

In [8]:

```
[!] unzip ~/dogs_cats.zip -d ~/
```

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```
-packages (from tensorflow) (0.36.2)
Collecting astunparse~=1.6.3
  Downloading astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Collecting absl-py~=0.10
  Downloading absl_py-0.13.0-py3-none-any.whl (132 kB)
| [REDACTED] | 132 kB 9.2 MB/s eta 0:00:01
Collecting flatbuffers~=1.12.0
  Downloading flatbuffers-1.12-py2.py3-none-any.whl (15 kB)
Collecting wrapt~=1.12.1
  Downloading wrapt-1.12.1.tar.gz (27 kB)
Collecting clang~=5.0
  Downloading clang-5.0.tar.gz (30 kB)
Collecting gast==0.4.0
  Downloading gast-0.4.0-py3-none-any.whl (9.8 kB)
Collecting keras~=2.6
  Downloading keras-2.6.0-py2.py3-none-any.whl (1.3 MB)
| [REDACTED] | 1.3 MB 35.0 MB/s eta 0:00:01
Collecting tensorflow-estimator~=2.6
  Downloading tensorflow_estimator-2.6.0-py2.py3-none-any.whl (462 kB)
| [REDACTED] | 462 kB 27.3 MB/s eta 0:00:01
Collecting grpcio<2.0,>=1.37.0
  Downloading grpcio-1.39.0-cp36-cp36m-manylinux2014_x86_64.whl (4.3 MB)
| [REDACTED] | 4.3 MB 51.3 MB/s eta 0:00:01
Collecting google-pasta~=0.2
  Downloading google_pasta-0.2.0-py3-none-any.whl (57 kB)
| [REDACTED] | 57 kB 5.6 MB/s eta 0:00:01
Collecting opt-einsum~=3.3.0
  Downloading opt_einsum-3.3.0-py3-none-any.whl (65 kB)
| [REDACTED] | 65 kB 4.3 MB/s eta 0:00:01
Collecting cached-property
  Downloading cached_property-1.5.2-py2.py3-none-any.whl (7.6 kB)
Collecting tensorboard-data-server<0.7.0,>=0.6.0
  Downloading tensorboard_data_server-0.6.1-py3-none-manylinux2010_x86_64.whl (4.9 MB)
| [REDACTED] | 4.9 MB 37.4 MB/s eta 0:00:01
Requirement already satisfied: requests<3,>=2.21.0 in /srv/conda/envs/notebook/lib/python
3.6/site-packages (from tensorboard~=2.6->tensorflow) (2.25.1)
Collecting google-auth<2,>=1.6.3
  Downloading google_auth-1.35.0-py2.py3-none-any.whl (152 kB)
| [REDACTED] | 152 kB 37.3 MB/s eta 0:00:01
Collecting tensorboard-plugin-wit>=1.6.0
  Downloading tensorboard_plugin_wit-1.8.0-py3-none-any.whl (781 kB)
| [REDACTED] | 781 kB 26.9 MB/s eta 0:00:01
Collecting markdown>=2.6.8
  Downloading Markdown-3.3.4-py3-none-any.whl (97 kB)
| [REDACTED] | 97 kB 7.6 MB/s eta 0:00:01
Collecting werkzeug>=0.11.15
  Downloading Werkzeug-2.0.1-py3-none-any.whl (288 kB)
| [REDACTED] | 288 kB 49.2 MB/s eta 0:00:01
Collecting google-auth-oauthlib<0.5,>=0.4.1
  Downloading google_auth_oauthlib-0.4.5-py2.py3-none-any.whl (18 kB)
Requirement already satisfied: setuptools>=41.0.0 in /srv/conda/envs/notebook/lib/python3
.6/site-packages (from tensorboard~=2.6->tensorflow) (49.6.0.post20210108)
Collecting pyasn1-modules>=0.2.1
  Downloading pyasn1_modules-0.2.8-py2.py3-none-any.whl (155 kB)
| [REDACTED] | 155 kB 43.3 MB/s eta 0:00:01
Collecting cachetools<5.0,>=2.0.0
  Downloading cachetools-4.2.2-py3-none-any.whl (11 kB)
Collecting rsa<5,>=3.1.4
  Downloading rsa-4.7.2-py3-none-any.whl (34 kB)
Collecting requests-oauthlib>=0.7.0
  Downloading requests_oauthlib-1.3.0-py2.py3-none-any.whl (23 kB)
Requirement already satisfied: importlib-metadata in /srv/conda/envs/notebook/lib/python3
.6/site-packages (from markdown>=2.6.8->tensorboard~=2.6->tensorflow) (3.4.0)
Collecting pyasn1<0.5.0,>=0.4.6
  Downloading pyasn1-0.4.8-py2.py3-none-any.whl (77 kB)
