In [24]:

```python
# Não exibir warnings
import os
import sys
sys.stderr = open(os.devnull, "w")  # silence stderr
sys.stderr = sys.__stderr__   # unsilence stderr
```

In [25]:

```python
#https://github.com/PacktPublishing/Neural-Network-Projects-with-Python/blob/master/Chapter04/main_vgg16.py

from keras.applications.vgg16 import VGG16
from keras.models import Model

from keras.models import Sequential
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
from keras.layers import Dense
import matplotlib.pyplot as plt
from sklearn.metrics import classification_report, confusion_matrix
import tensorflow as tf
import numpy as np
import pandas as pd
import seaborn as sns


from PIL import Image, ImageFile
ImageFile.LOAD_TRUNCATED_IMAGES = True
```

In [26]:

```python
# load and evaluate a saved model
from numpy import loadtxt
from keras.models import load_model

# load model
model = load_model('modelo_classificador_A_InceptionV3_novo.h5')
# summarize model.
model.summary()
```

```
WARNING:tensorflow:From D:\Usuarios\spi112884\Anaconda3\lib\site-packages
\keras\backend\tensorflow_backend.py:4074: The name tf.nn.avg_pool is depr
ecated. Please use tf.nn.avg_pool2d instead.
```

Model: "model_1"
_____
_____
Layer (type)   Output Shape   Param #   Connected
to
==
============================
input_1 (InputLayer)   (None, 128, 128, 3)   0
_____
_____
conv2d_1 (Conv2D)   (None, 63, 63, 32)   864   input_1
[0][0]
_____
_____
batch_normalization_1 (BatchNor (None, 63, 63, 32) 96   conv2d_1
[0][0]
_____
_____
activation_1 (Activation)   (None, 63, 63, 32)   0   batch_nor
malization_1[0][0]
_____
_____
conv2d_2 (Conv2D)   (None, 61, 61, 32)   9216   activatio
n_1[0][0]
_____
_____
batch_normalization_2 (BatchNor (None, 61, 61, 32) 96   conv2d_2
[0][0]
_____
_____
activation_2 (Activation)   (None, 61, 61, 32)   0   batch_nor
malization_2[0][0]
_____
_____
conv2d_3 (Conv2D)   (None, 61, 61, 64)   18432   activatio
n_2[0][0]
_____
_____
batch_normalization_3 (BatchNor (None, 61, 61, 64) 192   conv2d_3
[0][0]
_____
_____
activation_3 (Activation)   (None, 61, 61, 64)   0   batch_nor
malization_3[0][0]
_____
_____
max_pooling2d_1 (MaxPooling2D) (None, 30, 30, 64) 0   activatio
n_3[0][0]
_____
_____
conv2d_4 (Conv2D)   (None, 30, 30, 80)   5120   max_pooli
ng2d_1[0][0]
_____
_____
batch_normalization_4 (BatchNor (None, 30, 30, 80) 240   conv2d_4
[0][0]
_____
_____
```

```
_____
activation_4 (Activation)        (None, 30, 30, 80)    0            batch_nor
malization_4[0][0]
_____
conv2d_5 (Conv2D)                (None, 28, 28, 192)   138240       activatio
n_4[0][0]
_____
batch_normalization_5 (BatchNor  (None, 28, 28, 192)   576          conv2d_5
[0][0]
_____
activation_5 (Activation)        (None, 28, 28, 192)   0            batch_nor
malization_5[0][0]
_____
max_pooling2d_2 (MaxPooling2D)   (None, 13, 13, 192)   0            activatio
n_5[0][0]
_____
conv2d_9 (Conv2D)                (None, 13, 13, 64)    12288        max_pooli
ng2d_2[0][0]
_____
batch_normalization_9 (BatchNor  (None, 13, 13, 64)    192          conv2d_9
[0][0]
_____
activation_9 (Activation)        (None, 13, 13, 64)    0            batch_nor
malization_9[0][0]
_____
conv2d_7 (Conv2D)                (None, 13, 13, 48)    9216         max_pooli
ng2d_2[0][0]
_____
conv2d_10 (Conv2D)               (None, 13, 13, 96)    55296        activatio
n_9[0][0]
_____
batch_normalization_7 (BatchNor  (None, 13, 13, 48)    144          conv2d_7
[0][0]
_____
batch_normalization_10 (BatchNo  (None, 13, 13, 96)    288          conv2d_10
[0][0]
_____
activation_7 (Activation)        (None, 13, 13, 48)    0            batch_nor
malization_7[0][0]
_____
activation_10 (Activation)       (None, 13, 13, 96)    0            batch_nor
malization_10[0][0]
_____
average_pooling2d_1 (AveragePoo  (None, 13, 13, 192)   0            max_pooli
ng2d_2[0][0]
_____
```

Layer	Output Shape	Param #	Connected to
conv2d_6 (Conv2D)	(None, 13, 13, 64)	12288	max_pooling2d_2[0][0]
conv2d_8 (Conv2D)	(None, 13, 13, 64)	76800	activation_7[0][0]
conv2d_11 (Conv2D)	(None, 13, 13, 96)	82944	activation_10[0][0]
conv2d_12 (Conv2D)	(None, 13, 13, 32)	6144	average_pooling2d_1[0][0]
batch_normalization_6 (BatchNor	(None, 13, 13, 64)	192	conv2d_6[0][0]
batch_normalization_8 (BatchNor	(None, 13, 13, 64)	192	conv2d_8[0][0]
batch_normalization_11 (BatchNo	(None, 13, 13, 96)	288	conv2d_11[0][0]
batch_normalization_12 (BatchNo	(None, 13, 13, 32)	96	conv2d_12[0][0]
activation_6 (Activation)	(None, 13, 13, 64)	0	batch_normalization_6[0][0]
activation_8 (Activation)	(None, 13, 13, 64)	0	batch_normalization_8[0][0]
activation_11 (Activation)	(None, 13, 13, 96)	0	batch_normalization_11[0][0]
activation_12 (Activation)	(None, 13, 13, 32)	0	batch_normalization_12[0][0]
mixed0 (Concatenate)	(None, 13, 13, 256)	0	activation_6[0][0] activation_8[0][0] activation_11[0][0] activation_12[0][0]
conv2d_16 (Conv2D)	(None, 13, 13, 64)	16384	mixed0[0][0]

```
_____
batch_normalization_16 (BatchNo   (None, 13, 13, 64)    192      conv2d_16
[0][0]
_____
_____
activation_16 (Activation)        (None, 13, 13, 64)    0        batch_nor
malization_16[0][0]
_____
_____
conv2d_14 (Conv2D)                (None, 13, 13, 48)    12288    mixed0[0]
[0]
_____
_____
conv2d_17 (Conv2D)                (None, 13, 13, 96)    55296    activatio
n_16[0][0]
_____
_____
batch_normalization_14 (BatchNo   (None, 13, 13, 48)    144      conv2d_14
[0][0]
_____
_____
batch_normalization_17 (BatchNo   (None, 13, 13, 96)    288      conv2d_17
[0][0]
_____
_____
activation_14 (Activation)        (None, 13, 13, 48)    0        batch_nor
malization_14[0][0]
_____
_____
activation_17 (Activation)        (None, 13, 13, 96)    0        batch_nor
malization_17[0][0]
_____
_____
average_pooling2d_2 (AveragePoo   (None, 13, 13, 256)   0        mixed0[0]
[0]
_____
_____
conv2d_13 (Conv2D)                (None, 13, 13, 64)    16384    mixed0[0]
[0]
_____
_____
conv2d_15 (Conv2D)                (None, 13, 13, 64)    76800    activatio
n_14[0][0]
_____
_____
conv2d_18 (Conv2D)                (None, 13, 13, 96)    82944    activatio
n_17[0][0]
_____
_____
conv2d_19 (Conv2D)                (None, 13, 13, 64)    16384    average_p
ooling2d_2[0][0]
_____
_____
batch_normalization_13 (BatchNo   (None, 13, 13, 64)    192      conv2d_13
[0][0]
_____
_____
batch_normalization_15 (BatchNo   (None, 13, 13, 64)    192      conv2d_15
[0][0]
_____
_____
```

batch_normalization_18 (BatchNo [0][0]	(None, 13, 13, 96)	288	conv2d_18
batch_normalization_19 (BatchNo [0][0]	(None, 13, 13, 64)	192	conv2d_19
activation_13 (Activation) malization_13[0][0]	(None, 13, 13, 64)	0	batch_nor
activation_15 (Activation) malization_15[0][0]	(None, 13, 13, 64)	0	batch_nor
activation_18 (Activation) malization_18[0][0]	(None, 13, 13, 96)	0	batch_nor
activation_19 (Activation) malization_19[0][0]	(None, 13, 13, 64)	0	batch_nor
mixed1 (Concatenate) n_13[0][0] n_15[0][0] n_18[0][0] n_19[0][0]	(None, 13, 13, 288)	0	activatio activatio activatio activatio
conv2d_23 (Conv2D) [0]	(None, 13, 13, 64)	18432	mixed1[0]
batch_normalization_23 (BatchNo [0][0]	(None, 13, 13, 64)	192	conv2d_23
activation_23 (Activation) malization_23[0][0]	(None, 13, 13, 64)	0	batch_nor
conv2d_21 (Conv2D) [0]	(None, 13, 13, 48)	13824	mixed1[0]
conv2d_24 (Conv2D) n_23[0][0]	(None, 13, 13, 96)	55296	activatio
batch_normalization_21 (BatchNo [0][0]	(None, 13, 13, 48)	144	conv2d_21
batch_normalization_24 (BatchNo [0][0]	(None, 13, 13, 96)	288	conv2d_24

_____

Layer	Output Shape	Param #	Connected to
activation_21 (Activation)	(None, 13, 13, 48)	0	batch_nor malization_21[0][0]
activation_24 (Activation)	(None, 13, 13, 96)	0	batch_nor malization_24[0][0]
average_pooling2d_3 (AveragePoo	(None, 13, 13, 288)	0	mixed1[0] [0]
conv2d_20 (Conv2D)	(None, 13, 13, 64)	18432	mixed1[0] [0]
conv2d_22 (Conv2D)	(None, 13, 13, 64)	76800	activatio n_21[0][0]
conv2d_25 (Conv2D)	(None, 13, 13, 96)	82944	activatio n_24[0][0]
conv2d_26 (Conv2D)	(None, 13, 13, 64)	18432	average_p ooling2d_3[0][0]
batch_normalization_20 (BatchNo	(None, 13, 13, 64)	192	conv2d_20 [0][0]
batch_normalization_22 (BatchNo	(None, 13, 13, 64)	192	conv2d_22 [0][0]
batch_normalization_25 (BatchNo	(None, 13, 13, 96)	288	conv2d_25 [0][0]
batch_normalization_26 (BatchNo	(None, 13, 13, 64)	192	conv2d_26 [0][0]
activation_20 (Activation)	(None, 13, 13, 64)	0	batch_nor malization_20[0][0]
activation_22 (Activation)	(None, 13, 13, 64)	0	batch_nor malization_22[0][0]
activation_25 (Activation)	(None, 13, 13, 96)	0	batch_nor malization_25[0][0]
activation_26 (Activation)	(None, 13, 13, 64)	0	batch_nor malization_26[0][0]

_____

mixed2 (Concatenate)	(None, 13, 13, 288)	0	activatio
n_20[0][0]			
			activatio
n_22[0][0]			
			activatio
n_25[0][0]			
			activatio
n_26[0][0]			
conv2d_28 (Conv2D)	(None, 13, 13, 64)	18432	mixed2[0]
[0]			
batch_normalization_28 (BatchNo	(None, 13, 13, 64)	192	conv2d_28
[0][0]			
activation_28 (Activation)	(None, 13, 13, 64)	0	batch_nor
malization_28[0][0]			
conv2d_29 (Conv2D)	(None, 13, 13, 96)	55296	activatio
n_28[0][0]			
batch_normalization_29 (BatchNo	(None, 13, 13, 96)	288	conv2d_29
[0][0]			
activation_29 (Activation)	(None, 13, 13, 96)	0	batch_nor
malization_29[0][0]			
conv2d_27 (Conv2D)	(None, 6, 6, 384)	995328	mixed2[0]
[0]			
conv2d_30 (Conv2D)	(None, 6, 6, 96)	82944	activatio
n_29[0][0]			
batch_normalization_27 (BatchNo	(None, 6, 6, 384)	1152	conv2d_27
[0][0]			
batch_normalization_30 (BatchNo	(None, 6, 6, 96)	288	conv2d_30
[0][0]			
activation_27 (Activation)	(None, 6, 6, 384)	0	batch_nor
malization_27[0][0]			
activation_30 (Activation)	(None, 6, 6, 96)	0	batch_nor
malization_30[0][0]			
max_pooling2d_3 (MaxPooling2D)	(None, 6, 6, 288)	0	mixed2[0]
[0]			

mixed3 (Concatenate)	(None, 6, 6, 768)	0	activatio
n_27[0][0]			
			activatio
n_30[0][0]			
			max_pooli
ng2d_3[0][0]			

conv2d_35 (Conv2D)	(None, 6, 6, 128)	98304	mixed3[0]
[0]			

batch_normalization_35 (BatchNo	(None, 6, 6, 128)	384	conv2d_35
[0][0]			

activation_35 (Activation)	(None, 6, 6, 128)	0	batch_nor
malization_35[0][0]			

conv2d_36 (Conv2D)	(None, 6, 6, 128)	114688	activatio
n_35[0][0]			

batch_normalization_36 (BatchNo	(None, 6, 6, 128)	384	conv2d_36
[0][0]			

activation_36 (Activation)	(None, 6, 6, 128)	0	batch_nor
malization_36[0][0]			

conv2d_32 (Conv2D)	(None, 6, 6, 128)	98304	mixed3[0]
[0]			

conv2d_37 (Conv2D)	(None, 6, 6, 128)	114688	activatio
n_36[0][0]			

batch_normalization_32 (BatchNo	(None, 6, 6, 128)	384	conv2d_32
[0][0]			

batch_normalization_37 (BatchNo	(None, 6, 6, 128)	384	conv2d_37
[0][0]			

activation_32 (Activation)	(None, 6, 6, 128)	0	batch_nor
malization_32[0][0]			

activation_37 (Activation)	(None, 6, 6, 128)	0	batch_nor
malization_37[0][0]			

conv2d_33 (Conv2D)	(None, 6, 6, 128)	114688	activatio
n_32[0][0]			

Layer	Output Shape	Param #	Connected to
conv2d_38 (Conv2D)	(None, 6, 6, 128)	114688	activation_37[0][0]
batch_normalization_33 (BatchNo	(None, 6, 6, 128)	384	conv2d_33[0][0]
batch_normalization_38 (BatchNo	(None, 6, 6, 128)	384	conv2d_38[0][0]
activation_33 (Activation)	(None, 6, 6, 128)	0	batch_normalization_33[0][0]
activation_38 (Activation)	(None, 6, 6, 128)	0	batch_normalization_38[0][0]
average_pooling2d_4 (AveragePoo	(None, 6, 6, 768)	0	mixed3[0][0]
conv2d_31 (Conv2D)	(None, 6, 6, 192)	147456	mixed3[0][0]
conv2d_34 (Conv2D)	(None, 6, 6, 192)	172032	activation_33[0][0]
conv2d_39 (Conv2D)	(None, 6, 6, 192)	172032	activation_38[0][0]
conv2d_40 (Conv2D)	(None, 6, 6, 192)	147456	average_pooling2d_4[0][0]
batch_normalization_31 (BatchNo	(None, 6, 6, 192)	576	conv2d_31[0][0]
batch_normalization_34 (BatchNo	(None, 6, 6, 192)	576	conv2d_34[0][0]
batch_normalization_39 (BatchNo	(None, 6, 6, 192)	576	conv2d_39[0][0]
batch_normalization_40 (BatchNo	(None, 6, 6, 192)	576	conv2d_40[0][0]
activation_31 (Activation)	(None, 6, 6, 192)	0	batch_normalization_31[0][0]
activation_34 (Activation)	(None, 6, 6, 192)	0	batch_normalization_

malization_34[0][0]

_____

_____
activation_39 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_39[0][0]

_____

_____
activation_40 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_40[0][0]

_____

_____
mixed4 (Concatenate)   (None, 6, 6, 768)   0   activatio
n_31[0][0]

                                                            activatio
n_34[0][0]

                                                            activatio
n_39[0][0]

                                                            activatio
n_40[0][0]

_____

_____
conv2d_45 (Conv2D)   (None, 6, 6, 160)   122880   mixed4[0]
[0]

_____

_____
batch_normalization_45 (BatchNo (None, 6, 6, 160) 480   conv2d_45
[0][0]

_____

_____
activation_45 (Activation)   (None, 6, 6, 160)   0   batch_nor
malization_45[0][0]

_____

_____
conv2d_46 (Conv2D)   (None, 6, 6, 160)   179200   activatio
n_45[0][0]

_____

_____
batch_normalization_46 (BatchNo (None, 6, 6, 160) 480   conv2d_46
[0][0]

_____

_____
activation_46 (Activation)   (None, 6, 6, 160)   0   batch_nor
malization_46[0][0]

_____

_____
conv2d_42 (Conv2D)   (None, 6, 6, 160)   122880   mixed4[0]
[0]

_____

_____
conv2d_47 (Conv2D)   (None, 6, 6, 160)   179200   activatio
n_46[0][0]

_____

_____
batch_normalization_42 (BatchNo (None, 6, 6, 160) 480   conv2d_42
[0][0]

_____

_____
batch_normalization_47 (BatchNo (None, 6, 6, 160) 480   conv2d_47
[0][0]

_____

_____

activation_42 (Activation)	(None, 6, 6, 160)	0	batch_nor	
malization_42[0][0]				

activation_47 (Activation)	(None, 6, 6, 160)	0	batch_nor	
malization_47[0][0]				

conv2d_43 (Conv2D)	(None, 6, 6, 160)	179200	activatio	
n_42[0][0]				

conv2d_48 (Conv2D)	(None, 6, 6, 160)	179200	activatio	
n_47[0][0]				

batch_normalization_43 (BatchNo	(None, 6, 6, 160)	480	conv2d_43	
[0][0]				

batch_normalization_48 (BatchNo	(None, 6, 6, 160)	480	conv2d_48	
[0][0]				

activation_43 (Activation)	(None, 6, 6, 160)	0	batch_nor	
malization_43[0][0]				

activation_48 (Activation)	(None, 6, 6, 160)	0	batch_nor	
malization_48[0][0]				

average_pooling2d_5 (AveragePoo	(None, 6, 6, 768)	0	mixed4[0]	
[0]				

conv2d_41 (Conv2D)	(None, 6, 6, 192)	147456	mixed4[0]	
[0]				

conv2d_44 (Conv2D)	(None, 6, 6, 192)	215040	activatio	
n_43[0][0]				

conv2d_49 (Conv2D)	(None, 6, 6, 192)	215040	activatio	
n_48[0][0]				

conv2d_50 (Conv2D)	(None, 6, 6, 192)	147456	average_p	
ooling2d_5[0][0]				

batch_normalization_41 (BatchNo	(None, 6, 6, 192)	576	conv2d_41	
[0][0]				

batch_normalization_44 (BatchNo	(None, 6, 6, 192)	576	conv2d_44	
[0][0]				

batch_normalization_49 (BatchNo	(None, 6, 6, 192)	576	conv2d_49	

```
                                                                [0][0]
_____
_____
batch_normalization_50 (BatchNo (None, 6, 6, 192)    576         conv2d_50
[0][0]
_____
_____
activation_41 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_41[0][0]
_____
_____
activation_44 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_44[0][0]
_____
_____
activation_49 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_49[0][0]
_____
_____
activation_50 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_50[0][0]
_____
_____
mixed5 (Concatenate)            (None, 6, 6, 768)    0           activatio
n_41[0][0]
                                                                activatio
n_44[0][0]
                                                                activatio
n_49[0][0]
                                                                activatio
n_50[0][0]
_____
_____
conv2d_55 (Conv2D)              (None, 6, 6, 160)    122880      mixed5[0]
[0]
_____
_____
batch_normalization_55 (BatchNo (None, 6, 6, 160)    480         conv2d_55
[0][0]
_____
_____
activation_55 (Activation)      (None, 6, 6, 160)    0           batch_nor
malization_55[0][0]
_____
_____
conv2d_56 (Conv2D)              (None, 6, 6, 160)    179200      activatio
n_55[0][0]
_____
_____
batch_normalization_56 (BatchNo (None, 6, 6, 160)    480         conv2d_56
[0][0]
_____
_____
activation_56 (Activation)      (None, 6, 6, 160)    0           batch_nor
malization_56[0][0]
_____
_____
conv2d_52 (Conv2D)              (None, 6, 6, 160)    122880      mixed5[0]
[0]
_____
_____
```

conv2d_57 (Conv2D)	(None, 6, 6, 160)	179200	activatio n_56[0][0]
batch_normalization_52 (BatchNo	(None, 6, 6, 160)	480	conv2d_52 [0][0]
batch_normalization_57 (BatchNo	(None, 6, 6, 160)	480	conv2d_57 [0][0]
activation_52 (Activation)	(None, 6, 6, 160)	0	batch_nor malization_52[0][0]
activation_57 (Activation)	(None, 6, 6, 160)	0	batch_nor malization_57[0][0]
conv2d_53 (Conv2D)	(None, 6, 6, 160)	179200	activatio n_52[0][0]
conv2d_58 (Conv2D)	(None, 6, 6, 160)	179200	activatio n_57[0][0]
batch_normalization_53 (BatchNo	(None, 6, 6, 160)	480	conv2d_53 [0][0]
batch_normalization_58 (BatchNo	(None, 6, 6, 160)	480	conv2d_58 [0][0]
activation_53 (Activation)	(None, 6, 6, 160)	0	batch_nor malization_53[0][0]
activation_58 (Activation)	(None, 6, 6, 160)	0	batch_nor malization_58[0][0]
average_pooling2d_6 (AveragePoo	(None, 6, 6, 768)	0	mixed5[0] [0]
conv2d_51 (Conv2D)	(None, 6, 6, 192)	147456	mixed5[0] [0]
conv2d_54 (Conv2D)	(None, 6, 6, 192)	215040	activatio n_53[0][0]
conv2d_59 (Conv2D)	(None, 6, 6, 192)	215040	activatio n_58[0][0]
conv2d_60 (Conv2D)	(None, 6, 6, 192)	147456	average_p

ooling2d_6[0][0]

_____

_____

batch_normalization_51 (BatchNo (None, 6, 6, 192)   576   conv2d_51
[0][0]

_____

_____

batch_normalization_54 (BatchNo (None, 6, 6, 192)   576   conv2d_54
[0][0]

_____

_____

batch_normalization_59 (BatchNo (None, 6, 6, 192)   576   conv2d_59
[0][0]

_____

_____

batch_normalization_60 (BatchNo (None, 6, 6, 192)   576   conv2d_60
[0][0]

_____

_____

activation_51 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_51[0][0]

_____

_____

activation_54 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_54[0][0]

_____

_____

activation_59 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_59[0][0]

_____

_____

activation_60 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_60[0][0]

_____

_____

mixed6 (Concatenate)   (None, 6, 6, 768)   0   activatio
n_51[0][0]

                                                                 activatio
n_54[0][0]

                                                                 activatio
n_59[0][0]

                                                                 activatio
n_60[0][0]

_____

_____

conv2d_65 (Conv2D)   (None, 6, 6, 192)   147456   mixed6[0]
[0]

_____

_____

batch_normalization_65 (BatchNo (None, 6, 6, 192)   576   conv2d_65
[0][0]

_____

_____

activation_65 (Activation)   (None, 6, 6, 192)   0   batch_nor
malization_65[0][0]

_____

_____

conv2d_66 (Conv2D)   (None, 6, 6, 192)   258048   activatio
n_65[0][0]

_____

_____

batch_normalization_66 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_66
activation_66 (Activation) malization_66[0][0]	(None, 6, 6, 192)	0	batch_nor
conv2d_62 (Conv2D) [0]	(None, 6, 6, 192)	147456	mixed6[0]
conv2d_67 (Conv2D) n_66[0][0]	(None, 6, 6, 192)	258048	activatio
batch_normalization_62 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_62
batch_normalization_67 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_67
activation_62 (Activation) malization_62[0][0]	(None, 6, 6, 192)	0	batch_nor
activation_67 (Activation) malization_67[0][0]	(None, 6, 6, 192)	0	batch_nor
conv2d_63 (Conv2D) n_62[0][0]	(None, 6, 6, 192)	258048	activatio
conv2d_68 (Conv2D) n_67[0][0]	(None, 6, 6, 192)	258048	activatio
batch_normalization_63 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_63
batch_normalization_68 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_68
activation_63 (Activation) malization_63[0][0]	(None, 6, 6, 192)	0	batch_nor
activation_68 (Activation) malization_68[0][0]	(None, 6, 6, 192)	0	batch_nor
average_pooling2d_7 (AveragePoo [0]	(None, 6, 6, 768)	0	mixed6[0]
conv2d_61 (Conv2D)	(None, 6, 6, 192)	147456	mixed6[0]

```
                    [0]
_____

_____
conv2d_64 (Conv2D)              (None, 6, 6, 192)    258048      activatio
n_63[0][0]
_____

_____
conv2d_69 (Conv2D)              (None, 6, 6, 192)    258048      activatio
n_68[0][0]
_____

_____
conv2d_70 (Conv2D)              (None, 6, 6, 192)    147456      average_p
ooling2d_7[0][0]
_____

_____
batch_normalization_61 (BatchNo (None, 6, 6, 192)    576         conv2d_61
[0][0]
_____

_____
batch_normalization_64 (BatchNo (None, 6, 6, 192)    576         conv2d_64
[0][0]
_____

_____
batch_normalization_69 (BatchNo (None, 6, 6, 192)    576         conv2d_69
[0][0]
_____

_____
batch_normalization_70 (BatchNo (None, 6, 6, 192)    576         conv2d_70
[0][0]
_____

_____
activation_61 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_61[0][0]
_____

_____
activation_64 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_64[0][0]
_____

_____
activation_69 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_69[0][0]
_____

_____
activation_70 (Activation)      (None, 6, 6, 192)    0           batch_nor
malization_70[0][0]
_____

_____
mixed7 (Concatenate)            (None, 6, 6, 768)    0           activatio
n_61[0][0]
                                                                 activatio
n_64[0][0]
                                                                 activatio
n_69[0][0]
                                                                 activatio
n_70[0][0]
_____

_____
conv2d_73 (Conv2D)              (None, 6, 6, 192)    147456      mixed7[0]
[0]
_____

_____
```

Layer (type)	Output Shape	Param #	Connected to
batch_normalization_73 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_73
activation_73 (Activation) malization_73[0][0]	(None, 6, 6, 192)	0	batch_nor
conv2d_74 (Conv2D) n_73[0][0]	(None, 6, 6, 192)	258048	activatio
batch_normalization_74 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_74
activation_74 (Activation) malization_74[0][0]	(None, 6, 6, 192)	0	batch_nor
conv2d_71 (Conv2D) [0]	(None, 6, 6, 192)	147456	mixed7[0]
conv2d_75 (Conv2D) n_74[0][0]	(None, 6, 6, 192)	258048	activatio
batch_normalization_71 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_71
batch_normalization_75 (BatchNo [0][0]	(None, 6, 6, 192)	576	conv2d_75
activation_71 (Activation) malization_71[0][0]	(None, 6, 6, 192)	0	batch_nor
activation_75 (Activation) malization_75[0][0]	(None, 6, 6, 192)	0	batch_nor
conv2d_72 (Conv2D) n_71[0][0]	(None, 2, 2, 320)	552960	activatio
conv2d_76 (Conv2D) n_75[0][0]	(None, 2, 2, 192)	331776	activatio
batch_normalization_72 (BatchNo [0][0]	(None, 2, 2, 320)	960	conv2d_72
batch_normalization_76 (BatchNo [0][0]	(None, 2, 2, 192)	576	conv2d_76
activation_72 (Activation)	(None, 2, 2, 320)	0	batch_nor

malization_72[0][0]

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_____
activation_76 (Activation)   (None, 2, 2, 192)   0   batch_nor
malization_76[0][0]

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_____
max_pooling2d_4 (MaxPooling2D) (None, 2, 2, 768)   0   mixed7[0]
[0]

_____

_____
mixed8 (Concatenate)   (None, 2, 2, 1280)   0   activatio
n_72[0][0]

                                                                 activatio
n_76[0][0]

                                                                 max_pooli
ng2d_4[0][0]

_____

_____
conv2d_81 (Conv2D)   (None, 2, 2, 448)   573440   mixed8[0]
[0]

_____

_____
batch_normalization_81 (BatchNo (None, 2, 2, 448)   1344   conv2d_81
[0][0]

_____

_____
activation_81 (Activation)   (None, 2, 2, 448)   0   batch_nor
malization_81[0][0]

_____

_____
conv2d_78 (Conv2D)   (None, 2, 2, 384)   491520   mixed8[0]
[0]

_____

_____
conv2d_82 (Conv2D)   (None, 2, 2, 384)   1548288   activatio
n_81[0][0]

_____

_____
batch_normalization_78 (BatchNo (None, 2, 2, 384)   1152   conv2d_78
[0][0]

_____

_____
batch_normalization_82 (BatchNo (None, 2, 2, 384)   1152   conv2d_82
[0][0]

_____

_____
activation_78 (Activation)   (None, 2, 2, 384)   0   batch_nor
malization_78[0][0]

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_____
activation_82 (Activation)   (None, 2, 2, 384)   0   batch_nor
malization_82[0][0]

_____

_____
conv2d_79 (Conv2D)   (None, 2, 2, 384)   442368   activatio
n_78[0][0]

_____

_____
conv2d_80 (Conv2D)   (None, 2, 2, 384)   442368   activatio
n_78[0][0]

conv2d_83 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_82[0][0]
conv2d_84 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_82[0][0]
average_pooling2d_8 (AveragePoo	(None, 2, 2, 1280)	0	mixed8[0] [0]
conv2d_77 (Conv2D)	(None, 2, 2, 320)	409600	mixed8[0] [0]
batch_normalization_79 (BatchNo	(None, 2, 2, 384)	1152	conv2d_79 [0][0]
batch_normalization_80 (BatchNo	(None, 2, 2, 384)	1152	conv2d_80 [0][0]
batch_normalization_83 (BatchNo	(None, 2, 2, 384)	1152	conv2d_83 [0][0]
batch_normalization_84 (BatchNo	(None, 2, 2, 384)	1152	conv2d_84 [0][0]
conv2d_85 (Conv2D)	(None, 2, 2, 192)	245760	average_p ooling2d_8[0][0]
batch_normalization_77 (BatchNo	(None, 2, 2, 320)	960	conv2d_77 [0][0]
activation_79 (Activation)	(None, 2, 2, 384)	0	batch_nor malization_79[0][0]
activation_80 (Activation)	(None, 2, 2, 384)	0	batch_nor malization_80[0][0]
activation_83 (Activation)	(None, 2, 2, 384)	0	batch_nor malization_83[0][0]
activation_84 (Activation)	(None, 2, 2, 384)	0	batch_nor malization_84[0][0]
batch_normalization_85 (BatchNo	(None, 2, 2, 192)	576	conv2d_85 [0][0]

_____

| activation_77 (Activation) | (None, 2, 2, 320) | 0 | batch_nor |
| malization_77[0][0] | | | |

_____

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mixed9_0 (Concatenate)	(None, 2, 2, 768)	0	activatio
n_79[0][0]			
			activatio
n_80[0][0]			

_____

_____

concatenate_1 (Concatenate)	(None, 2, 2, 768)	0	activatio
n_83[0][0]			
			activatio
n_84[0][0]			

_____

_____

| activation_85 (Activation) | (None, 2, 2, 192) | 0 | batch_nor |
| malization_85[0][0] | | | |

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_____

mixed9 (Concatenate)	(None, 2, 2, 2048)	0	activatio
n_77[0][0]			
[0][0]			mixed9_0
			concatena
te_1[0][0]			
			activatio
n_85[0][0]			

_____

_____

| conv2d_90 (Conv2D) | (None, 2, 2, 448) | 917504 | mixed9[0] |
| [0] | | | |

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| batch_normalization_90 (BatchNo | (None, 2, 2, 448) | 1344 | conv2d_90 |
| [0][0] | | | |

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_____

| activation_90 (Activation) | (None, 2, 2, 448) | 0 | batch_nor |
| malization_90[0][0] | | | |

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| conv2d_87 (Conv2D) | (None, 2, 2, 384) | 786432 | mixed9[0] |
| [0] | | | |

_____

_____

| conv2d_91 (Conv2D) | (None, 2, 2, 384) | 1548288 | activatio |
| n_90[0][0] | | | |

_____

_____

| batch_normalization_87 (BatchNo | (None, 2, 2, 384) | 1152 | conv2d_87 |
| [0][0] | | | |

_____

_____

| batch_normalization_91 (BatchNo | (None, 2, 2, 384) | 1152 | conv2d_91 |
| [0][0] | | | |

_____

_____

| activation_87 (Activation) | (None, 2, 2, 384) | 0 | batch_nor |
| malization_87[0][0] | | | |

activation_91 (Activation)	(None, 2, 2, 384)	0	batch_nor malization_91[0][0]
conv2d_88 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_87[0][0]
conv2d_89 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_87[0][0]
conv2d_92 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_91[0][0]
conv2d_93 (Conv2D)	(None, 2, 2, 384)	442368	activatio n_91[0][0]
average_pooling2d_9 (AveragePoo [0]	(None, 2, 2, 2048)	0	mixed9[0]
conv2d_86 (Conv2D) [0]	(None, 2, 2, 320)	655360	mixed9[0]
batch_normalization_88 (BatchNo [0][0]	(None, 2, 2, 384)	1152	conv2d_88
batch_normalization_89 (BatchNo [0][0]	(None, 2, 2, 384)	1152	conv2d_89
batch_normalization_92 (BatchNo [0][0]	(None, 2, 2, 384)	1152	conv2d_92
batch_normalization_93 (BatchNo [0][0]	(None, 2, 2, 384)	1152	conv2d_93
conv2d_94 (Conv2D) ooling2d_9[0][0]	(None, 2, 2, 192)	393216	average_p
batch_normalization_86 (BatchNo [0][0]	(None, 2, 2, 320)	960	conv2d_86
activation_88 (Activation) malization_88[0][0]	(None, 2, 2, 384)	0	batch_nor
activation_89 (Activation) malization_89[0][0]	(None, 2, 2, 384)	0	batch_nor

```
_____
activation_92 (Activation)        (None, 2, 2, 384)     0           batch_nor
malization_92[0][0]
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_____
activation_93 (Activation)        (None, 2, 2, 384)     0           batch_nor
malization_93[0][0]
_____

_____
batch_normalization_94 (BatchNo   (None, 2, 2, 192)     576         conv2d_94
[0][0]
_____

_____
activation_86 (Activation)        (None, 2, 2, 320)     0           batch_nor
malization_86[0][0]
_____

_____
mixed9_1 (Concatenate)            (None, 2, 2, 768)     0           activatio
n_88[0][0]

                                                                    activatio
n_89[0][0]
_____

_____
concatenate_2 (Concatenate)       (None, 2, 2, 768)     0           activatio
n_92[0][0]

                                                                    activatio
n_93[0][0]
_____

_____
activation_94 (Activation)        (None, 2, 2, 192)     0           batch_nor
malization_94[0][0]
_____

_____
mixed10 (Concatenate)             (None, 2, 2, 2048)    0           activatio
n_86[0][0]

                                                                    mixed9_1
[0][0]

                                                                    concatena
te_2[0][0]

                                                                    activatio
n_94[0][0]
_____

_____
global_average_pooling2d_1 (Glo   (None, 2048)          0           mixed10
[0][0]
_____

_____
dense_1 (Dense)                   (None, 2)             4098        global_av
erage_pooling2d_1[0][0]
==========================================================================
==========================
Total params: 21,806,882
Trainable params: 4,098
Non-trainable params: 21,802,784
_____

_____
```

In [27]:

```python
#Função de geração da matriz de confusão
def print_confusion_matrix(confusion_matrix, class_names, figsize = (10,7), fontsize=11
):
    df_cm = pd.DataFrame(
        confusion_matrix, index=class_names, columns=class_names,
    )
    fig = plt.figure(figsize=figsize)
    try:
        heatmap = sns.heatmap(df_cm, cmap="YlGnBu", annot=True, fmt="d")
    except ValueError:
        raise ValueError("Confusion matrix values must be integers.")
    heatmap.yaxis.set_ticklabels(heatmap.yaxis.get_ticklabels(), rotation=0, ha='right'
, fontsize=fontsize)
    heatmap.xaxis.set_ticklabels(heatmap.xaxis.get_ticklabels(), rotation=30, ha='righ
t', fontsize=fontsize)

    b, t = plt.ylim() # discover the values for bottom and top
    b += 0.5 # Add 0.5 to the bottom
    t -= 0.5 # Subtract 0.5 from the top
    plt.ylim(b, t) # update the ylim(bottom, top) values

    plt.ylabel('True label')
    plt.xlabel('Predicted label')
    #return fig
```

In [28]:

```python
batch = 32


from keras.preprocessing.image import ImageDataGenerator

validation_datagen = ImageDataGenerator(rescale = 1./255)

validation_set = validation_datagen.flow_from_directory('classificador_A/validation/',
                                    target_size = (128, 128),
                                    color_mode="rgb",
                                    batch_size = batch, #alterado para 1
                                    class_mode = 'categorical',
                                    shuffle=True)
num_validation = validation_set.samples
```

Found 2396 images belonging to 2 classes.

In [29]:

```python
### Conjunto de Validação ###

print ("### Matriz de confusão para o conjunto de validação ###")

#Conjunto de validação
validation_datagen = ImageDataGenerator(rescale = 1./255)

validation_set = validation_datagen.flow_from_directory('classificador_A/validation/',
                                    target_size = (128, 128),
                                    color_mode="rgb",
                                    batch_size = batch, #alterado para 1
                                    class_mode = 'categorical',
                                    shuffle= False)


#Confution Matrix
Y_pred = model.predict_generator(validation_set, num_validation//batch, verbose=1)

test_preds = np.argmax(Y_pred, axis=-1)
l=test_preds.shape[0]
test_trues = validation_set.classes
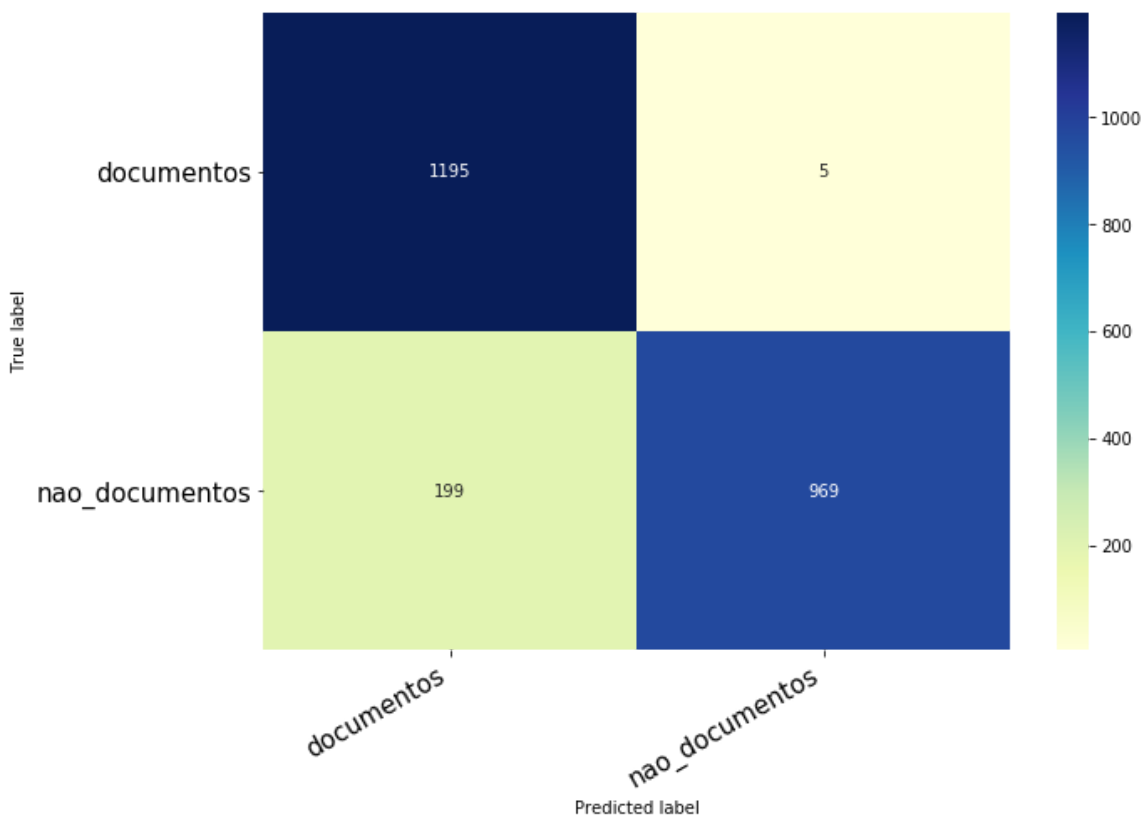cm =confusion_matrix(test_trues[:l], test_preds)

print_confusion_matrix(cm, ["documentos", "nao_documentos"], figsize = (10,7), fontsize
=15)
```

```
### Matriz de confusão para o conjunto de validação ###
Found 2396 images belonging to 2 classes.
74/74 [==============================] - 27s 370ms/step
```

In [30]:

```python
### Conjunto de Teste ###

print ("### Matriz de confusão para o conjunto de teste ###")

test_datagen = ImageDataGenerator(rescale = 1./255)

test_set = test_datagen.flow_from_directory('classificador_A/test/',
                                            target_size = (128, 128),
                                            color_mode="rgb",
                                            batch_size = 1,
                                            class_mode = 'categorical',
                                            shuffle=False)
num_test = test_set.samples


#Confution Matrix
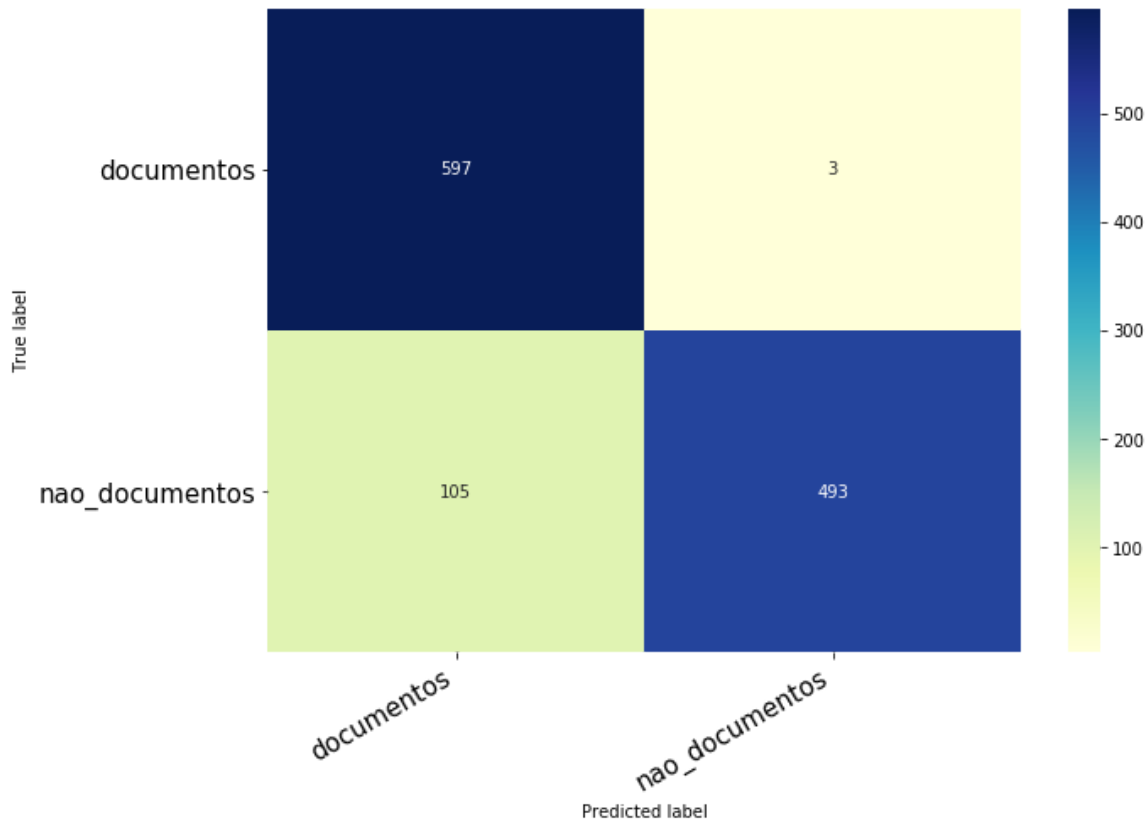Y_pred = model.predict_generator(test_set, num_test, verbose=1)

test_preds = np.argmax(Y_pred, axis=-1)
l=test_preds.shape[0]
test_trues = test_set.classes
cm =confusion_matrix(test_trues[:l], test_preds)

print_confusion_matrix(cm, ["documentos", "nao_documentos"], figsize = (10,7), fontsize
=15)

# Accuracy and Loss for the Test set
loss, acc = model.evaluate_generator(test_set, num_test, verbose=1)

# Final accuracy and loss
print ("Test accuracy: %.3f" % acc)
print ("Test loss: %.3f" % loss)
```

```
### Matriz de confusão para o conjunto de teste ###
Found 1198 images belonging to 2 classes.
1198/1198 [==============================] - 46s 38ms/step
1198/1198 [==============================] - 48s 40ms/step
Test accuracy: 0.910
Test loss: 0.000
```


In [ ]: