```
import numpy as np
import pandas as pd
import os
import time
import path
import pydot
from typing import List, Tuple
from matplotlib.pyplot import imshow
%matplotlib inline
import matplotlib.pyplot as plt
import PIL.Image
import pathlib
import shutil

import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.preprocessing import image
from tensorflow.keras import layers
from tensorflow.keras.layers import Input, Add, Dense, Activation,
ZeroPadding2D, BatchNormalization, Flatten, Conv2D, AveragePooling2D,
MaxPooling2D, GlobalMaxPooling2D, Dropout
from tensorflow.keras.initializers import glorot_uniform
from tensorflow.keras.models import Model, load_model, Sequential

from tensorflow.python.keras.utils import layer_utils
#from tensorflow.keras.utils.vis_utils import model_to_dot
from tensorflow.keras.utils import model_to_dot
from tensorflow.keras.utils import plot_model

from tensorflow.keras.preprocessing.image import ImageDataGenerator
from sklearn.model_selection import train_test_split
import pickle

from tensorflow.keras.applications.imagenet_utils import
preprocess_input

from IPython.display import SVG

import scipy.misc
import tensorflow.keras.backend as K
K.set_image_data_format('channels_last') # can be channels_first or
channels_last.

image_size = (128, 128)
channels = 3
num_classes = 4

data_path =
"/kaggle/input/kaggle-cat-vs-dog-dataset/kagglecatsanddogs_3367a/PetIm
ages"
```

```python
images = []
labels = []

for subfolder in os.listdir(data_path):

    subfolder_path = os.path.join(data_path, subfolder)
    if not os.path.isdir(subfolder_path):
        continue

    for image_filename in os.listdir(subfolder_path):
        image_path = os.path.join(subfolder_path, image_filename)
        images.append(image_path)

        labels.append(subfolder)

data = pd.DataFrame({'image': images, 'label': labels})

data.head()
```

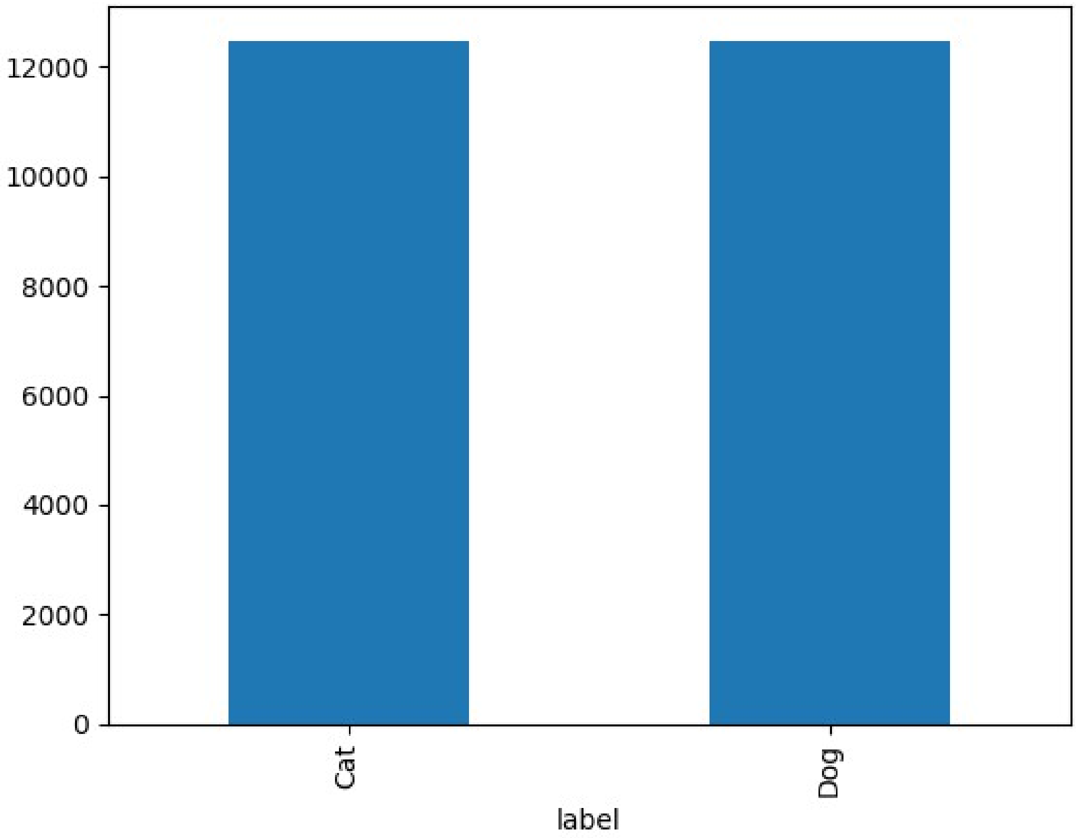
```
                                               image label
0  /kaggle/input/kaggle-cat-vs-dog-dataset/kaggle...   Dog
1  /kaggle/input/kaggle-cat-vs-dog-dataset/kaggle...   Dog
2  /kaggle/input/kaggle-cat-vs-dog-dataset/kaggle...   Dog
3  /kaggle/input/kaggle-cat-vs-dog-dataset/kaggle...   Dog
4  /kaggle/input/kaggle-cat-vs-dog-dataset/kaggle...   Dog
```

```python
data['label'].value_counts()
```

```
label
Cat    12491
Dog    12470
Name: count, dtype: int64
```

```python
data['label'].value_counts().plot.bar()
```

```
<Axes: xlabel='label'>
```



```
strat = data['label']
train_df, dummy_df = train_test_split(data,  train_size= 0.60,
shuffle= True, random_state= 123, stratify= strat)

strat = dummy_df['label']
valid_df, test_df = train_test_split(dummy_df,  train_size= 0.5,
shuffle= True, random_state= 123, stratify= strat)

batch_size = 32
img_size = (128, 128)
channels = 3
img_shape = (img_size[0], img_size[1], channels)

tr_gen = ImageDataGenerator(rescale=1./255,
                                     rotation_range=45,
                                     width_shift_range=0.2,
                                     height_shift_range=0.2,
                                     shear_range=0.2,
                                     zoom_range=0.2,
                                     horizontal_flip=True,
                                     fill_mode='nearest')
ts_gen = ImageDataGenerator(rescale=1./255)

train_gen = tr_gen.flow_from_dataframe(train_df, x_col='image',
y_col='label', target_size=img_size,
                                       class_mode='binary',
color_mode='rgb', shuffle=True, batch_size=batch_size)

valid_gen = ts_gen.flow_from_dataframe(valid_df, x_col='image',
y_col='label', target_size=img_size,
                                       class_mode='binary',
color_mode='rgb', shuffle=True, batch_size=batch_size)

test_gen = ts_gen.flow_from_dataframe(test_df, x_col='image',
y_col='label', target_size=img_size,
                                      class_mode='binary',
color_mode='rgb', shuffle=False, batch_size=batch_size)
```

```
Found 14975 validated image filenames belonging to 2 classes.
```

```
/opt/conda/lib/python3.10/site-packages/keras/src/legacy/
preprocessing/image.py:920: UserWarning: Found 1 invalid image
filename(s) in x_col="image". These filename(s) will be ignored.
  warnings.warn(
```

```
Found 4991 validated image filenames belonging to 2 classes.
```

```
/opt/conda/lib/python3.10/site-packages/keras/src/legacy/
preprocessing/image.py:920: UserWarning: Found 1 invalid image
filename(s) in x_col="image". These filename(s) will be ignored.
  warnings.warn(
```

```
Found 4993 validated image filenames belonging to 2 classes.
```

```
model = Sequential()

model.add(Conv2D(32, (3, 3), activation='relu',
input_shape=img_shape))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(128, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Flatten())
model.add(Dense(512, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.5))
model.add(Dense(2, activation='softmax'))

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

model.summary()

Model: "sequential_5"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━
━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━
━━━━━┩
│ conv2d_4 (Conv2D)               │ (None, 126, 126, 32)   │
896 │
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ batch_normalization_5           │ (None, 126, 126, 32)   │
128 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ max_pooling2d_4 (MaxPooling2D)  │ (None, 63, 63, 32)     │
0 │
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ dropout_4 (Dropout)             │ (None, 63, 63, 32)     │
0 │
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ conv2d_5 (Conv2D)               │ (None, 61, 61, 64)     │
18,496 │
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ batch_normalization_6           │ (None, 61, 61, 64)     │
256 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ max_pooling2d_5 (MaxPooling2D)  │ (None, 30, 30, 64)     │
0 │
├─────────────────────────────────┼────────────────────────┼───────────
─────┤
│ dropout_5 (Dropout)             │ (None, 30, 30, 64)     │
0 │
```

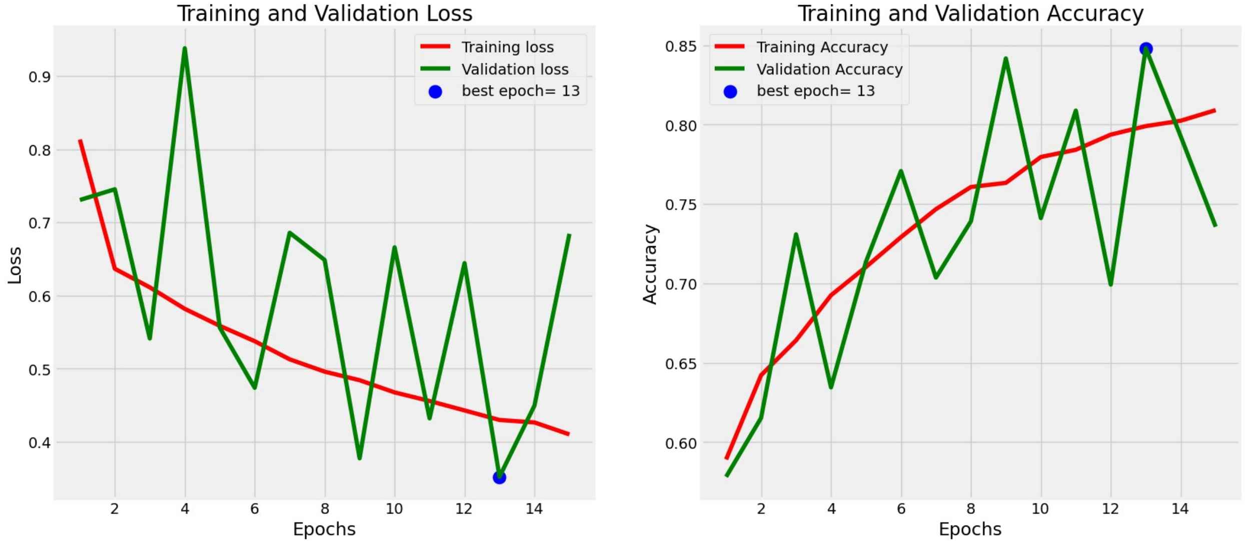
```
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ conv2d_6 (Conv2D)               │ (None, 28, 28, 128)    │
73,856 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_7           │ (None, 28, 28, 128)    │
512 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_6 (MaxPooling2D)  │ (None, 14, 14, 128)    │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_6 (Dropout)             │ (None, 14, 14, 128)    │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ flatten_1 (Flatten)             │ (None, 25088)          │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_2 (Dense)                 │ (None, 512)            │
12,845,568 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_8           │ (None, 512)            │
2,048 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_7 (Dropout)             │ (None, 512)            │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_3 (Dense)                 │ (None, 2)              │
1,026 │
└─────────────────────────────────┴────────────────────────┴──────────
─────┘

 Total params: 12,942,786 (49.37 MB)

 Trainable params: 12,941,314 (49.37 MB)

 Non-trainable params: 1,472 (5.75 KB)
```

```
class myCallback(tf.keras.callbacks.Callback):
    def on_epoch_end(self, epoch, logs={}):
        if(logs.get('val_accuracy') > 0.99):
            print("\nReached 90% accuracy so cancelling training!")
            self.model.stop_training = True

cb = myCallback()
history = model.fit(
    train_gen,
    epochs=15,
    batch_size=64,
    verbose=1,
    validation_data=valid_gen,
    callbacks=[cb]
)
```

```
Epoch 1/15

/opt/conda/lib/python3.10/site-packages/keras/src/trainers/
data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset`
class should call `super().__init__(**kwargs)` in its constructor.
`**kwargs` can include `workers`, `use_multiprocessing`,
`max_queue_size`. Do not pass these arguments to `fit()`, as they will
be ignored.
  self._warn_if_super_not_called()
WARNING: All log messages before absl::InitializeLog() is called are
written to STDERR
I0000 00:00:1727599370.856500     293 service.cc:145] XLA service
0x7b8b50007980 initialized for platform CUDA (this does not guarantee
that XLA will be used). Devices:
I0000 00:00:1727599370.856556     293 service.cc:153]   StreamExecutor
device (0): Tesla T4, Compute Capability 7.5
I0000 00:00:1727599370.856564     293 service.cc:153]   StreamExecutor
device (1): Tesla T4, Compute Capability 7.5

  1/468 ━━━━━━━━━━━━━━━━━━━━ 2:08:37 17s/step - accuracy: 0.5312 -
loss: 1.2162

I0000 00:00:1727599381.074031     293 device_compiler.h:188] Compiled
cluster using XLA!  This line is logged at most once for the lifetime
of the process.

 20/468 ━━━━━━━━━━━━━━━━━━━━ 2:40 359ms/step - accuracy: 0.5227 -
loss: 2.1648

/opt/conda/lib/python3.10/site-packages/PIL/TiffImagePlugin.py:900:
UserWarning: Truncated File Read
  warnings.warn(str(msg))

468/468 ━━━━━━━━━━━━━━━━━━━━ 252s 503ms/step - accuracy: 0.5667 -
loss: 1.0315 - val_accuracy: 0.5782 - val_loss: 0.7306
```

```
Epoch 2/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 107s 197ms/step - accuracy: 0.6322 -
loss: 0.6495 - val_accuracy: 0.6153 - val_loss: 0.7453
Epoch 3/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 97s 204ms/step - accuracy: 0.6608 - loss:
0.6163 - val_accuracy: 0.7309 - val_loss: 0.5412
Epoch 4/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 195ms/step - accuracy: 0.6932 - loss:
0.5825 - val_accuracy: 0.6345 - val_loss: 0.9381
Epoch 5/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 198ms/step - accuracy: 0.7104 - loss:
0.5611 - val_accuracy: 0.7137 - val_loss: 0.5563
Epoch 6/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 198ms/step - accuracy: 0.7188 - loss:
0.5478 - val_accuracy: 0.7708 - val_loss: 0.4738
Epoch 7/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 95s 200ms/step - accuracy: 0.7392 - loss:
0.5223 - val_accuracy: 0.7037 - val_loss: 0.6858
Epoch 8/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 197ms/step - accuracy: 0.7589 - loss:
0.4986 - val_accuracy: 0.7391 - val_loss: 0.6486
Epoch 9/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 96s 202ms/step - accuracy: 0.7597 - loss:
0.4900 - val_accuracy: 0.8417 - val_loss: 0.3774
Epoch 10/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 197ms/step - accuracy: 0.7840 - loss:
0.4654 - val_accuracy: 0.7411 - val_loss: 0.6659
Epoch 11/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 199ms/step - accuracy: 0.7865 - loss:
0.4530 - val_accuracy: 0.8089 - val_loss: 0.4321
Epoch 12/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 197ms/step - accuracy: 0.7903 - loss:
0.4421 - val_accuracy: 0.6993 - val_loss: 0.6443
Epoch 13/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 92s 193ms/step - accuracy: 0.7945 - loss:
0.4358 - val_accuracy: 0.8481 - val_loss: 0.3522
Epoch 14/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 90s 191ms/step - accuracy: 0.8074 - loss:
0.4255 - val_accuracy: 0.7926 - val_loss: 0.4496
Epoch 15/15
468/468 ━━━━━━━━━━━━━━━━━━━━ 90s 190ms/step - accuracy: 0.8088 - loss:
0.4096 - val_accuracy: 0.7357 - val_loss: 0.6844
```

```python
def plot_history(history):
    tr_acc = history.history['accuracy']
    tr_loss = history.history['loss']
    val_acc = history.history['val_accuracy']
    val_loss = history.history['val_loss']
    index_loss = np.argmin(val_loss)
    val_lowest = val_loss[index_loss]
    index_acc = np.argmax(val_acc)
    acc_highest = val_acc[index_acc]
    Epochs = [i+1 for i in range(len(tr_acc))]
    loss_label = f'best epoch= {str(index_loss + 1)}'
    acc_label = f'best epoch= {str(index_acc + 1)}'

    plt.figure(figsize= (20, 8))
    plt.style.use('fivethirtyeight')
    plt.subplot(1, 2, 1)
    plt.plot(Epochs, tr_loss, 'r', label= 'Training loss')
    plt.plot(Epochs, val_loss, 'g', label= 'Validation loss')
    plt.scatter(index_loss + 1, val_lowest, s= 150, c= 'blue', label=
loss_label)
    plt.title('Training and Validation Loss')
    plt.xlabel('Epochs')
    plt.ylabel('Loss')
    plt.legend()

    plt.subplot(1, 2, 2)
    plt.plot(Epochs, tr_acc, 'r', label= 'Training Accuracy')
    plt.plot(Epochs, val_acc, 'g', label= 'Validation Accuracy')
    plt.scatter(index_acc + 1 , acc_highest, s= 150, c= 'blue', label=
acc_label)
    plt.title('Training and Validation Accuracy')
    plt.xlabel('Epochs')
    plt.ylabel('Accuracy')
    plt.legend()
    plt.tight_layout

    plt.show()

plot_history(history)
```



```
preds = model.predict(test_gen)
y_pred = np.argmax(preds, axis=1)
```

```
/opt/conda/lib/python3.10/site-packages/keras/src/trainers/
data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset`
class should call `super().__init__(**kwargs)` in its constructor.
`**kwargs` can include `workers`, `use_multiprocessing`,
`max_queue_size`. Do not pass these arguments to `fit()`, as they will
be ignored.
  self._warn_if_super_not_called()
```

```
157/157 ━━━━━━━━━━━━━━━━━━━━ 43s 270ms/step
```

```
test_gen.class_indices
```

```
{'Cat': 0, 'Dog': 1}
```

```
from sklearn.metrics import *
```

```
print(classification_report(test_gen.classes, y_pred))
```

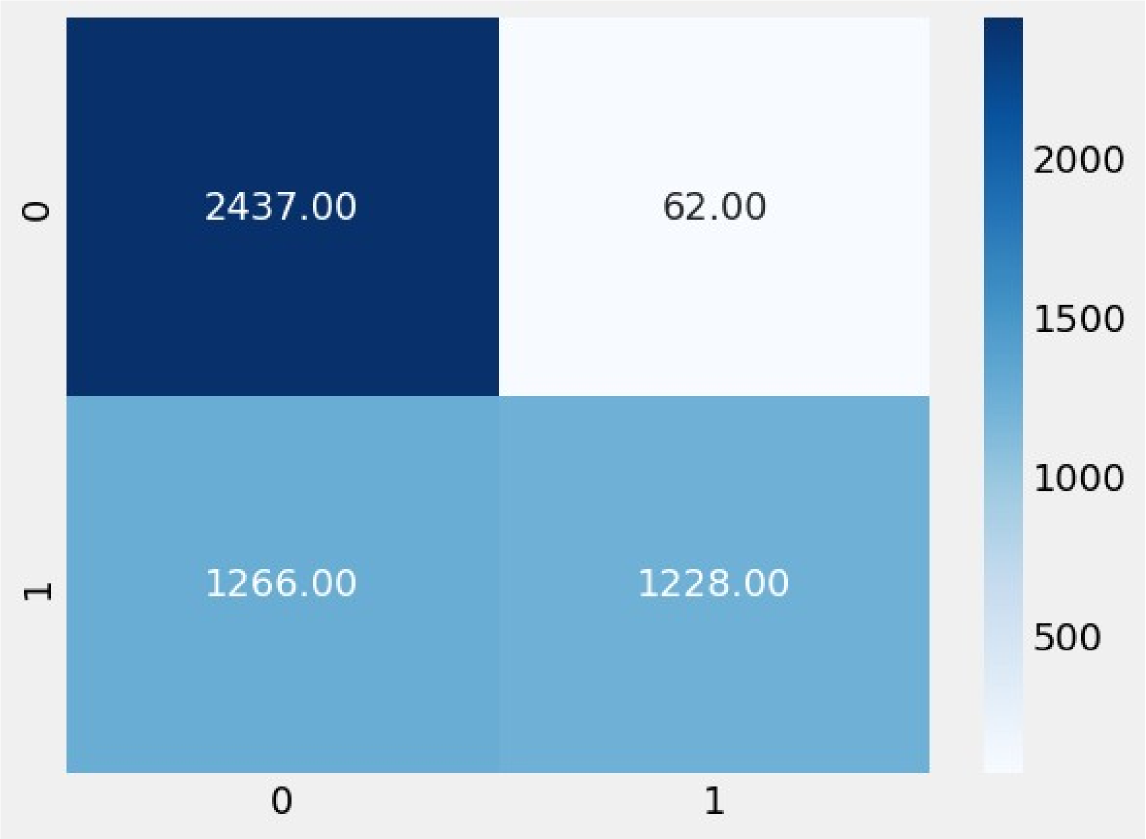
```
              precision    recall  f1-score   support

           0       0.66      0.98      0.79      2499
           1       0.95      0.49      0.65      2494

    accuracy                           0.73      4993
   macro avg       0.81      0.73      0.72      4993
weighted avg       0.80      0.73      0.72      4993
```

```
accuracy_score(test_gen.classes, y_pred)
```

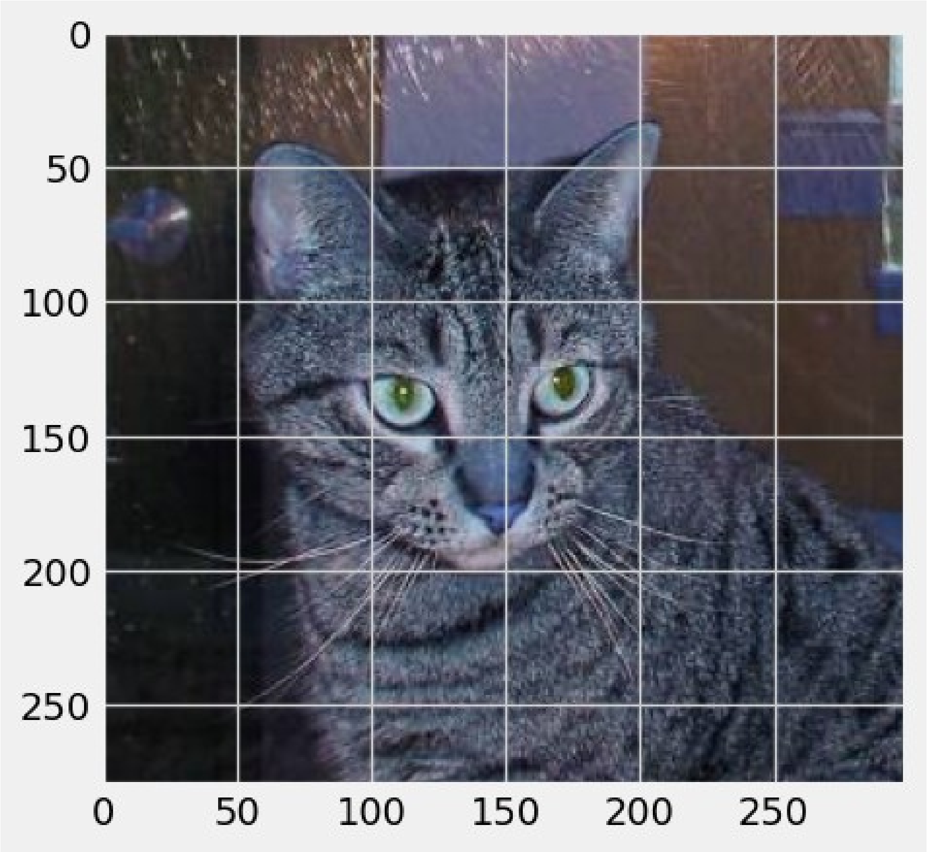
```
0.7340276386941719
```

```
sns.heatmap(confusion_matrix(test_gen.classes,y_pred), cmap='Blues',
annot=True, fmt='0.2f')
```

```
<Axes: >
```



```
model.save("model1.h5")

import cv2
def predict_image(model, img):
  img = cv2.imread(img)
  plt.imshow(img)
  plt.show()
  resize = tf.image.resize(img, (128,128))
  yhat = model.predict(np.expand_dims(resize/255, 0))
  max_index = np.argmax(yhat)
  op_d = {0:'Cat',1:'Dog'}
  print(op_d[max_index])

predict_image(model,'/kaggle/input/kaggle-cat-vs-dog-dataset/
kagglecatsanddogs_3367a/PetImages/Cat/1.jpg')
```



```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Cat

model = Sequential()

model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128,
3)))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(128, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(256, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Flatten())
model.add(Dense(512, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.25))
model.add(Dense(2, activation='softmax'))

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

```
Model: "sequential_9"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━
━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━
━━━━━┩
│ conv2d_16 (Conv2D)              │ (None, 126, 126, 32)   │
896 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_19          │ (None, 126, 126, 32)   │
128 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_15 (MaxPooling2D) │ (None, 63, 63, 32)     │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_18 (Dropout)            │ (None, 63, 63, 32)     │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ conv2d_17 (Conv2D)              │ (None, 61, 61, 64)     │
18,496 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_20          │ (None, 61, 61, 64)     │
256 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_16 (MaxPooling2D) │ (None, 30, 30, 64)     │
0 │
```

```
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_19 (Dropout)            │ (None, 30, 30, 64)     │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ conv2d_18 (Conv2D)              │ (None, 28, 28, 128)    │
73,856 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_21          │ (None, 28, 28, 128)    │
512 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_17 (MaxPooling2D) │ (None, 14, 14, 128)    │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_20 (Dropout)            │ (None, 14, 14, 128)    │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ conv2d_19 (Conv2D)              │ (None, 12, 12, 256)    │
295,168 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ batch_normalization_22          │ (None, 12, 12, 256)    │
1,024 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ max_pooling2d_18 (MaxPooling2D) │ (None, 6, 6, 256)      │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_21 (Dropout)            │ (None, 6, 6, 256)      │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ flatten_4 (Flatten)             │ (None, 9216)           │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_8 (Dense)                 │ (None, 512)            │
4,719,104 │
├─────────────────────────────────┼────────────────────────┼──────────
```

```
─────┤
│ batch_normalization_23          │ (None, 512)            │
2,048 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dropout_22 (Dropout)            │ (None, 512)            │
0 │
├─────────────────────────────────┼────────────────────────┼──────────
─────┤
│ dense_9 (Dense)                 │ (None, 2)              │
1,026 │
└─────────────────────────────────┴────────────────────────┴──────────
─────┘

 Total params: 5,112,514 (19.50 MB)

 Trainable params: 5,110,530 (19.50 MB)

 Non-trainable params: 1,984 (7.75 KB)
```

```
from time import time
s = time()
cb = myCallback()

history = model.fit(
    train_gen,
    epochs=60,
    batch_size=64,
    verbose=1,
    validation_data=valid_gen,
    callbacks=[cb]
)
et = time()
```

```
Epoch 1/60
386/468 ━━━━━━━━━━━━━━━━━━━━ 18s 231ms/step - accuracy: 0.5836 - loss:
0.8256

/opt/conda/lib/python3.10/site-packages/PIL/TiffImagePlugin.py:900:
UserWarning: Truncated File Read
  warnings.warn(str(msg))

468/468 ━━━━━━━━━━━━━━━━━━━━ 135s 257ms/step - accuracy: 0.5890 -
loss: 0.8076 - val_accuracy: 0.6009 - val_loss: 0.6916
Epoch 2/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 198ms/step - accuracy: 0.6639 - loss:
0.6260 - val_accuracy: 0.7187 - val_loss: 0.5450
Epoch 3/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 109s 229ms/step - accuracy: 0.6912 -
```

```
loss: 0.5833 - val_accuracy: 0.7337 - val_loss: 0.5381
Epoch 4/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 100s 211ms/step - accuracy: 0.7172 -
loss: 0.5442 - val_accuracy: 0.6826 - val_loss: 0.5936
Epoch 5/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 119s 251ms/step - accuracy: 0.7378 -
loss: 0.5237 - val_accuracy: 0.7824 - val_loss: 0.4591
Epoch 6/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 101s 212ms/step - accuracy: 0.7556 -
loss: 0.4992 - val_accuracy: 0.7912 - val_loss: 0.4512
Epoch 7/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 100s 211ms/step - accuracy: 0.7835 -
loss: 0.4611 - val_accuracy: 0.8159 - val_loss: 0.4143
Epoch 8/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 106s 223ms/step - accuracy: 0.7957 -
loss: 0.4352 - val_accuracy: 0.8431 - val_loss: 0.3828
Epoch 9/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 196ms/step - accuracy: 0.8094 - loss:
0.4066 - val_accuracy: 0.8439 - val_loss: 0.3482
Epoch 10/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 198ms/step - accuracy: 0.8144 - loss:
0.4048 - val_accuracy: 0.7560 - val_loss: 0.5386
Epoch 11/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 96s 202ms/step - accuracy: 0.8186 - loss:
0.3995 - val_accuracy: 0.6924 - val_loss: 1.0046
Epoch 12/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 95s 200ms/step - accuracy: 0.8272 - loss:
0.3753 - val_accuracy: 0.8339 - val_loss: 0.3790
Epoch 13/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 197ms/step - accuracy: 0.8416 - loss:
0.3564 - val_accuracy: 0.7722 - val_loss: 0.5435
Epoch 14/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 94s 199ms/step - accuracy: 0.8451 - loss:
0.3482 - val_accuracy: 0.8499 - val_loss: 0.3644
Epoch 15/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 196ms/step - accuracy: 0.8472 - loss:
0.3447 - val_accuracy: 0.7626 - val_loss: 0.6001
Epoch 16/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 104s 219ms/step - accuracy: 0.8535 -
loss: 0.3276 - val_accuracy: 0.8964 - val_loss: 0.2510
Epoch 17/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 122s 259ms/step - accuracy: 0.8558 -
loss: 0.3310 - val_accuracy: 0.8415 - val_loss: 0.3495
Epoch 18/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 97s 203ms/step - accuracy: 0.8545 - loss:
0.3201 - val_accuracy: 0.8750 - val_loss: 0.2851
Epoch 19/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 93s 197ms/step - accuracy: 0.8647 - loss:
0.3138 - val_accuracy: 0.8858 - val_loss: 0.2756
```

```
Epoch 20/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 102s 216ms/step - accuracy: 0.8664 -
loss: 0.3032 - val_accuracy: 0.7419 - val_loss: 0.5228
Epoch 21/60
468/468 ━━━━━━━━━━━━━━━━━━━━ 98s 207ms/step - accuracy: 0.8642 - loss:
0.3112 - val_accuracy: 0.8868 - val_loss: 0.2644
Epoch 22/60
467/468 ━━━━━━━━━━━━━━━━━━━━ 0s 186ms/step - accuracy: 0.8628 - loss:
0.3089
Reached 90% accuracy so cancelling training!
468/468 ━━━━━━━━━━━━━━━━━━━━ 116s 246ms/step - accuracy: 0.8628 -
loss: 0.3089 - val_accuracy: 0.9171 - val_loss: 0.2056
```

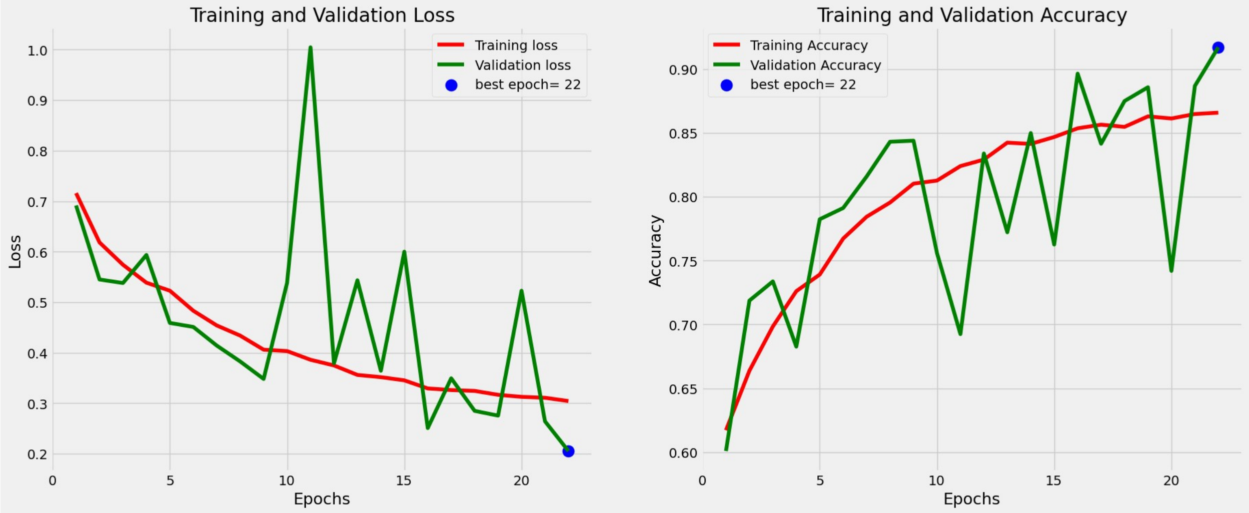
```
print(et-s)
```

```
2254.379696369171
```

```
scores = model.evaluate(test_gen)
```

```
157/157 ━━━━━━━━━━━━━━━━━━━━ 36s 229ms/step - accuracy: 0.9291 - loss:
0.1853
```

```
plot_history(history)
```



```
preds = model.predict(test_gen)
y_pred = np.argmax(preds, axis=1)
```

```
157/157 ━━━━━━━━━━━━━━━━━━━━ 11s 66ms/step
```

```
from sklearn.metrics import *
```

```
print(classification_report(test_gen.classes, y_pred))
```

```
              precision    recall  f1-score   support
```

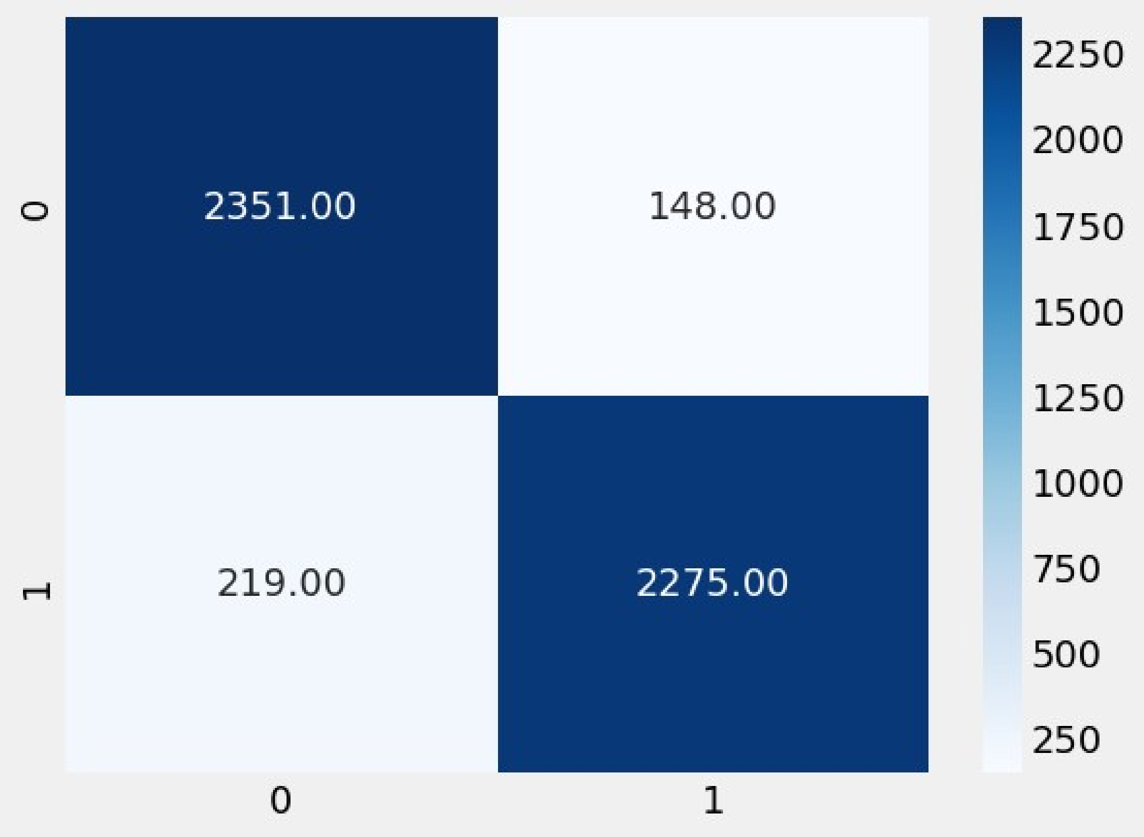
```
           0       0.91      0.94      0.93      2499
           1       0.94      0.91      0.93      2494

    accuracy                           0.93      4993
   macro avg       0.93      0.93      0.93      4993
weighted avg       0.93      0.93      0.93      4993
```

```
accuracy_score(test_gen.classes, y_pred)
```

```
0.9264970959343081
```

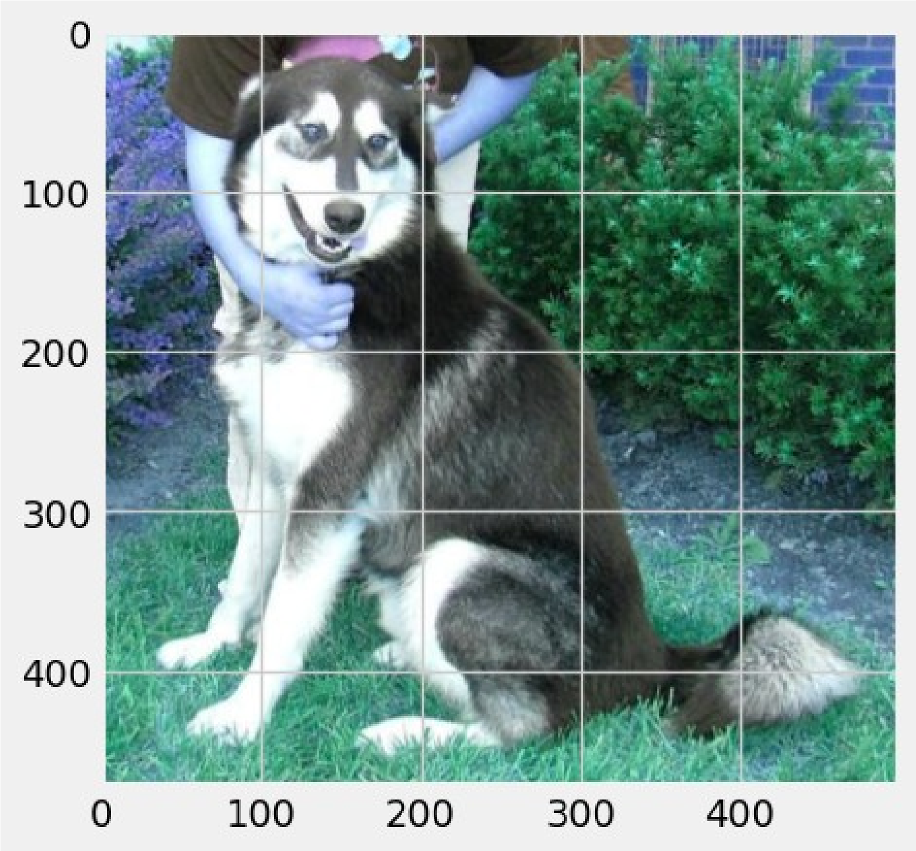
```
sns.heatmap(confusion_matrix(test_gen.classes,y_pred), cmap='Blues',
annot=True, fmt='0.2f')
```

```
<Axes: >
```



```
model.save("model2.h5")
```

```
predict_image(model,'/kaggle/input/kaggle-cat-vs-dog-dataset/
kagglecatsanddogs_3367a/PetImages/Dog/10021.jpg')
```



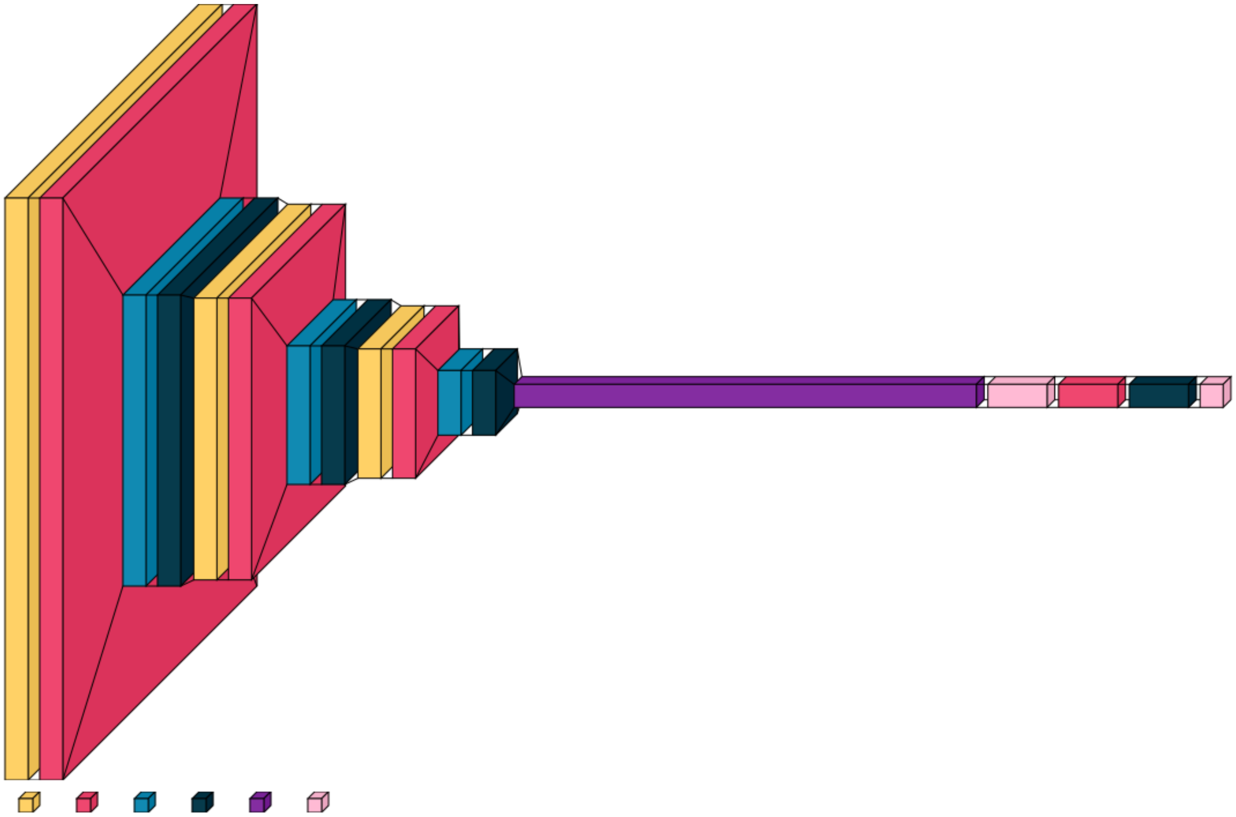
```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 360ms/step
Dog
```

```
!pip install visualkeras
```

```
/opt/conda/lib/python3.10/pty.py:89: RuntimeWarning: os.fork() was
called. os.fork() is incompatible with multithreaded code, and JAX is
multithreaded, so this will likely lead to a deadlock.
  pid, fd = os.forkpty()
```

```
Collecting visualkeras
  Downloading visualkeras-0.1.3-py3-none-any.whl.metadata (11 kB)
Requirement already satisfied: pillow>=6.2.0 in
/opt/conda/lib/python3.10/site-packages (from visualkeras) (10.3.0)
Requirement already satisfied: numpy>=1.18.1 in
/opt/conda/lib/python3.10/site-packages (from visualkeras) (1.26.4)
Collecting aggdraw>=1.3.11 (from visualkeras)
  Downloading aggdraw-1.3.19-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (655 bytes)
Downloading visualkeras-0.1.3-py3-none-any.whl (16 kB)
Downloading aggdraw-1.3.19-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (993 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 993.7/993.7 kB 21.3 MB/s eta
0:00:0000:01
```

```
import visualkeras

model1 = load_model('model1.h5')

visualkeras.layered_view(model1, legend=True)
```



```
model2 = load_model('model2.h5')

from collections import defaultdict

color_map = defaultdict(dict)
color_map[Conv2D]['fill'] = 'orange'
color_map[ZeroPadding2D]['fill'] = 'gray'
color_map[Dropout]['fill'] = 'pink'
color_map[MaxPooling2D]['fill'] = 'red'
color_map[Dense]['fill'] = 'green'
color_map[Flatten]['fill'] = 'teal'

visualkeras.layered_view(model2,legend=True, color_map=color_map)
```