| [REDACTED] | 77 kB 3.9 MB/s eta 0:00:01
Requirement already satisfied: chardet<5,>=3.0.2 in /srv/conda/envs/notebook/lib/python3.
6/site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow) (4.0.0)
Requirement already satisfied: certifi>=2017.4.17 in /srv/conda/envs/notebook/lib/python3
.6/site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow) (2020.12.5)
Requirement already satisfied: idna<3,>=2.5 in /srv/conda/envs/notebook/lib/python3.6/sit
e-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow) (2.10)
```

Requirement already satisfied: urllib3<1.27,>=1.21.1 in /srv/conda/envs/notebook/lib/python3.6/site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow) (1.26.3)
Requirement already satisfied: oauthlib>=3.0.0 in /srv/conda/envs/notebook/lib/python3.6/site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.6->tensorflow) (3.0.1)
Requirement already satisfied: dataclasses in /srv/conda/envs/notebook/lib/python3.6/site-packages (from werkzeug>=0.11.15->tensorboard~=2.6->tensorflow) (0.7)
Requirement already satisfied: zipp>=0.5 in /srv/conda/envs/notebook/lib/python3.6/site-packages (from importlib-metadata->markdown>=2.6.8->tensorboard~=2.6->tensorflow) (3.4.0)
Building wheels for collected packages: clang, termcolor, wrapt
Building wheel for clang (setup.py) ... done
Created wheel for clang: filename=clang-5.0-py3-none-any.whl size=30702 sha256=3c92632d399e2c50b464669dcb58c37044324fe87ca95d497b9f46f35d680dec
Stored in directory: /home/jovyan/.cache/pip/wheels/22/4c/94/0583f60c9c5b6024ed64f290cb2d43b06bb4f75577dc3c93a7
Building wheel for termcolor (setup.py) ... done
Created wheel for termcolor: filename=termcolor-1.1.0-py3-none-any.whl size=4829 sha256=df981e243570edf068942184971c44cbfe2133da6784e7f3b9a1c2b7ec7f2e9c
Stored in directory: /home/jovyan/.cache/pip/wheels/93/2a/eb/e58dbcbc963549ee4f065ff80a59f274cc7210b6eab962acdc
Building wheel for wrapt (setup.py) ... done
Created wheel for wrapt: filename=wrapt-1.12.1-cp36-cp36m-linux_x86_64.whl size=69773 sha256=36b023ffe04d54df9f3293a69086b7987dbf10f430fc7437c7a5b938f042b0be
Stored in directory: /home/jovyan/.cache/pip/wheels/32/42/7f/23cae9ff6ef66798d00dc5d659088e57dbba01566f6c60db63
Successfully built clang termcolor wrapt
Installing collected packages: pyasn1, rsa, pyasn1-modules, cachetools, requests-oauthlib, google-auth, werkzeug, tensorboard-plugin-wit, tensorboard-data-server, protobuf, markdown, grpcio, google-auth-oauthlib, cached-property, absl-py, wrapt, termcolor, tensorflow-estimator, tensorboard, opt-einsum, keras-preprocessing, keras, h5py, google-pasta, gast, flatbuffers, clang, astunparse, tensorflow
Successfully installed absl-py-0.13.0 astunparse-1.6.3 cached-property-1.5.2 cachetools-4.2.2 clang-5.0 flatbuffers-1.12 gast-0.4.0 google-auth-1.35.0 google-auth-oauthlib-0.4.5 google-pasta-0.2.0 grpcio-1.39.0 h5py-3.1.0 keras-2.6.0 keras-preprocessing-1.1.2 markdown-3.3.4 opt-einsum-3.3.0 protobuf-3.17.3 pyasn1-0.4.8 pyasn1-modules-0.2.8 requests-oauthlib-1.3.0 rsa-4.7.2 tensorboard-2.6.0 tensorboard-data-server-0.6.1 tensorboard-plugin-wit-1.8.0 tensorflow-2.6.0 tensorflow-estimator-2.6.0 termcolor-1.1.0 werkzeug-2.0.1 wrapt-1.12.1
Note: you may need to restart the kernel to use updated packages.

In [12]:

```
pip install keras
```

Requirement already satisfied: keras in /srv/conda/envs/notebook/lib/python3.6/site-packages (2.6.0)
Note: you may need to restart the kernel to use updated packages.

In [1]:

```
import tensorflow as tf
from keras.preprocessing.image import ImageDataGenerator
```

In [2]:

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

In [3]:

```
pwd
```

Out[3]:

```
'/home/jovyan/binder'
```

In [4]:

```
training_set= train_datagen.flow_from_directory('/home/jovyan/binder/dogs_cats/training_
```

```
set',  
  
target_size = (64, 64),  
batch_size = 32,  
class_mode = 'binary')
```

Found 8000 images belonging to 2 classes.

In [5]:

```
test_datagen = ImageDataGenerator(rescale = 1./255)  
test_set = test_datagen.flow_from_directory('/home/jovyan/binder/dogs_cats/test_set',  
                                           target_size = (64, 64),  
                                           batch_size = 32,  
                                           class_mode = 'binary')
```

Found 2000 images belonging to 2 classes.

CNN

In [7]:

```
cnn = tf.keras.models.Sequential()
```

In [8]:

```
cnn.add(tf.keras.layers.Conv2D(filters=32, kernel_size=3, activation='relu', input_shape  
=[64, 64, 3]))
```

In [9]:

```
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2, strides=2))
```

In [10]:

```
cnn.add(tf.keras.layers.Conv2D(filters=32, kernel_size=3, activation='relu'))  
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2, strides=2))
```

In [11]:

```
cnn.add(tf.keras.layers.Flatten())
```

In [12]:

```
cnn.add(tf.keras.layers.Dense(units=128, activation='relu'))
```

In [13]:

```
cnn.add(tf.keras.layers.Dense(units=1, activation='sigmoid'))
```

Training and Compiling

In [14]:

```
cnn.compile(optimizer = 'adam', loss = 'binary_crossentropy', metrics = ['accuracy'])
```

In [15]:

```
cnn.fit(x = training_set, validation_data = test_set, epochs = 25)
```

Epoch 1/25

250/250 [=====] - 131s 522ms/step - loss: 0.6726 - accuracy: 0.5796 - val_loss: 0.6217 - val_accuracy: 0.6420

Epoch 2/25

250/250 [=====] - 118s 471ms/step - loss: 0.6025 - accuracy: 0.6773 - val_loss: 0.5711 - val_accuracy: 0.7110

Epoch 3/25

250/250 [=====] - 119s 475ms/step - loss: 0.5604 - accuracy: 0.7

```
113 - val_loss: 0.5418 - val_accuracy: 0.7320
Epoch 4/25
250/250 [=====] - 118s 472ms/step - loss: 0.5306 - accuracy: 0.7
333 - val_loss: 0.5117 - val_accuracy: 0.7560
Epoch 5/25
250/250 [=====] - 120s 478ms/step - loss: 0.4972 - accuracy: 0.7
566 - val_loss: 0.4961 - val_accuracy: 0.7630
Epoch 6/25
250/250 [=====] - 121s 486ms/step - loss: 0.4863 - accuracy: 0.7
623 - val_loss: 0.5174 - val_accuracy: 0.7515
Epoch 7/25
250/250 [=====] - 126s 503ms/step - loss: 0.4721 - accuracy: 0.7
745 - val_loss: 0.5062 - val_accuracy: 0.7610
Epoch 8/25
250/250 [=====] - 125s 499ms/step - loss: 0.4444 - accuracy: 0.7
885 - val_loss: 0.5271 - val_accuracy: 0.7530
Epoch 9/25
250/250 [=====] - 127s 507ms/step - loss: 0.4407 - accuracy: 0.7
937 - val_loss: 0.4640 - val_accuracy: 0.7930
Epoch 10/25
250/250 [=====] - 125s 502ms/step - loss: 0.4283 - accuracy: 0.8
036 - val_loss: 0.4676 - val_accuracy: 0.7770
Epoch 11/25
250/250 [=====] - 120s 479ms/step - loss: 0.4086 - accuracy: 0.8
154 - val_loss: 0.5244 - val_accuracy: 0.7630
Epoch 12/25
250/250 [=====] - 119s 474ms/step - loss: 0.4030 - accuracy: 0.8
154 - val_loss: 0.4483 - val_accuracy: 0.8020
Epoch 13/25
250/250 [=====] - 112s 447ms/step - loss: 0.3885 - accuracy: 0.8
269 - val_loss: 0.4480 - val_accuracy: 0.7955
Epoch 14/25
250/250 [=====] - 113s 451ms/step - loss: 0.3774 - accuracy: 0.8
301 - val_loss: 0.4764 - val_accuracy: 0.7895
Epoch 15/25
250/250 [=====] - 112s 446ms/step - loss: 0.3605 - accuracy: 0.8
388 - val_loss: 0.4541 - val_accuracy: 0.8055
Epoch 16/25
250/250 [=====] - 110s 438ms/step - loss: 0.3532 - accuracy: 0.8
396 - val_loss: 0.4586 - val_accuracy: 0.8040
Epoch 17/25
250/250 [=====] - 118s 472ms/step - loss: 0.3468 - accuracy: 0.8
493 - val_loss: 0.4490 - val_accuracy: 0.8035
Epoch 18/25
250/250 [=====] - 129s 516ms/step - loss: 0.3341 - accuracy: 0.8
534 - val_loss: 0.5772 - val_accuracy: 0.7620
Epoch 19/25
250/250 [=====] - 119s 475ms/step - loss: 0.3355 - accuracy: 0.8
504 - val_loss: 0.5122 - val_accuracy: 0.7810
Epoch 20/25
250/250 [=====] - 117s 468ms/step - loss: 0.3128 - accuracy: 0.8
658 - val_loss: 0.4654 - val_accuracy: 0.8085
Epoch 21/25
250/250 [=====] - 117s 466ms/step - loss: 0.3055 - accuracy: 0.8
634 - val_loss: 0.4817 - val_accuracy: 0.8060
Epoch 22/25
250/250 [=====] - 115s 460ms/step - loss: 0.2946 - accuracy: 0.8
719 - val_loss: 0.5094 - val_accuracy: 0.7975
Epoch 23/25
250/250 [=====] - 117s 470ms/step - loss: 0.2959 - accuracy: 0.8
752 - val_loss: 0.4710 - val_accuracy: 0.8085
Epoch 24/25
250/250 [=====] - 115s 461ms/step - loss: 0.2746 - accuracy: 0.8
836 - val_loss: 0.4660 - val_accuracy: 0.8115
Epoch 25/25
250/250 [=====] - 113s 452ms/step - loss: 0.2656 - accuracy: 0.8
873 - val_loss: 0.4912 - val_accuracy: 0.8095
```

Out[15]:

<keras.callbacks.History at 0x7f18d3de8320>

In [47]:

```
import numpy as np
from keras.preprocessing import image
test_image = image.load_img('/home/jovyan/binder/dogs_cats/single_prediction/cat_dog.jpg'
, target_size = (64, 64))
test_image = image.img_to_array(test_image)
test_image = np.expand_dims(test_image, axis = 0)
result = cnn.predict(test_image)
training_set.class_indices
if result[0][0] == 1:
    prediction = 'dog'
else:
    prediction = 'cat'
```

In [48]:

```
print(result)
```

```
[[0.]]
```

In []: