Transfer Learning Inception V3 using Keras

Please download the dataset from the below url

In [1]:

```
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)
```

In [2]:

```
# 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.inception_v3 import InceptionV3
#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
#import matplotlib.pyplot as plt
```

In [3]:

```
# re-size all the images to this
IMAGE_SIZE = [224, 224]

train_path = 'Datasets/train'
valid_path = 'Datasets/test'
```

In [4]:

```
# Import the Vgg 16 library as shown below and add preprocessing layer to the front of VG
G
# Here we will be using imagenet weights

inception = InceptionV3(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=Fa
lse)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/incept
ion_v3/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5
87916544/87910968 [==============================] - 11s 0us/step
```

In [7]:

```
# don't train existing weights
for layer in inception.layers:
    layer.trainable = False
```

In [8]:

```
# useful for getting number of output classes
folders = glob('Datasets/train/*')
```

In [9]:

```
# our layers - you can add more if you want
```

```
x = Flatten()(inception.output)
```

In [10]:

```
prediction = Dense(len(folders), activation='softmax')(x)

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

In [11]:

```
# view the structure of the model
model.summary()
```

```
Model: "model"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 224, 224, 3)      0
_________________________________________________________________
conv2d (Conv2D)              (None, 111, 111, 32)      864
_________________________________________________________________
batch_normalization (BatchNorma (None, 111, 111, 32)      96
_________________________________________________________________
activation (Activation)      (None, 111, 111, 32)      0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 109, 109, 32)      9216
_________________________________________________________________
batch_normalization_1 (BatchNor (None, 109, 109, 32)      96
_________________________________________________________________
activation_1 (Activation)    (None, 109, 109, 32)      0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 109, 109, 64)      18432
_________________________________________________________________
batch_normalization_2 (BatchNor (None, 109, 109, 64)      192
_________________________________________________________________
activation_2 (Activation)    (None, 109, 109, 64)      0
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 54, 54, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 54, 54, 80)        5120
_________________________________________________________________
batch_normalization_3 (BatchNor (None, 54, 54, 80)        240
```

activation_3 (Activation)	(None, 54, 54, 80)	0	batch_normalization_3[0][0]
conv2d_4 (Conv2D)	(None, 52, 52, 192)	138240	activation_3[0][0]
batch_normalization_4 (BatchNor	(None, 52, 52, 192)	576	conv2d_4[0][0]
activation_4 (Activation)	(None, 52, 52, 192)	0	batch_normalization_4[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 25, 25, 192)	0	activation_4[0][0]
conv2d_8 (Conv2D)	(None, 25, 25, 64)	12288	max_pooling2d_1[0][0]
batch_normalization_8 (BatchNor	(None, 25, 25, 64)	192	conv2d_8[0][0]
activation_8 (Activation)	(None, 25, 25, 64)	0	batch_normalization_8[0][0]
conv2d_6 (Conv2D)	(None, 25, 25, 48)	9216	max_pooling2d_1[0][0]
conv2d_9 (Conv2D)	(None, 25, 25, 96)	55296	activation_8[0][0]
batch_normalization_6 (BatchNor	(None, 25, 25, 48)	144	conv2d_6[0][0]
batch_normalization_9 (BatchNor	(None, 25, 25, 96)	288	conv2d_9[0][0]
activation_6 (Activation)	(None, 25, 25, 48)	0	batch_normalization_6[0][0]
activation_9 (Activation)	(None, 25, 25, 96)	0	batch_normalization_9[0][0]
average_pooling2d (AveragePooli	(None, 25, 25, 192)	0	max_pooling2d_1[0][0]
conv2d_5 (Conv2D)	(None, 25, 25, 64)	12288	max_pooling2d_1[0][0]
conv2d_7 (Conv2D)	(None, 25, 25, 64)	76800	activation_6[0][0]
conv2d_10 (Conv2D)	(None, 25, 25, 96)	82944	activation_9[0][0]

conv2d_11 (Conv2D)	(None, 25, 25, 32)	6144	average_pooling2d[0][0]
batch_normalization_5 (BatchNor	(None, 25, 25, 64)	192	conv2d_5[0][0]
batch_normalization_7 (BatchNor	(None, 25, 25, 64)	192	conv2d_7[0][0]
batch_normalization_10 (BatchNo	(None, 25, 25, 96)	288	conv2d_10[0][0]
batch_normalization_11 (BatchNo	(None, 25, 25, 32)	96	conv2d_11[0][0]
activation_5 (Activation) [0]	(None, 25, 25, 64)	0	batch_normalization_5[0]
activation_7 (Activation) [0]	(None, 25, 25, 64)	0	batch_normalization_7[0]
activation_10 (Activation)][0]	(None, 25, 25, 96)	0	batch_normalization_10[0
activation_11 (Activation)][0]	(None, 25, 25, 32)	0	batch_normalization_11[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 (BatchNo	(None, 25, 25, 64)	192	conv2d_15[0][0]
activation_15 (Activation)][0]	(None, 25, 25, 64)	0	batch_normalization_15[0
conv2d_13 (Conv2D)	(None, 25, 25, 48)	12288	mixed0[0][0]
conv2d_16 (Conv2D)	(None, 25, 25, 96)	55296	activation_15[0][0]
batch_normalization_13 (BatchNo	(None, 25, 25, 48)	144	conv2d_13[0][0]
batch_normalization_16 (BatchNo	(None, 25, 25, 96)	288	conv2d_16[0][0]

activation_13 (Activation)	(None, 25, 25, 48)	0	batch_normalization_13[0][0]
activation_16 (Activation)	(None, 25, 25, 96)	0	batch_normalization_16[0][0]
average_pooling2d_1 (AveragePoo	(None, 25, 25, 256)	0	mixed0[0][0]
conv2d_12 (Conv2D)	(None, 25, 25, 64)	16384	mixed0[0][0]
conv2d_14 (Conv2D)	(None, 25, 25, 64)	76800	activation_13[0][0]
conv2d_17 (Conv2D)	(None, 25, 25, 96)	82944	activation_16[0][0]
conv2d_18 (Conv2D)	(None, 25, 25, 64)	16384	average_pooling2d_1[0][0]
batch_normalization_12 (BatchNo	(None, 25, 25, 64)	192	conv2d_12[0][0]
batch_normalization_14 (BatchNo	(None, 25, 25, 64)	192	conv2d_14[0][0]
batch_normalization_17 (BatchNo	(None, 25, 25, 96)	288	conv2d_17[0][0]
batch_normalization_18 (BatchNo	(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]

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conv2d_22 (Conv2D)              (None, 25, 25, 64)   18432       mixed1[0][0]

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batch_normalization_22 (BatchNo (None, 25, 25, 64)   192         conv2d_22[0][0]

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activation_22 (Activation)      (None, 25, 25, 64)   0           batch_normalization_22[0
][0]
__________
conv2d_20 (Conv2D)              (None, 25, 25, 48)   13824       mixed1[0][0]

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conv2d_23 (Conv2D)              (None, 25, 25, 96)   55296       activation_22[0][0]

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batch_normalization_20 (BatchNo (None, 25, 25, 48)   144         conv2d_20[0][0]

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batch_normalization_23 (BatchNo (None, 25, 25, 96)   288         conv2d_23[0][0]

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activation_20 (Activation)      (None, 25, 25, 48)   0           batch_normalization_20[0
][0]
__________
activation_23 (Activation)      (None, 25, 25, 96)   0           batch_normalization_23[0
][0]
__________
average_pooling2d_2 (AveragePoo (None, 25, 25, 288)  0           mixed1[0][0]

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conv2d_19 (Conv2D)              (None, 25, 25, 64)   18432       mixed1[0][0]

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conv2d_21 (Conv2D)              (None, 25, 25, 64)   76800       activation_20[0][0]

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conv2d_24 (Conv2D)              (None, 25, 25, 96)   82944       activation_23[0][0]

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conv2d_25 (Conv2D)              (None, 25, 25, 64)   18432       average_pooling2d_2[0][0
]
__________
batch_normalization_19 (BatchNo (None, 25, 25, 64)   192         conv2d_19[0][0]

__________
batch_normalization_21 (BatchNo (None, 25, 25, 64)   192         conv2d_21[0][0]

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batch_normalization_24 (BatchNo (None, 25, 25, 96)   288         conv2d_24[0][0]

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batch_normalization_25 (BatchNo (None, 25, 25, 64)   192         conv2d_25[0][0]
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__________
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 (BatchNo (None, 25, 25, 64)   192         conv2d_27[0][0]
__________
activation_27 (Activation)      (None, 25, 25, 64)   0           batch_normalization_27[0
][0]
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conv2d_28 (Conv2D)              (None, 25, 25, 96)   55296       activation_27[0][0]
__________
batch_normalization_28 (BatchNo (None, 25, 25, 96)   288         conv2d_28[0][0]
__________
activation_28 (Activation)      (None, 25, 25, 96)   0           batch_normalization_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 (BatchNo (None, 12, 12, 384)  1152        conv2d_26[0][0]
__________
batch_normalization_29 (BatchNo (None, 12, 12, 96)   288         conv2d_29[0][0]
__________
activation_26 (Activation)      (None, 12, 12, 384)  0           batch_normalization_26[0
][0]
__________
activation_29 (Activation)      (None, 12, 12, 96)   0           batch_normalization_29[0
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][0]
__________________________________________________________________________________________________
__________
max_pooling2d_2 (MaxPooling2D)  (None, 12, 12, 288)  0           mixed2[0][0]
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__________
mixed3 (Concatenate)            (None, 12, 12, 768)  0           activation_26[0][0]
                                                                 activation_29[0][0]
                                                                 max_pooling2d_2[0][0]
__________________________________________________________________________________________________
__________
conv2d_34 (Conv2D)              (None, 12, 12, 128)  98304       mixed3[0][0]
__________________________________________________________________________________________________
__________
batch_normalization_34 (BatchNo (None, 12, 12, 128)  384         conv2d_34[0][0]
__________________________________________________________________________________________________
__________
activation_34 (Activation)      (None, 12, 12, 128)  0           batch_normalization_34[0
][0]
__________________________________________________________________________________________________
__________
conv2d_35 (Conv2D)              (None, 12, 12, 128)  114688      activation_34[0][0]
__________________________________________________________________________________________________
__________
batch_normalization_35 (BatchNo (None, 12, 12, 128)  384         conv2d_35[0][0]
__________________________________________________________________________________________________
__________
activation_35 (Activation)      (None, 12, 12, 128)  0           batch_normalization_35[0
][0]
__________________________________________________________________________________________________
__________
conv2d_31 (Conv2D)              (None, 12, 12, 128)  98304       mixed3[0][0]
__________________________________________________________________________________________________
__________
conv2d_36 (Conv2D)              (None, 12, 12, 128)  114688      activation_35[0][0]
__________________________________________________________________________________________________
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batch_normalization_31 (BatchNo (None, 12, 12, 128)  384         conv2d_31[0][0]
__________________________________________________________________________________________________
__________
batch_normalization_36 (BatchNo (None, 12, 12, 128)  384         conv2d_36[0][0]
__________________________________________________________________________________________________
__________
activation_31 (Activation)      (None, 12, 12, 128)  0           batch_normalization_31[0
][0]
__________________________________________________________________________________________________
__________
activation_36 (Activation)      (None, 12, 12, 128)  0           batch_normalization_36[0
][0]
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conv2d_32 (Conv2D)              (None, 12, 12, 128)  114688      activation_31[0][0]
__________________________________________________________________________________________________
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conv2d_37 (Conv2D)              (None, 12, 12, 128)  114688      activation_36[0][0]
__________________________________________________________________________________________________
__________
batch_normalization_32 (BatchNo (None, 12, 12, 128)  384         conv2d_32[0][0]
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__________________________________________________________________________________________________
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batch_normalization_37 (BatchNo (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]
__________________________________________________________________________________________________
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average_pooling2d_3 (AveragePoo (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
]
__________________________________________________________________________________________________
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batch_normalization_30 (BatchNo (None, 12, 12, 192)  576         conv2d_30[0][0]
__________________________________________________________________________________________________
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batch_normalization_33 (BatchNo (None, 12, 12, 192)  576         conv2d_33[0][0]
__________________________________________________________________________________________________
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batch_normalization_38 (BatchNo (None, 12, 12, 192)  576         conv2d_38[0][0]
__________________________________________________________________________________________________
__________
batch_normalization_39 (BatchNo (None, 12, 12, 192)  576         conv2d_39[0][0]
__________________________________________________________________________________________________
__________
activation_30 (Activation)      (None, 12, 12, 192)  0           batch_normalization_30[0
][0]
__________________________________________________________________________________________________
__________
activation_33 (Activation)      (None, 12, 12, 192)  0           batch_normalization_33[0
][0]
__________________________________________________________________________________________________
__________
activation_38 (Activation)      (None, 12, 12, 192)  0           batch_normalization_38[0
][0]
__________________________________________________________________________________________________
__________
activation_39 (Activation)      (None, 12, 12, 192)  0           batch_normalization_39[0
][0]
__________________________________________________________________________________________________
__________
mixed4 (Concatenate)            (None, 12, 12, 768)  0           activation_30[0][0]
                                                                 activation_33[0][0]
                                                                 activation_38[0][0]
```

			activation_39[0][0]
conv2d_44 (Conv2D)	(None, 12, 12, 160)	122880	mixed4[0][0]
batch_normalization_44 (BatchNo	(None, 12, 12, 160)	480	conv2d_44[0][0]
activation_44 (Activation)	(None, 12, 12, 160)	0	batch_normalization_44[0][0]
conv2d_45 (Conv2D)	(None, 12, 12, 160)	179200	activation_44[0][0]
batch_normalization_45 (BatchNo	(None, 12, 12, 160)	480	conv2d_45[0][0]
activation_45 (Activation)	(None, 12, 12, 160)	0	batch_normalization_45[0][0]
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 (BatchNo	(None, 12, 12, 160)	480	conv2d_41[0][0]
batch_normalization_46 (BatchNo	(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 (BatchNo	(None, 12, 12, 160)	480	conv2d_42[0][0]
batch_normalization_47 (BatchNo	(None, 12, 12, 160)	480	conv2d_47[0][0]
activation_42 (Activation)	(None, 12, 12, 160)	0	batch_normalization_42[0][0]

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activation_47 (Activation)      (None, 12, 12, 160)  0           batch_normalization_47[0
][0]
__________
average_pooling2d_4 (AveragePoo (None, 12, 12, 768)  0           mixed4[0][0]
__________
conv2d_40 (Conv2D)              (None, 12, 12, 192)  147456      mixed4[0][0]
__________
conv2d_43 (Conv2D)              (None, 12, 12, 192)  215040      activation_42[0][0]
__________
conv2d_48 (Conv2D)              (None, 12, 12, 192)  215040      activation_47[0][0]
__________
conv2d_49 (Conv2D)              (None, 12, 12, 192)  147456      average_pooling2d_4[0][0
]
__________
batch_normalization_40 (BatchNo (None, 12, 12, 192)  576         conv2d_40[0][0]
__________
batch_normalization_43 (BatchNo (None, 12, 12, 192)  576         conv2d_43[0][0]
__________
batch_normalization_48 (BatchNo (None, 12, 12, 192)  576         conv2d_48[0][0]
__________
batch_normalization_49 (BatchNo (None, 12, 12, 192)  576         conv2d_49[0][0]
__________
activation_40 (Activation)      (None, 12, 12, 192)  0           batch_normalization_40[0
][0]
__________
activation_43 (Activation)      (None, 12, 12, 192)  0           batch_normalization_43[0
][0]
__________
activation_48 (Activation)      (None, 12, 12, 192)  0           batch_normalization_48[0
][0]
__________
activation_49 (Activation)      (None, 12, 12, 192)  0           batch_normalization_49[0
][0]
__________
mixed5 (Concatenate)            (None, 12, 12, 768)  0           activation_40[0][0]
                                                                 activation_43[0][0]
                                                                 activation_48[0][0]
                                                                 activation_49[0][0]
__________
conv2d_54 (Conv2D)              (None, 12, 12, 160)  122880      mixed5[0][0]
__________
batch_normalization_54 (BatchNo (None, 12, 12, 160)  480         conv2d_54[0][0]
```

activation_54 (Activation)	(None, 12, 12, 160)	0	batch_normalization_54[0][0]
conv2d_55 (Conv2D)	(None, 12, 12, 160)	179200	activation_54[0][0]
batch_normalization_55 (BatchNo	(None, 12, 12, 160)	480	conv2d_55[0][0]
activation_55 (Activation)	(None, 12, 12, 160)	0	batch_normalization_55[0][0]
conv2d_51 (Conv2D)	(None, 12, 12, 160)	122880	mixed5[0][0]
conv2d_56 (Conv2D)	(None, 12, 12, 160)	179200	activation_55[0][0]
batch_normalization_51 (BatchNo	(None, 12, 12, 160)	480	conv2d_51[0][0]
batch_normalization_56 (BatchNo	(None, 12, 12, 160)	480	conv2d_56[0][0]
activation_51 (Activation)	(None, 12, 12, 160)	0	batch_normalization_51[0][0]
activation_56 (Activation)	(None, 12, 12, 160)	0	batch_normalization_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 (BatchNo	(None, 12, 12, 160)	480	conv2d_52[0][0]
batch_normalization_57 (BatchNo	(None, 12, 12, 160)	480	conv2d_57[0][0]
activation_52 (Activation)	(None, 12, 12, 160)	0	batch_normalization_52[0][0]
activation_57 (Activation)	(None, 12, 12, 160)	0	batch_normalization_57[0][0]
average_pooling2d_5 (AveragePoo	(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 (BatchNo	(None, 12, 12, 192)	576	conv2d_50[0][0]
batch_normalization_53 (BatchNo	(None, 12, 12, 192)	576	conv2d_53[0][0]
batch_normalization_58 (BatchNo	(None, 12, 12, 192)	576	conv2d_58[0][0]
batch_normalization_59 (BatchNo	(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 (BatchNo	(None, 12, 12, 192)	576	conv2d_64[0][0]
activation_64 (Activation)	(None, 12, 12, 192)	0	batch_normalization_64[0][0]
conv2d_65 (Conv2D)	(None, 12, 12, 192)	258048	activation_64[0][0]

batch_normalization_65 (BatchNo	(None, 12, 12, 192)	576	conv2d_65[0][0]
activation_65 (Activation)	(None, 12, 12, 192)	0	batch_normalization_65[0][0]
conv2d_61 (Conv2D)	(None, 12, 12, 192)	147456	mixed6[0][0]
conv2d_66 (Conv2D)	(None, 12, 12, 192)	258048	activation_65[0][0]
batch_normalization_61 (BatchNo	(None, 12, 12, 192)	576	conv2d_61[0][0]
batch_normalization_66 (BatchNo	(None, 12, 12, 192)	576	conv2d_66[0][0]
activation_61 (Activation)	(None, 12, 12, 192)	0	batch_normalization_61[0][0]
activation_66 (Activation)	(None, 12, 12, 192)	0	batch_normalization_66[0][0]
conv2d_62 (Conv2D)	(None, 12, 12, 192)	258048	activation_61[0][0]
conv2d_67 (Conv2D)	(None, 12, 12, 192)	258048	activation_66[0][0]
batch_normalization_62 (BatchNo	(None, 12, 12, 192)	576	conv2d_62[0][0]
batch_normalization_67 (BatchNo	(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 (AveragePoo	(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 (BatchNo (None, 12, 12, 192)  576         conv2d_60[0][0]
__________
batch_normalization_63 (BatchNo (None, 12, 12, 192)  576         conv2d_63[0][0]
__________
batch_normalization_68 (BatchNo (None, 12, 12, 192)  576         conv2d_68[0][0]
__________
batch_normalization_69 (BatchNo (None, 12, 12, 192)  576         conv2d_69[0][0]
__________
activation_60 (Activation)      (None, 12, 12, 192)  0           batch_normalization_60[0
][0]
__________
activation_63 (Activation)      (None, 12, 12, 192)  0           batch_normalization_63[0
][0]
__________
activation_68 (Activation)      (None, 12, 12, 192)  0           batch_normalization_68[0
][0]
__________
activation_69 (Activation)      (None, 12, 12, 192)  0           batch_normalization_69[0
][0]
__________
mixed7 (Concatenate)            (None, 12, 12, 768)  0           activation_60[0][0]
                                                                 activation_63[0][0]
                                                                 activation_68[0][0]
                                                                 activation_69[0][0]
__________
conv2d_72 (Conv2D)              (None, 12, 12, 192)  147456      mixed7[0][0]
__________
batch_normalization_72 (BatchNo (None, 12, 12, 192)  576         conv2d_72[0][0]
__________
activation_72 (Activation)      (None, 12, 12, 192)  0           batch_normalization_72[0
][0]
__________
conv2d_73 (Conv2D)              (None, 12, 12, 192)  258048      activation_72[0][0]
__________
batch_normalization_73 (BatchNo (None, 12, 12, 192)  576         conv2d_73[0][0]
__________
activation_73 (Activation)      (None, 12, 12, 192)  0           batch_normalization_73[0
][0]
__________
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 (BatchNo	(None, 12, 12, 192)	576	conv2d_70[0][0]
batch_normalization_74 (BatchNo	(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 (BatchNo	(None, 5, 5, 320)	960	conv2d_71[0][0]
batch_normalization_75 (BatchNo	(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)	(None, 5, 5, 1280)	0	activation_71[0][0] activation_75[0][0] max_pooling2d_3[0][0]
conv2d_80 (Conv2D)	(None, 5, 5, 448)	573440	mixed8[0][0]
batch_normalization_80 (BatchNo	(None, 5, 5, 448)	1344	conv2d_80[0][0]
activation_80 (Activation)	(None, 5, 5, 448)	0	batch_normalization_80[0][0]
conv2d_77 (Conv2D)	(None, 5, 5, 384)	491520	mixed8[0][0]

conv2d_81 (Conv2D)	(None, 5, 5, 384)	1548288	activation_80[0][0]
batch_normalization_77 (BatchNo	(None, 5, 5, 384)	1152	conv2d_77[0][0]
batch_normalization_81 (BatchNo	(None, 5, 5, 384)	1152	conv2d_81[0][0]
activation_77 (Activation)	(None, 5, 5, 384)	0	batch_normalization_77[0][0]
activation_81 (Activation)	(None, 5, 5, 384)	0	batch_normalization_81[0][0]
conv2d_78 (Conv2D)	(None, 5, 5, 384)	442368	activation_77[0][0]
conv2d_79 (Conv2D)	(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 (AveragePoo	(None, 5, 5, 1280)	0	mixed8[0][0]
conv2d_76 (Conv2D)	(None, 5, 5, 320)	409600	mixed8[0][0]
batch_normalization_78 (BatchNo	(None, 5, 5, 384)	1152	conv2d_78[0][0]
batch_normalization_79 (BatchNo	(None, 5, 5, 384)	1152	conv2d_79[0][0]
batch_normalization_82 (BatchNo	(None, 5, 5, 384)	1152	conv2d_82[0][0]
batch_normalization_83 (BatchNo	(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 (BatchNo	(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]
__________________________________________________________________________________________________
__________
activation_83 (Activation)      (None, 5, 5, 384)    0           batch_normalization_83[0
][0]
__________________________________________________________________________________________________
__________
batch_normalization_84 (BatchNo (None, 5, 5, 192)    576         conv2d_84[0][0]

__________________________________________________________________________________________________
__________
activation_76 (Activation)      (None, 5, 5, 320)    0           batch_normalization_76[0
][0]
__________________________________________________________________________________________________
__________
mixed9_0 (Concatenate)          (None, 5, 5, 768)    0           activation_78[0][0]
                                                                 activation_79[0][0]

__________________________________________________________________________________________________
__________
concatenate (Concatenate)       (None, 5, 5, 768)    0           activation_82[0][0]
                                                                 activation_83[0][0]

__________________________________________________________________________________________________
__________
activation_84 (Activation)      (None, 5, 5, 192)    0           batch_normalization_84[0
][0]
__________________________________________________________________________________________________
__________
mixed9 (Concatenate)            (None, 5, 5, 2048)   0           activation_76[0][0]
                                                                 mixed9_0[0][0]
                                                                 concatenate[0][0]
                                                                 activation_84[0][0]

__________________________________________________________________________________________________
__________
conv2d_89 (Conv2D)              (None, 5, 5, 448)    917504      mixed9[0][0]

__________________________________________________________________________________________________
__________
batch_normalization_89 (BatchNo (None, 5, 5, 448)    1344        conv2d_89[0][0]

__________________________________________________________________________________________________
__________
activation_89 (Activation)      (None, 5, 5, 448)    0           batch_normalization_89[0
][0]
__________________________________________________________________________________________________
__________
conv2d_86 (Conv2D)              (None, 5, 5, 384)    786432      mixed9[0][0]

__________________________________________________________________________________________________
__________
conv2d_90 (Conv2D)              (None, 5, 5, 384)    1548288     activation_89[0][0]

__________________________________________________________________________________________________
__________
batch_normalization_86 (BatchNo (None, 5, 5, 384)    1152        conv2d_86[0][0]
```

```
__________
batch_normalization_90 (BatchNo (None, 5, 5, 384)    1152        conv2d_90[0][0]
__________
activation_86 (Activation)      (None, 5, 5, 384)    0           batch_normalization_86[0
][0]
__________
activation_90 (Activation)      (None, 5, 5, 384)    0           batch_normalization_90[0
][0]
__________
conv2d_87 (Conv2D)              (None, 5, 5, 384)    442368      activation_86[0][0]
__________
conv2d_88 (Conv2D)              (None, 5, 5, 384)    442368      activation_86[0][0]
__________
conv2d_91 (Conv2D)              (None, 5, 5, 384)    442368      activation_90[0][0]
__________
conv2d_92 (Conv2D)              (None, 5, 5, 384)    442368      activation_90[0][0]
__________
average_pooling2d_8 (AveragePoo (None, 5, 5, 2048)   0           mixed9[0][0]
__________
conv2d_85 (Conv2D)              (None, 5, 5, 320)    655360      mixed9[0][0]
__________
batch_normalization_87 (BatchNo (None, 5, 5, 384)    1152        conv2d_87[0][0]
__________
batch_normalization_88 (BatchNo (None, 5, 5, 384)    1152        conv2d_88[0][0]
__________
batch_normalization_91 (BatchNo (None, 5, 5, 384)    1152        conv2d_91[0][0]
__________
batch_normalization_92 (BatchNo (None, 5, 5, 384)    1152        conv2d_92[0][0]
__________
conv2d_93 (Conv2D)              (None, 5, 5, 192)    393216      average_pooling2d_8[0][0
]
__________
batch_normalization_85 (BatchNo (None, 5, 5, 320)    960         conv2d_85[0][0]
__________
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 (BatchNo (None, 5, 5, 192)    576         conv2d_93[0][0]
__________
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)     (None, 5, 5, 768)    0           activation_91[0][0]
                                                                 activation_92[0][0]
__________
activation_93 (Activation)      (None, 5, 5, 192)    0           batch_normalization_93[0
][0]
__________
mixed10 (Concatenate)           (None, 5, 5, 2048)   0           activation_85[0][0]
                                                                 mixed9_1[0][0]
                                                                 concatenate_1[0][0]
                                                                 activation_93[0][0]
__________
flatten (Flatten)               (None, 51200)        0           mixed10[0][0]
__________
dense (Dense)                   (None, 4)            204804      flatten[0][0]
==================================================================================
=========
Total params: 22,007,588
Trainable params: 204,804
Non-trainable params: 21,802,784
__________________________________________________________________________________
__________
```

In [12]:

```
# tell the model what cost and optimization method to use
model.compile(
  loss='categorical_crossentropy',
  optimizer='adam',
  metrics=['accuracy']
)
```

In [13]:

```
# Use the Image Data Generator to import the images from the dataset
from tensorflow.keras.preprocessing.image import ImageDataGenerator

train_datagen = ImageDataGenerator(rescale = 1./255,
                                   shear_range = 0.2,
                                   zoom_range = 0.2,
                                   horizontal_flip = True)
```

```
test_datagen = ImageDataGenerator(rescale = 1./255)
```

In [14]:

```
# Make sure you provide the same target size as initialied for the image size
training_set = train_datagen.flow_from_directory('Datasets/train',
                                                 target_size = (224, 224),
                                                 batch_size = 32,
                                                 class_mode = 'categorical')
```

```
Found 1951 images belonging to 4 classes.
```

In [15]:

```
test_set = test_datagen.flow_from_directory('Datasets/test',
                                            target_size = (224, 224),
                                            batch_size = 32,
                                            class_mode = 'categorical')
```

```
Found 18 images belonging to 4 classes.
```

In [16]:

```
# fit the model
# Run the cell. It will take some time to execute
r = model.fit_generator(
  training_set,
  validation_data=test_set,
  epochs=20,
  steps_per_epoch=len(training_set),
  validation_steps=len(test_set)
)
```

```
WARNING:tensorflow:From <ipython-input-16-2d02736eff38>:8: Model.fit_generator (from tens
orflow.python.keras.engine.training) is deprecated and will be removed in a future versio
n.
Instructions for updating:
Please use Model.fit, which supports generators.
Epoch 1/20
61/61 [==============================] - 20s 333ms/step - loss: 2.0140 - accuracy: 0.7401
- val_loss: 1.0249 - val_accuracy: 0.7222
Epoch 2/20
61/61 [==============================] - 18s 300ms/step - loss: 0.7547 - accuracy: 0.8785
- val_loss: 0.2171 - val_accuracy: 0.9444
Epoch 3/20
61/61 [==============================] - 18s 299ms/step - loss: 0.4645 - accuracy: 0.9149
- val_loss: 0.1363 - val_accuracy: 0.9444
Epoch 4/20
61/61 [==============================] - 18s 298ms/step - loss: 0.6390 - accuracy: 0.9021
- val_loss: 0.1251 - val_accuracy: 0.9444
Epoch 5/20
61/61 [==============================] - 18s 300ms/step - loss: 0.6016 - accuracy: 0.9190
- val_loss: 0.0513 - val_accuracy: 0.9444
Epoch 6/20
61/61 [==============================] - 18s 300ms/step - loss: 0.4437 - accuracy: 0.9329
- val_loss: 0.0368 - val_accuracy: 1.0000
Epoch 7/20
61/61 [==============================] - 18s 299ms/step - loss: 0.8518 - accuracy: 0.9021
- val_loss: 0.6182 - val_accuracy: 0.9444
Epoch 8/20
61/61 [==============================] - 18s 299ms/step - loss: 0.4498 - accuracy: 0.9416
- val_loss: 0.1105 - val_accuracy: 0.9444
Epoch 9/20
61/61 [==============================] - 18s 297ms/step - loss: 0.5562 - accuracy: 0.9426
- val_loss: 0.0010 - val_accuracy: 1.0000
Epoch 10/20
61/61 [==============================] - 18s 297ms/step - loss: 0.3613 - accuracy: 0.9508
- val_loss: 0.0884 - val_accuracy: 0.9444
Epoch 11/20
61/61 [==============================] - 18s 299ms/step - loss: 0.4488 - accuracy: 0.9467
- val_loss: 1.9574e-05 - val_accuracy: 1.0000
```

```
Epoch 12/20
61/61 [==============================] - 18s 298ms/step - loss: 0.4369 - accuracy: 0.9421
- val_loss: 0.0121 - val_accuracy: 1.0000
Epoch 13/20
61/61 [==============================] - 18s 299ms/step - loss: 0.3984 - accuracy: 0.9457
- val_loss: 2.0362e-05 - val_accuracy: 1.0000
Epoch 14/20
61/61 [==============================] - 18s 299ms/step - loss: 0.3902 - accuracy: 0.9569
- val_loss: 0.0014 - val_accuracy: 1.0000
Epoch 15/20
61/61 [==============================] - 18s 297ms/step - loss: 0.4971 - accuracy: 0.9446
- val_loss: 2.3416e-05 - val_accuracy: 1.0000
Epoch 16/20
61/61 [==============================] - 18s 298ms/step - loss: 0.3149 - accuracy: 0.9621
- val_loss: 0.0120 - val_accuracy: 1.0000
Epoch 17/20
61/61 [==============================] - 18s 297ms/step - loss: 0.2741 - accuracy: 0.9646
- val_loss: 2.8941e-06 - val_accuracy: 1.0000
Epoch 18/20
61/61 [==============================] - 18s 297ms/step - loss: 0.4285 - accuracy: 0.9616
- val_loss: 0.0100 - val_accuracy: 1.0000
Epoch 19/20
61/61 [==============================] - 18s 298ms/step - loss: 0.4299 - accuracy: 0.9549
- val_loss: 0.1313 - val_accuracy: 0.9444
Epoch 20/20
61/61 [==============================] - 18s 298ms/step - loss: 0.5233 - accuracy: 0.9487
- val_loss: 0.0012 - val_accuracy: 1.0000
```

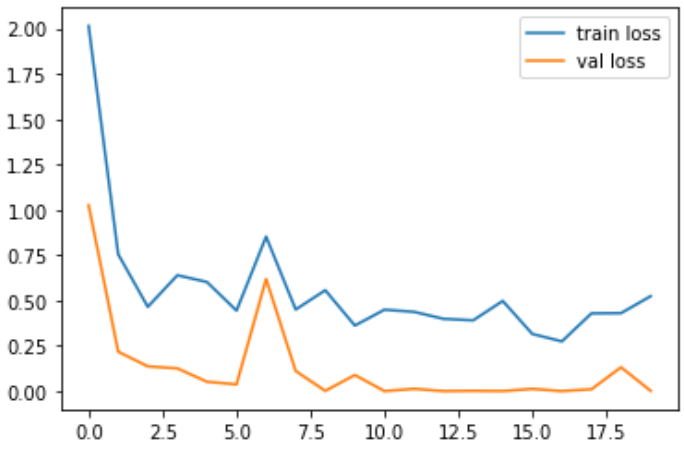
In [18]:

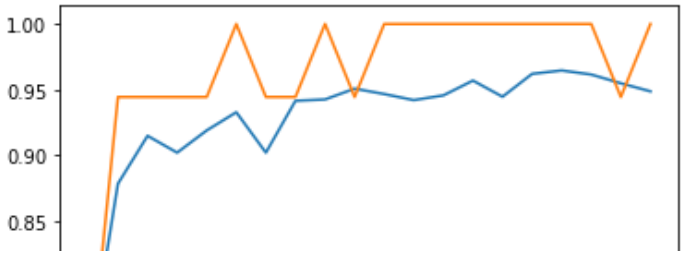
```
import matplotlib.pyplot as plt
```

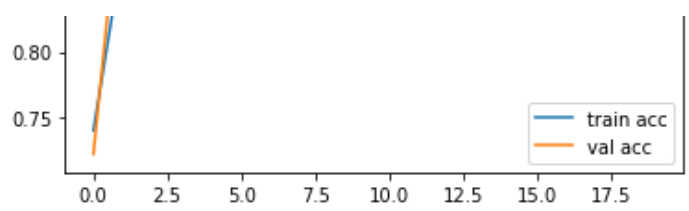
In [19]:

```
# plot the loss
plt.plot(r.history['loss'], label='train loss')
plt.plot(r.history['val_loss'], label='val loss')
plt.legend()
plt.show()
plt.savefig('LossVal_loss')

# plot the accuracy
plt.plot(r.history['accuracy'], label='train acc')
plt.plot(r.history['val_accuracy'], label='val acc')
plt.legend()
plt.show()
plt.savefig('AccVal_acc')
```








```
<Figure size 432x288 with 0 Axes>
```

In [20]:

```
# save it as a h5 file


from tensorflow.keras.models import load_model

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

In [ ]:

```

```

In [21]:

```
y_pred = model.predict(test_set)
```

In [22]:

```
y_pred
```

Out[22]:

```
array([[9.8109645e-01, 1.8903527e-02, 3.2149321e-13, 3.6633790e-15],
       [0.0000000e+00, 1.0000000e+00, 6.7508175e-31, 9.6766906e-34],
       [1.0000000e+00, 0.0000000e+00, 5.1786687e-12, 4.6748233e-21],
       [5.8609026e-21, 3.5736174e-38, 1.0000000e+00, 6.6462439e-35],
       [7.0799731e-33, 1.0000000e+00, 2.7118872e-18, 1.2365503e-16],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 1.6401240e-34],
       [7.8406102e-38, 1.5452786e-03, 0.0000000e+00, 9.9845469e-01],
       [1.1753855e-34, 6.4181074e-30, 2.3469242e-26, 1.0000000e+00],
       [1.6965836e-25, 7.5243352e-23, 1.0000000e+00, 1.5732070e-17],
       [2.4483354e-23, 9.3621990e-09, 2.4969464e-17, 1.0000000e+00],
       [2.9495364e-14, 9.7012167e-14, 1.4914777e-04, 9.9985087e-01],
       [1.0000000e+00, 2.5258806e-23, 2.3514068e-17, 3.6277342e-38],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 0.0000000e+00],
       [1.6495063e-24, 9.0913505e-33, 1.0000000e+00, 1.4732772e-30],
       [7.5178525e-30, 3.0929136e-20, 1.0000000e+00, 4.5963940e-38],
       [2.4522337e-15, 5.0726370e-04, 3.0320957e-09, 9.9949276e-01],
       [3.3097366e-23, 0.0000000e+00, 1.0000000e+00, 0.0000000e+00],
       [8.4912202e-33, 1.0000000e+00, 3.7951684e-15, 4.5114293e-16]],
      dtype=float32)
```

In [23]:

```
import numpy as np
y_pred = np.argmax(y_pred, axis=1)
```

In [24]:

```
y_pred
```

Out[24]:

```
array([0, 1, 0, 2, 1, 1, 3, 3, 2, 3, 3, 0, 1, 2, 2, 3, 2, 1], dtype=int64)
```

In [ ]:

```

```

In [1]:

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
```

In [2]:

```
model=load_model('model_resnet50.h5')
```

In [39]:

```
img_data
```

Out[39]:

```
array([[[[ 6.7060997e+01,  5.4221001e+01,  4.7320000e+01],
         [ 6.9060997e+01,  5.6221001e+01,  4.9320000e+01],
         [ 7.3060997e+01,  6.0221001e+01,  5.3320000e+01],
         ...,
         [ 7.4060997e+01,  5.6221001e+01,  4.6320000e+01],
         [ 5.5060997e+01,  3.7221001e+01,  2.7320000e+01],
         [ 4.1060997e+01,  2.3221001e+01,  1.3320000e+01]],

        [[ 7.5060997e+01,  6.2221001e+01,  5.5320000e+01],
         [ 7.8060997e+01,  6.5221001e+01,  5.8320000e+01],
         [ 8.1060997e+01,  6.8221001e+01,  6.1320000e+01],
         ...,
         [ 9.7060997e+01,  7.9221001e+01,  6.9320000e+01],
         [ 7.3060997e+01,  5.5221001e+01,  4.5320000e+01],
         [ 4.9060997e+01,  3.1221001e+01,  2.1320000e+01]],

        [[ 8.7060997e+01,  7.4221001e+01,  6.7320000e+01],
         [ 9.0060997e+01,  7.7221001e+01,  7.0320000e+01],
         [ 9.3060997e+01,  8.0221001e+01,  7.3320000e+01],
         ...,
         [ 1.0106100e+02,  8.3221001e+01,  7.3320000e+01],
         [ 7.5060997e+01,  5.7221001e+01,  4.7320000e+01],
         [ 5.0060997e+01,  3.2221001e+01,  2.2320000e+01]],

        ...,

        [[ 1.0406100e+02,  8.9221001e+01,  9.4320000e+01],
         [ 1.0206100e+02,  8.7221001e+01,  9.2320000e+01],
         [ 9.9060997e+01,  8.4221001e+01,  8.9320000e+01],
         ...,
         [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01],
         [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01],
         [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01]],

        [[ 1.0606100e+02,  9.1221001e+01,  9.6320000e+01],
         [ 1.0406100e+02,  8.9221001e+01,  9.4320000e+01],
         [ 1.0006100e+02,  8.5221001e+01,  9.0320000e+01],
         ...,
         [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00],
         [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00],
         [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00]],

        [[ 1.0806100e+02,  9.4221001e+01,  9.6320000e+01],
         [ 1.0606100e+02,  9.2221001e+01,  9.4320000e+01],
         [ 1.0206100e+02,  8.8221001e+01,  9.0320000e+01],
         ...,
         [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00],
         [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00],
         [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00]]]],
      dtype=float32)
```

In [11]:

```
img=image.load_img('Datasets/Test/Coffee/download (2).jpg',target_size=(224,224))
```

In [12]:

```
x=image.img_to_array(img)
```

```
x
```

Out[12]:

```
array([[[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       ...,

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]]], dtype=float32)
```

In [13]:

```
x.shape
```

Out[13]:

```
(224, 224, 3)
```

In [14]:

```
x=x/255
```

In [15]:

```
import numpy as np
x=np.expand_dims(x,axis=0)
img_data=preprocess_input(x)
img_data.shape
```

Out[15]:

```
(1, 224, 224, 3)
```

In [16]:

```
model.predict(img_data)
```

Out[16]:

```
array([[0.9745471, 0.0254529]], dtype=float32)
```

In [17]:

```
a=np.argmax(model.predict(img_data), axis=1)
```

In [102]:

```
a==1
```

Out[102]:

```
array([ True])
```

In [18]:

```
import tensorflow as tf
```

In [19]:

```
tf.__version__
```

Out[19]:

```
'2.2.0'
```

In [ ]:

```

```