][0]']
activation_77 (Activation) n_77[0][0]	(None, 5, 5, 384)	0	['batch_normalization_77[0][0]']
activation_81 (Activation) n_81[0][0]	(None, 5, 5, 384)	0	['batch_normalization_81[0][0]']
conv2d_78 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_77[0][0]']
conv2d_79 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_77[0][0]']

conv2d_82 (Conv2D)	(None, 5, 5, 384)	442368	['activation_81[0][0]']
conv2d_83 (Conv2D)	(None, 5, 5, 384)	442368	['activation_81[0][0]']
average_pooling2d_7 (AveragePooling2D)	(None, 5, 5, 1280)	0	['mixed8[0][0]']
conv2d_76 (Conv2D)	(None, 5, 5, 320)	409600	['mixed8[0][0]']
batch_normalization_78 (BatchNormalization)	(None, 5, 5, 384)	1152	['conv2d_78[0][0]']
batch_normalization_79 (BatchNormalization)	(None, 5, 5, 384)	1152	['conv2d_79[0][0]']
batch_normalization_82 (BatchNormalization)	(None, 5, 5, 384)	1152	['conv2d_82[0][0]']
batch_normalization_83 (BatchNormalization)	(None, 5, 5, 384)	1152	['conv2d_83[0][0]']
conv2d_84 (Conv2D)	(None, 5, 5, 192)	245760	['average_pooling2d_7[0][0]']
batch_normalization_76 (BatchNormalization)	(None, 5, 5, 320)	960	['conv2d_76[0][0]']
activation_78 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_78[0][0]']
activation_79 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_79[0][0]']
activation_82 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_82[0][0]']

n_82[0][0]			']
activation_83 (Activation) n_83[0][0]	(None, 5, 5, 384)	0	['batch_normalizatio ']
batch_normalization_84 (Ba tchNormalization)	(None, 5, 5, 192)	576	['conv2d_84[0][0]']
activation_76 (Activation) n_76[0][0]	(None, 5, 5, 320)	0	['batch_normalizatio ']
mixed9_0 (Concatenate) [0]', [0]']	(None, 5, 5, 768)	0	['activation_78[0] 'activation_79[0]
concatenate (Concatenate) [0]', [0]']	(None, 5, 5, 768)	0	['activation_82[0] 'activation_83[0]
activation_84 (Activation) n_84[0][0]	(None, 5, 5, 192)	0	['batch_normalizatio ']
mixed9 (Concatenate) [0]', [0]', [0]']	(None, 5, 5, 2048)	0	['activation_76[0] 'mixed9_0[0][0]', 'concatenate[0] 'activation_84[0]
conv2d_89 (Conv2D)	(None, 5, 5, 448)	917504	['mixed9[0][0]']
batch_normalization_89 (Ba tchNormalization)	(None, 5, 5, 448)	1344	['conv2d_89[0][0]']
activation_89 (Activation) n_89[0][0]	(None, 5, 5, 448)	0	['batch_normalizatio ']

conv2d_86 (Conv2D)	(None, 5, 5, 384)	786432	['mixed9[0][0]']
conv2d_90 (Conv2D) [0]']	(None, 5, 5, 384)	1548288	['activation_89[0]
batch_normalization_86 (Ba tchNormalization)	(None, 5, 5, 384)	1152	['conv2d_86[0][0]']
batch_normalization_90 (Ba tchNormalization)	(None, 5, 5, 384)	1152	['conv2d_90[0][0]']
activation_86 (Activation) n_86[0][0]	(None, 5, 5, 384)	0	['batch_normalizatio '']
activation_90 (Activation) n_90[0][0]	(None, 5, 5, 384)	0	['batch_normalizatio '']
conv2d_87 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_86[0]
conv2d_88 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_86[0]
conv2d_91 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_90[0]
conv2d_92 (Conv2D) [0]']	(None, 5, 5, 384)	442368	['activation_90[0]
average_pooling2d_8 (Avera gePooling2D)	(None, 5, 5, 2048)	0	['mixed9[0][0]']
conv2d_85 (Conv2D)	(None, 5, 5, 320)	655360	['mixed9[0][0]']
batch_normalization_87 (Ba tchNormalization)	(None, 5, 5, 384)	1152	['conv2d_87[0][0]']
batch_normalization_88 (Ba	(None, 5, 5, 384)	1152	['conv2d_88[0][0]']

tchNormalization)			
batch_normalization_91 (Batch Normalization)	(None, 5, 5, 384)	1152	['conv2d_91[0][0]']
tchNormalization)			
batch_normalization_92 (Batch Normalization)	(None, 5, 5, 384)	1152	['conv2d_92[0][0]']
tchNormalization)			
conv2d_93 (Conv2D)	(None, 5, 5, 192)	393216	['average_pooling2d_8[0][0]']
batch_normalization_85 (Batch Normalization)	(None, 5, 5, 320)	960	['conv2d_85[0][0]']
tchNormalization)			
activation_87 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_87[0][0]']
activation_88 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_88[0][0]']
activation_91 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_91[0][0]']
activation_92 (Activation)	(None, 5, 5, 384)	0	['batch_normalization_92[0][0]']
batch_normalization_93 (Batch Normalization)	(None, 5, 5, 192)	576	['conv2d_93[0][0]']
tchNormalization)			
activation_85 (Activation)	(None, 5, 5, 320)	0	['batch_normalization_85[0][0]']
mixed9_1 (Concatenate)	(None, 5, 5, 768)	0	['activation_87[0][0]', 'activation_88[0][0]']

