Animal_Classifier

Cat Vs Dog Image Classification

Sifatullah Sunesh , Dec 10 Jan

Importing all required lib

```
import os
import shutil
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
import cv2
from PIL import Image, ImageOps
from os.path import exists
import zipfile
```

```
import tensorflow as tf
from tensorflow.keras.models import Sequential, Model
from tensorflow.keras.layers import Dense, Dropout, Flatten, Conv2D, MaxPool2D, GlobalAveragePooling2D, InputLayer, LeakyReLU
from tensorflow.keras.optimizers import Adam, SGD
from tensorflow.keras.callbacks import ReduceLROnPlateau, EarlyStopping, History
from tensorflow.keras.preprocessing.image import ImageDataGenerator, load_img
from tensorflow.keras.utils import to_categorical
from tqdm.keras import TqdmCallback
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix
```

```
# GPU Checking whether physical devices for tensorflow recognize
```

```
!nvidia-smi -q -d MEMORY,UTILIZATION
```

```
GPU 00000000:04:00.0
    Fb Memory Usage
        Total                   : 16160 MiB
        Reserved                : 2 MiB
        Used                    : 0 MiB
        Free                    : 16158 MiB
    Utilization
        Gpu                     : 0 %
        Memory                  : 0 %
        Encoder                 : 0 %
        Decoder                 : 0 %
```

```
!pip install -q -U keras-tuner
```

```
[K     |████████████████████████████████| 176 kB 5.1 MB/s
[K     |████████████████████████████████| 62 kB 1.3 MB/s
[K     |████████████████████████████████| 1.6 MB 5.3 MB/s
[K     |████████████████████████████████| 78 kB 8.1 MB/s
[K     |████████████████████████████████| 140 kB 5.1 MB/s
[K     |████████████████████████████████| 1.1 MB 5.3 MB/s
[K     |████████████████████████████████| 1.3
```

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

0.00 0.00 0.00

0.00 0.00 0.00

[redacted]

0.00 0.00 0.00

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

[redacted]

```
Found 5000 images belonging to 2 classes.
Found 1000 images belonging to 2 classes.
```

Trainings images using VGG19

```
tensorflow_version 2.x
```

```
DOWNLOADING: data FOLDER stack_dataset/PetImages/Cat
DOWNLOADING: data FOLDER stack_dataset/PetImages/Dog
Extracting data ZIP file stack_dataset/PetImages.zip
```

```
Found 24998 files belonging to 2 classes.
Using 19999 files for training.
Found 24998 files belonging to 2 classes.
Using 4999 files for validation.
```

```
[b'stack_dataset/PetImages/Cat/10125.jpg'
 b'stack_dataset/PetImages/Cat/10189.jpg'
 b'stack_dataset/PetImages/Cat/10201.jpg'
 b'stack_dataset/PetImages/Cat/10403.jpg'
 b'stack_dataset/PetImages/Cat/10501.jpg']
```

```
Model: "vgg19"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 224, 224, 3)]     0
_________________________________________________________________
block1_conv1 (Conv2D)        (None, 224, 224, 64)      1792
_________________________________________________________________
block1_conv2 (Conv2D)        (None, 224, 224, 64)      36928
_________________________________________________________________
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
_________________________________________________________________
block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
_________________________________________________________________
block2_conv2 (Conv2D)        (None, 112, 112, 128)     147584
_________________________________________________________________
block2_pool (MaxPooling2D)   (None, 56, 56, 128)       0
_________________________________________________________________
block3_conv1 (Conv2D)        (None, 56, 56, 256)       295936
_________________________________________________________________
block3_conv2 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_conv3 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_conv4 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_pool (MaxPooling2D)   (None, 28, 28, 256)       0
_________________________________________________________________
block4_conv1 (Conv2D)        (None, 28, 28, 512)       1180160
_________________________________________________________________
block4_conv2 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv3 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv4 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_pool (MaxPooling2D)   (None, 14, 14, 512)       0
_________________________________________________________________
block5_conv1 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv2 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv3 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv4 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_pool (MaxPooling2D)   (None, 7, 7, 512)         0
=================================================================
Total params: 20,024,384
Trainable params: 20,024,384
Non-trainable params: 0
_________________________________________________________________
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
vgg19 (Functional)           (None, 7, 7, 512)         20024384
_________________________________________________________________
flatten (Flatten)            (None, 25088)             0
_________________________________________________________________
dense (Dense)                (None, 256)               6422784
_________________________________________________________________
dropout (Dropout)            (None, 256)               0
_________________________________________________________________
dense_1 (Dense)              (None, 2)                 514
=================================================================
Total params: 26,447,682
Trainable params: 6,423,298
Non-trainable params: 20,024,384
_________________________________________________________________
```

```
epoch, precision, recall, loss, val_precision, val_recall, val_loss
0, 0.7126, 0.7126, 0.5540, 0.8000, 0.8000, 0.4500
1, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
2, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
3, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
4, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
5, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
6, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
7, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
8, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
9, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
10, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
11, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
12, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
13, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
14, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
15, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
16, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
17, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
18, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
19, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
20, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
21, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
22, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
23, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
24, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
25, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
26, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
27, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
28, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
29, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
30, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
31, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
32, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
33, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
34, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
35, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
36, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
37, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
38, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
39, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
40, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
41, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
42, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
43, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
44, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
45, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
46, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
47, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
48, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
49, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
```

```
Trainings images using VGG19
```

```
tensorflow_version 2.x
```

```
DOWNLOADING: data FOLDER stack_dataset/PetImages/Cat
DOWNLOADING: data FOLDER stack_dataset/PetImages/Dog
Extracting data ZIP file stack_dataset/PetImages.zip
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```

```
Model: "vgg19"
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Layer (type)                 Output Shape              Param #
=================================================================
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_________________________________________________________________
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
_________________________________________________________________
block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
_________________________________________________________________
block2_conv2 (Conv2D)        (None, 112, 112, 128)     147584
_________________________________________________________________
block2_pool (MaxPooling2D)   (None, 56, 56, 128)       0
_________________________________________________________________
block3_conv1 (Conv2D)        (None, 56, 56, 256)       295936
_________________________________________________________________
block3_conv2 (Conv2D)        (None, 56, 56, 256)       590080
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block3_conv3 (Conv2D)        (None, 56, 56, 256)       590080
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block3_conv4 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_pool (MaxPooling2D)   (None, 28, 28, 256)       0
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block4_conv1 (Conv2D)        (None, 28, 28, 512)       1180160
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block4_conv2 (Conv2D)        (None, 28, 28, 512)       2359808
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block4_conv3 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv4 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_pool (MaxPooling2D)   (None, 14, 14, 512)       0
_________________________________________________________________
block5_conv1 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv2 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv3 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv4 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_pool (MaxPooling2D)   (None, 7, 7, 512)         0
=================================================================
Total params: 20,024,384
Trainable params: 20,024,384
Non-trainable params: 0
_________________________________________________________________
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
vgg19 (Functional)           (None, 7, 7, 512)         20024384
_________________________________________________________________
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_________________________________________________________________
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_________________________________________________________________
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_________________________________________________________________
dense_1 (Dense)              (None, 2)                 514
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Trainable params: 6,423,298
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_________________________________________________________________
```

```
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1, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
2, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
3, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
4, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
5, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
6, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
7, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
8, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
9, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
10, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
11, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
12, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
13, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
14, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
15, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
16, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
17, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
18, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
19, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
20, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
21, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
22, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
23, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
24, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
25, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
26, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
27, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
28, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
29, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
30, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
31, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
32, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
33, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
34, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
35, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
36, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
37, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
38, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
39, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
40, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
41, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
42, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
43, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
44, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
45, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
46, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
47, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
48, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
49, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
```

```
pwd
```

```
/content/drive/MyDrive/Dataset_Classified
```

```
ls /content/drive/MyDrive/Dataset_Classified
```

```
'Test_Images'  Training_Images  Validation_Images  Testing_Images  Model_Data
```

```
ls /content/drive/
```

```
MyDrive
```

Test Image for model testing

```
Test_Images_path=Dataset/*/Test_Data/*
```

```
ls /content/Test_Images_path/
```

```
/content/Test_Images_path/
Test_Image_Cat.jpg
Test_Image_Dog.jpg
Test_Image_Cat.jpeg
Test_Image_Dog.jpeg
```

```
%cd /content/drive/MyDrive/Dataset_Classified/
```

```
/content/drive/MyDrive/Dataset_Classified
```

```
%ls -r /content/Test_Images_path/Test_Image_Cat.jpg
```

```
/content/Test_Images_path/Test_Image_Cat.jpg
```

```
%ls -r /content/Test_Images_path/Test_Image_Dog.jpg
```

```
/content/Test_Images_path/Test_Image_Dog.jpg
```

```
%ls -r /content/Test_Images_path/Test_Image_Cat.jpeg
```

```
/content/Test_Images_path/Test_Image_Cat.jpeg
```

```
%ls -r /content/Test_Images_path/Test_Image_Dog.jpeg
```

```
/content/Test_Images_path/Test_Image_Dog.jpeg
```

```
%cd /content/Test_Images_path/
```

```
/content/Test_Images_path
```

```
%ls -r Test_Image_Cat.jpg
```

```
%ls -r Test_Image_Dog.jpg
```



```
%ls -r Test_Image_Cat.jpeg
```



```
%ls -r Test_Image_Dog.jpeg
```



```
%cd /content/drive/
```

```
/content/drive
```

```
from keras.models import load_model
model = load_model('/content/drive/MyDrive/Dataset_Classified/Model_Data/vgg19.h5')
model.summary()
```

```
Model: "vgg19"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 224, 224, 3)]     0
_________________________________________________________________
block1_conv1 (Conv2D)        (None, 224, 224, 64)      1792
_________________________________________________________________
block1_conv2 (Conv2D)        (None, 224, 224, 64)      36928
_________________________________________________________________
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
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block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
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block3_pool (MaxPooling2D)   (None, 28, 28, 256)       0
_________________________________________________________________
block4_conv1 (Conv2D)        (None, 28, 28, 512)       1180160
_________________________________________________________________
block4_conv2 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv3 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv4 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_pool (MaxPooling2D)   (None, 14, 14, 512)       0
_________________________________________________________________
block5_conv1 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv2 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv3 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv4 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_pool (MaxPooling2D)   (None, 7, 7, 512)         0
=================================================================
Total params: 20,024,384
Trainable params: 20,024,384
Non-trainable params: 0
_________________________________________________________________
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
vgg19 (Functional)           (None, 7, 7, 512)         20024384
_________________________________________________________________
flatten (Flatten)            (None, 25088)             0
_________________________________________________________________
dense (Dense)                (None, 256)               6422784
_________________________________________________________________
dropout (Dropout)            (None, 256)               0
_________________________________________________________________
dense_1 (Dense)              (None, 2)                 514
=================================================================
Total params: 26,447,682
Trainable params: 6,423,298
Non-trainable params: 20,024,384
_________________________________________________________________
```

```
epoch, precision, recall, loss, val_precision, val_recall, val_loss
0, 0.7126, 0.7126, 0.5540, 0.8000, 0.8000, 0.4500
1, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
2, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
3, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
4, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
5, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
6, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
7, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
8, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
9, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
10, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
11, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
12, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
13, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
14, 0.8000, 0.8000, 0.4500, 0.8000, 0.8000, 0.4500
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```

```
from keras.preprocessing.image import load_img
from keras.preprocessing.image import img_to_array
image = load_img('/content/Test_Images_path/Test_Image_Cat.jpg')
image = img_to_array(image)
image = image.reshape((1, image.shape[0], image.shape[1], image.shape[2]))
image = preprocess_input(image)
yhat = model.predict(image)
print('%s (%.2f%%)' % ('Cat', yhat[0][0]*100))
```

```
Cat (100.00%)
```

```
from matplotlib import pyplot
from keras.preprocessing.image import load_img
image = load_img('/content/Test_Images_path/Test_Image_Cat.jpg')
pyplot.imshow(image)
pyplot.title('Test_Image_Cat')
pyplot.show()
```



```
from keras.models import load_model
model = load_model('/content/drive/MyDrive/Dataset_Classified/Model_Data/vgg19.h5')
from keras.preprocessing.image import load_img
from keras.preprocessing.image import img_to_array
from keras.applications.vgg19 import preprocess_input
from keras.applications.vgg19 import decode_predictions
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Flatten
from keras.layers import Dropout
from keras.layers import GlobalAveragePooling2D
from keras.layers import MaxPooling2D
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Dense, Flatten
from keras.models import Model
from keras.optimizers import Adam
from keras.callbacks import ReduceLROnPlateau
from keras.callbacks import EarlyStopping
from keras.callbacks import ModelCheckpoint
from keras.callbacks import CSVLogger
from keras.callbacks import TensorBoard
from keras.callbacks import TerminateOnNaN
from keras.callbacks import LearningRateScheduler
from keras.callbacks import RemoteMonitor
from keras.callbacks import BaseLogger
from keras.callbacks import ProgbarLogger
from keras.callbacks import History
from keras.callbacks import callbacks
import os
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
import keras
import keras_tuner as kt
import shutil
import zipfile
import os.path
import os
import glob
import pandas as pd
import sklearn
import sklearn.preprocessing
import sklearn.model_selection
import sklearn.metrics
import sklearn.utils
import sklearn.ensemble
import sklearn.tree
import sklearn.linear_model
import sklearn.svm
import sklearn.neighbors
import sklearn.naive_bayes
import sklearn.cluster
import sklearn.decomposition
import sklearn.manifold
import sklearn.preprocessing.label
import sklearn.preprocessing.LabelEncoder
import sklearn.preprocessing.OneHotEncoder
import sklearn.preprocessing.StandardScaler
import sklearn.preprocessing.MinMaxScaler
import sklearn.preprocessing.RobustScaler
import sklearn.preprocessing.Normalizer
import sklearn.preprocessing.Binarizer
import sklearn.preprocessing.PolynomialFeatures
import sklearn.preprocessing.PowerTransformer
import sklearn.preprocessing.QuantileTransformer
import sklearn.preprocessing.KBinsDiscretizer
import sklearn.preprocessing.FunctionTransformer
import sklearn.preprocessing.MaxAbsScaler
```