concatenate_1 (Concatenate [0]',) [0]']	(None, 5, 5, 768)	0	['activation_91[0] 'activation_92[0]
activation_93 (Activation) n_93[0][0]	(None, 5, 5, 192)	0	['batch_normalizatio ']
mixed10 (Concatenate) [0]', [0]', [0]']	(None, 5, 5, 2048)	0	['activation_85[0] 'mixed9_1[0][0]', 'concatenate_1[0] 'activation_93[0]
flatten_2 (Flatten)	(None, 51200)	0	['mixed10[0][0]']
dense (Dense)	(None, 4)	204804	['flatten_2[0][0]']

```
batch_size = 32,  
class_mode = 'categorical')
```

Found 18 images belonging to 4 classes.

```
In [22]: r = model.fit_generator(  
        training_set,  
        validation_data=test_set,  
        epochs=20,  
        steps_per_epoch=len(training_set),  
        validation_steps=len(test_set)  
    )
```

<ipython-input-22-dcaa1ca38143>:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.

```
    r = model.fit_generator(  
Epoch 1/20  
61/61 [=====] - 508s 8s/step - loss: 1.7962 - accuracy: 0.7622  
- val_loss: 0.8185 - val_accuracy: 0.8333  
Epoch 2/20  
61/61 [=====] - 277s 5s/step - loss: 0.9023 - accuracy: 0.8596  
- val_loss: 0.1151 - val_accuracy: 0.9444  
Epoch 3/20  
61/61 [=====] - 276s 4s/step - loss: 0.6724 - accuracy: 0.8995  
- val_loss: 0.3746 - val_accuracy: 0.8889  
Epoch 4/20  
61/61 [=====] - 272s 4s/step - loss: 0.6372 - accuracy: 0.9036  
- val_loss: 2.0711 - val_accuracy: 0.7778  
Epoch 5/20  
61/61 [=====] - 274s 4s/step - loss: 0.4227 - accuracy: 0.9339  
- val_loss: 0.0034 - val_accuracy: 1.0000  
Epoch 6/20  
61/61 [=====] - 274s 4s/step - loss: 0.4071 - accuracy: 0.9364  
- val_loss: 1.3184 - val_accuracy: 0.8333  
Epoch 7/20  
61/61 [=====] - 272s 4s/step - loss: 0.4949 - accuracy: 0.9298  
- val_loss: 0.1013 - val_accuracy: 0.9444  
Epoch 8/20  
61/61 [=====] - 275s 4s/step - loss: 0.4864 - accuracy: 0.9344  
- val_loss: 0.0048 - val_accuracy: 1.0000  
Epoch 9/20  
61/61 [=====] - 277s 5s/step - loss: 0.2723 - accuracy: 0.9564  
- val_loss: 0.2429 - val_accuracy: 0.9444  
Epoch 10/20  
61/61 [=====] - 271s 4s/step - loss: 0.3815 - accuracy: 0.9457  
- val_loss: 0.2780 - val_accuracy: 0.9444  
Epoch 11/20  
61/61 [=====] - 274s 4s/step - loss: 0.4017 - accuracy: 0.9503  
- val_loss: 0.0215 - val_accuracy: 1.0000  
Epoch 12/20  
61/61 [=====] - 271s 4s/step - loss: 0.3135 - accuracy: 0.9569  
- val_loss: 0.0021 - val_accuracy: 1.0000  
Epoch 13/20  
61/61 [=====] - 276s 5s/step - loss: 0.4093 - accuracy: 0.9467  
- val_loss: 5.6761e-04 - val_accuracy: 1.0000  
Epoch 14/20  
61/61 [=====] - 271s 4s/step - loss: 0.5500 - accuracy: 0.9354  
- val_loss: 0.0046 - val_accuracy: 1.0000  
Epoch 15/20  
61/61 [=====] - 277s 5s/step - loss: 0.7507 - accuracy: 0.9267  
- val_loss: 0.4010 - val_accuracy: 0.9444  
Epoch 16/20  
61/61 [=====] - 276s 5s/step - loss: 0.4919 - accuracy: 0.9508  
- val_loss: 2.2025e-05 - val_accuracy: 1.0000  
Epoch 17/20  
61/61 [=====] - 277s 5s/step - loss: 0.3064 - accuracy: 0.9585
```

```
- val_loss: 0.1559 - val_accuracy: 0.9444
Epoch 18/20
61/61 [=====] - 270s 4s/step - loss: 0.2200 - accuracy: 0.9698
- val_loss: 3.6814e-04 - val_accuracy: 1.0000
Epoch 19/20
61/61 [=====] - 273s 4s/step - loss: 0.3123 - accuracy: 0.9687
- val_loss: 2.0091e-04 - val_accuracy: 1.0000
Epoch 20/20
61/61 [=====] - 272s 4s/step - loss: 0.2526 - accuracy: 0.9651
- val_loss: 0.0098 - val_accuracy: 1.0000
```

In []: