In [1]:

```
import tensorflow as tf
import numpy as np
import pandas as pd
from sklearn.metrics import classification_report, confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sn
import os
```

```
INFO:tensorflow:Enabling eager execution
INFO:tensorflow:Enabling v2 tensorshape
INFO:tensorflow:Enabling resource variables
INFO:tensorflow:Enabling tensor equality
INFO:tensorflow:Enabling control flow v2
```

In [2]:

```
epochs = 10 # quantidade de vezes a ser executado o algoritmo, uma epoch é quanto todo
batch = 32 # número de amostras que será carregado a cada execução
```

In [3]:

```
#carrega o modelo da InceptionResNetV2 com os pesos aprendidos no treino de Inception
base_model = tf.keras.applications.InceptionResNetV2(weights='imagenet', include_top=F
```

In [4]:

```
# O restante do modelo e novas camadas serão discutidos a seguir
# x recebe o final da InceptionResNetV2
x=base_model.output
```

In [5]:

```
#Nova configuração para o modelo

#adiciona apos x uma camada GlobalMaxPooling2D e atribui este ao x novamente (logo a
x=tf.keras.layers.GlobalMaxPooling2D()(x)

#adiciona apos x uma camada densa com 128 neuronios com funcao de ativacao relu. Atrib
x=tf.keras.layers.Dense(128,activation='relu')(x)

#adiciona apos x uma camada densa com 64 neuronios com funcao de ativacao relu. Atrib
x=tf.keras.layers.Dense(64,activation='relu')(x)

#adiciona apos x uma camada densa com 32 neuronios com funcao de ativacao relu. Atrib
x=tf.keras.layers.Dense(32,activation='relu')(x)

#adiciona apos x os neuronios que devem ser utilizados, nesse caso foram desligados 2
x=tf.keras.layers.Dropout(0.5)(x)

#adiciona apos x uma camada densa com 7 neuronios (sete classes) com funcao de ativaca
#preds=tf.keras.layers.Dense(7,activation='softmax')(x)
preds=tf.keras.layers.Dense(3,activation='sigmoid')(x)

#definindo modelo final
model=tf.keras.models.Model(inputs=base_model.input,outputs=preds)

#mostrando modelo final e sua estrutura
model.summary()
```

```
Model: "model"
__________________________________________________________________________________________
Layer (type)                    Output Shape          Param #     Connected to
==========================================================================================
input_1 (InputLayer)            [(None, None, None,  0
conv2d (Conv2D)                 (None, None, None, 3 864         input_1[0][0]
batch_normalization (BatchNorma (None, None, None, 3 96          conv2d[0][0]
activation (Activation)         (None, None, None, 3 0           batch_normalization[0][0]
conv2d_1 (Conv2D)               (None, None, None, 3 9216        activation[0][0]
batch_normalization_1 (BatchNor (None, None, None, 3 96          conv2d_1[0][0]
activation_1 (Activation)       (None, None, None, 3 0           batch_normalization_1[0][0]
conv2d_2 (Conv2D)               (None, None, None, 6 18432       activation_1[0][0]
batch_normalization_2 (BatchNor (None, None, None, 6 192         conv2d_2[0][0]
activation_2 (Activation)       (None, None, None, 6 0           batch_normalization_2[0][0]
max_pooling2d (MaxPooling2D)    (None, None, None, 6 0           activation_2[0][0]
conv2d_3 (Conv2D)               (None, None, None, 8 5120        max_pooling2d[0][0]
batch_normalization_3 (BatchNor (None, None, None, 8 240         conv2d_3[0][0]
activation_3 (Activation)       (None, None, None, 8 0           batch_normalization_3[0][0]
conv2d_4 (Conv2D)               (None, None, None, 1 138240      activation_3[0][0]
batch_normalization_4 (BatchNor (None, None, None, 1 576         conv2d_4[0][0]
activation_4 (Activation)       (None, None, None, 1 0           batch_normalization_4[0][0]
max_pooling2d_1 (MaxPooling2D)  (None, None, None, 1 0           activation_4[0][0]
conv2d_8 (Conv2D)               (None, None, None, 6 12288       max_pooling2d_1[0][0]
batch_normalization_8 (BatchNor (None, None, None, 6 192         conv2d_8[0][0]
activation_8 (Activation)       (None, None, None, 6 0           batch_normalization_8[0][0]
conv2d_6 (Conv2D)               (None, None, None, 4 9216        max_pooling2d_1[0][0]
conv2d_9 (Conv2D)               (None, None, None, 9 55296       activation_8[0][0]
batch_normalization_6 (BatchNor (None, None, None, 4 144         conv2d_6[0][0]
batch_normalization_9 (BatchNor (None, None, None, 9 288         conv2d_9[0][0]
activation_6 (Activation)       (None, None, None, 4 0           batch_normalization_6[0][0]
activation_9 (Activation)       (None, None, None, 9 0           batch_normalization_9[0][0]
average_pooling2d (AveragePooli (None, None, None, 1 0           max_pooling2d_1[0][0]
conv2d_5 (Conv2D)               (None, None, None, 9 18432       max_pooling2d_1[0][0]
conv2d_7 (Conv2D)               (None, None, None, 6 76800       activation_6[0][0]
conv2d_10 (Conv2D)              (None, None, None, 9 82944       activation_9[0][0]
conv2d_11 (Conv2D)              (None, None, None, 6 12288       average_pooling2d[0][0]
batch_normalization_5 (BatchNor (None, None, None, 9 288         conv2d_5[0][0]
batch_normalization_7 (BatchNor (None, None, None, 6 192         conv2d_7[0][0]
batch_normalization_10 (BatchNo (None, None, None, 9 288         conv2d_10[0][0]
batch_normalization_11 (BatchNo (None, None, None, 6 192         conv2d_11[0][0]
activation_5 (Activation)       (None, None, None, 9 0           batch_normalization_5[0][0]
activation_7 (Activation)       (None, None, None, 6 0           batch_normalization_7[0][0]
activation_10 (Activation)      (None, None, None, 9 0           batch_normalization_10[0][0]
activation_11 (Activation)      (None, None, None, 6 0           batch_normalization_11[0][0]
mixed_5b (Concatenate)          (None, None, None, 3 0           activation_5[0][0]
                                                                 activation_7[0][0]
                                                                 activation_10[0][0]
                                                                 activation_11[0][0]
conv2d_15 (Conv2D)              (None, None, None, 3 10240       mixed_5b[0][0]
batch_normalization_15 (BatchNo (None, None, None, 3 96          conv2d_15[0][0]
activation_15 (Activation)      (None, None, None, 3 0           batch_normalization_15[0][0]
conv2d_13 (Conv2D)              (None, None, None, 3 10240       mixed_5b[0][0]
conv2d_16 (Conv2D)              (None, None, None, 4 13824       activation_15[0][0]
batch_normalization_13 (BatchNo (None, None, None, 3 96          conv2d_13[0][0]
batch_normalization_16 (BatchNo (None, None, None, 4 144         conv2d_16[0][0]
activation_13 (Activation)      (None, None, None, 3 0           batch_normalization_13[0][0]
activation_16 (Activation)      (None, None, None, 4 0           batch_normalization_16[0][0]
conv2d_12 (Conv2D)              (None, None, None, 3 10240       mixed_5b[0][0]
conv2d_14 (Conv2D)              (None, None, None, 3 9216        activation_13[0][0]
conv2d_17 (Conv2D)              (None, None, None, 6 27648       activation_16[0][0]
batch_normalization_12 (BatchNo (None, None, None, 3 96          conv2d_12[0][0]
batch_normalization_14 (BatchNo (None, None, None, 3 96          conv2d_14[0][0]
batch_normalization_17 (BatchNo (None, None, None, 6 192         conv2d_17[0][0]
activation_12 (Activation)      (None, None, None, 3 0           batch_normalization_12[0][0]
activation_14 (Activation)      (None, None, None, 3 0           batch_normalization_14[0][0]
activation_17 (Activation)      (None, None, None, 6 0           batch_normalization_17[0][0]
block35_1_mixed (Concatenate)   (None, None, None, 1 0           activation_12[0][0]
                                                                 activation_14[0][0]
                                                                 activation_17[0][0]
block35_1_conv (Conv2D)         (None, None, None, 3 41280       block35_1_mixed[0][0]
block35_1 (Lambda)              (None, None, None, 3 0           mixed_5b[0][0]
                                                                 block35_1_conv[0][0]
block35_1_ac (Activation)       (None, None, None, 3 0           block35_1[0][0]
conv2d_21 (Conv2D)              (None, None, None, 3 10240       block35_1_ac[0][0]
batch_normalization_21 (BatchNo (None, None, None, 3 96          conv2d_21[0][0]
activation_21 (Activation)      (None, None, None, 3 0           batch_normalization_21[0][0]
conv2d_19 (Conv2D)              (None, None, None, 3 10240       block35_1_ac[0][0]
conv2d_22 (Conv2D)              (None, None, None, 4 13824       activation_21[0][0]
batch_normalization_19 (BatchNo (None, None, None, 3 96          conv2d_19[0][0]
batch_normalization_22 (BatchNo (None, None, None, 4 144         conv2d_22[0][0]
activation_19 (Activation)      (None, None, None, 3 0           batch_normalization_19[0][0]
activation_22 (Activation)      (None, None, None, 4 0           batch_normalization_22[0][0]
conv2d_18 (Conv2D)              (None, None, None, 3 10240       block35_1_ac[0][0]
conv2d_20 (Conv2D)              (None, None, None, 3 9216        activation_19[0][0]
conv2d_23 (Conv2D)              (None, None, None, 6 27648       activation_22[0][0]
batch_normalization_18 (BatchNo (None, None, None, 3 96          conv2d_18[0][0]
batch_normalization_20 (BatchNo (None, None, None, 3 96          conv2d_20[0][0]
batch_normalization_23 (BatchNo (None, None, None, 6 192         conv2d_23[0][0]
activation_18 (Activation)      (None, None, None, 3 0           batch_normalization_18[0][0]
activation_20 (Activation)      (None, None, None, 3 0           batch_normalization_20[0][0]
activation_23 (Activation)      (None, None, None, 6 0           batch_normalization_23[0][0]
block35_2_mixed (Concatenate)   (None, None, None, 1 0           activation_18[0][0]
                                                                 activation_20[0][0]
                                                                 activation_23[0][0]
block35_2_conv (Conv2D)         (None, None, None, 3 41280       block35_2_mixed[0][0]
block35_2 (Lambda)              (None, None, None, 3 0           block35_1_ac[0][0]
                                                                 block35_2_conv[0][0]
block35_2_ac (Activation)       (None, None, None, 3 0           block35_2[0][0]
conv2d_27 (Conv2D)              (None, None, None, 3 10240       block35_2_ac[0][0]
batch_normalization_27 (BatchNo (None, None, None, 3 96          conv2d_27[0][0]
activation_27 (Activation)      (None, None, None, 3 0           batch_normalization_27[0][0]
conv2d_25 (Conv2D)              (None, None, None, 3 10240       block35_2_ac[0][0]
conv2d_28 (Conv2D)              (None, None, None, 4 13824       activation_27[0][0]
batch_normalization_25 (BatchNo (None, None, None, 3 96          conv2d_25[0][0]
batch_normalization_28 (BatchNo (None, None, None, 4 144         conv2d_28[0][0]
activation_25 (Activation)      (None, None, None, 3 0           batch_normalization_25[0][0]
activation_28 (Activation)      (None, None, None, 4 0           batch_normalization_28[0][0]
conv2d_24 (Conv2D)              (None, None, None, 3 10240       block35_2_ac[0][0]
conv2d_26 (Conv2D)              (None, None, None, 3 9216        activation_25[0][0]
conv2d_29 (Conv2D)              (None, None, None, 6 27648       activation_28[0][0]
batch_normalization_24 (BatchNo (None, None, None, 3 96          conv2d_24[0][0]
batch_normalization_26 (BatchNo (None, None, None, 3 96          conv2d_26[0][0]
batch_normalization_29 (BatchNo (None, None, None, 6 192         conv2d_29[0][0]
activation_24 (Activation)      (None, None, None, 3 0           batch_normalization_24[0][0]
activation_26 (Activation)      (None, None, None, 3 0           batch_normalization_26[0][0]
activation_29 (Activation)      (None, None, None, 6 0           batch_normalization_29[0][0]
block35_3_mixed (Concatenate)   (None, None, None, 1 0           activation_24[0][0]
                                                                 activation_26[0][0]
                                                                 activation_29[0][0]
block35_3_conv (Conv2D)         (None, None, None, 3 41280       block35_3_mixed[0][0]
block35_3 (Lambda)              (None, None, None, 3 0           block35_2_ac[0][0]
                                                                 block35_3_conv[0][0]
block35_3_ac (Activation)       (None, None, None, 3 0           block35_3[0][0]
conv2d_33 (Conv2D)              (None, None, None, 3 10240       block35_3_ac[0][0]
batch_normalization_33 (BatchNo (None, None, None, 3 96          conv2d_33[0][0]
activation_33 (Activation)      (None, None, None, 3 0           batch_normalization_33[0][0]
conv2d_31 (Conv2D)              (None, None, None, 3 10240       block35_3_ac[0][0]
conv2d_34 (Conv2D)              (None, None, None, 4 13824       activation_33[0][0]
batch_normalization_31 (BatchNo (None, None, None, 3 96          conv2d_31[0][0]
batch_normalization_34 (BatchNo (None, None, None, 4 144         conv2d_34[0][0]
activation_31 (Activation)      (None, None, None, 3 0           batch_normalization_31[0][0]
activation_34 (Activation)      (None, None, None, 4 0           batch_normalization_34[0][0]
conv2d_30 (Conv2D)              (None, None, None, 3 10240       block35_3_ac[0][0]
conv2d_32 (Conv2D)              (None, None, None, 3 9216        activation_31[0][0]
conv2d_35 (Conv2D)              (None, None, None, 6 27648       activation_34[0][0]
batch_normalization_30 (BatchNo (None, None, None, 3 96          conv2d_30[0][0]
batch_normalization_32 (BatchNo (None, None, None, 3 96          conv2d_32[0][0]
batch_normalization_35 (BatchNo (None, None, None, 6 192         conv2d_35[0][0]
activation_30 (Activation)      (None, None, None, 3 0           batch_normalization_30[0][0]
activation_32 (Activation)      (None, None, None, 3 0           batch_normalization_32[0][0]
activation_35 (Activation)      (None, None, None, 6 0           batch_normalization_35[0][0]
block35_4_mixed (Concatenate)   (None, None, None, 1 0           activation_30[0][0]
                                                                 activation_32[0][0]
                                                                 activation_35[0][0]
block35_4_conv (Conv2D)         (None, None, None, 3 41280       block35_4_mixed[0][0]
block35_4 (Lambda)              (None, None, None, 3 0           block35_3_ac[0][0]
                                                                 block35_4_conv[0][0]
block35_4_ac (Activation)       (None, None, None, 3 0           block35_4[0][0]
conv2d_39 (Conv2D)              (None, None, None, 3 10240       block35_4_ac[0][0]
batch_normalization_39 (BatchNo (None, None, None, 3 96          conv2d_39[0][0]
activation_39 (Activation)      (None, None, None, 3 0           batch_normalization_39[0][0]
conv2d_37 (Conv2D)              (None, None, None, 3 10240       block35_4_ac[0][0]
conv2d_40 (Conv2D)              (None, None, None, 4 13824       activation_39[0][0]
batch_normalization_37 (BatchNo (None, None, None, 3 96          conv2d_37[0][0]
batch_normalization_40 (BatchNo (None, None, None, 4 144         conv2d_40[0][0]
activation_37 (Activation)      (None, None, None, 3 0           batch_normalization_37[0][0]
activation_40 (Activation)      (None, None, None, 4 0           batch_normalization_40[0][0]
conv2d_36 (Conv2D)              (None, None, None, 3 10240       block35_4_ac[0][0]
conv2d_38 (Conv2D)              (None, None, None, 3 9216        activation_37[0][0]
conv2d_41 (Conv2D)              (None, None, None, 6 27648       activation_40[0][0]
batch_normalization_36 (BatchNo (None, None, None, 3 96          conv2d_36[0][0]
batch_normalization_38 (BatchNo (None, None, None, 3 96          conv2d_38[0][0]
batch_normalization_41 (BatchNo (None, None, None, 6 192         conv2d_41[0][0]
activation_36 (Activation)      (None, None, None, 3 0           batch_normalization_36[0][0]
activation_38 (Activation)      (None, None, None, 3 0           batch_normalization_38[0][0]
activation_41 (Activation)      (None, None, None, 6 0           batch_normalization_41[0][0]
block35_5_mixed (Concatenate)   (None, None, None, 1 0           activation_36[0][0]
                                                                 activation_38[0][0]
                                                                 activation_41[0][0]
block35_5_conv (Conv2D)         (None, None, None, 3 41280       block35_5_mixed[0][0]
block35_5 (Lambda)              (None, None, None, 3 0           block35_4_ac[0][0]
                                                                 block35_5_conv[0][0]
block35_5_ac (Activation)       (None, None, None, 3 0           block35_5[0][0]
conv2d_45 (Conv2D)              (None, None, None, 3 10240       block35_5_ac[0][0]
batch_normalization_45 (BatchNo (None, None, None, 3 96          conv2d_45[0][0]
activation_45 (Activation)      (None, None, None, 3 0           batch_normalization_45[0][0]
conv2d_43 (Conv2D)              (None, None, None, 3 10240       block35_5_ac[0][0]
conv2d_46 (Conv2D)              (None, None, None, 4 13824       activation_45[0][0]
batch_normalization_43 (BatchNo (None, None, None, 3 96          conv2d_43[0][0]
batch_normalization_46 (BatchNo (None, None, None, 4 144         conv2d_46[0][0]
activation_43 (Activation)      (None, None, None, 3 0           batch_normalization_43[0][0]
activation_46 (Activation)      (None, None, None, 4 0           batch_normalization_46[0][0]
conv2d_42 (Conv2D)              (None, None, None, 3 10240       block35_5_ac[0][0]
conv2d_44 (Conv2D)              (None, None, None, 3 9216        activation_43[0][0]
conv2d_47 (Conv2D)              (None, None, None, 6 27648       activation_46[0][0]
batch_normalization_42 (BatchNo (None, None, None, 3 96          conv2d_42[0][0]
batch_normalization_44 (BatchNo (None, None, None, 3 96          conv2d_44[0][0]
batch_normalization_47 (BatchNo (None, None, None, 6 192         conv2d_47[0][0]
activation_42 (Activation)      (None, None, None, 3 0           batch_normalization_42[0][0]
activation_44 (Activation)      (None, None, None, 3 0           batch_normalization_44[0][0]
activation_47 (Activation)      (None, None, None, 6 0           batch_normalization_47[0][0]
block35_6_mixed (Concatenate)   (None, None, None, 1 0           activation_42[0][0]
                                                                 activation_44[0][0]
                                                                 activation_47[0][0]
block35_6_conv (Conv2D)         (None, None, None, 3 41280       block35_6_mixed[0][0]
block35_6 (Lambda)              (None, None, None, 3 0           block35_5_ac[0][0]
                                                                 block35_6_conv[0][0]
block35_6_ac (Activation)       (None, None, None, 3 0           block35_6[0][0]
conv2d_51 (Conv2D)              (None, None, None, 3 10240       block35_6_ac[0][0]
batch_normalization_51 (BatchNo (None, None, None, 3 96          conv2d_51[0][0]
activation_51 (Activation)      (None, None, None, 3 0           batch_normalization_51[0][0]
conv2d_49 (Conv2D)              (None, None, None, 3 10240       block35_6_ac[0][0]
conv2d_52 (Conv2D)              (None, None, None, 4 13824       activation_51[0][0]
batch_normalization_49 (BatchNo (None, None, None, 3 96          conv2d_49[0][0]
batch_normalization_52 (BatchNo (None, None, None, 4 144         conv2d_52[0][0]
activation_49 (Activation)      (None, None, None, 3 0           batch_normalization_49[0][0]
activation_52 (Activation)      (None, None, None, 4 0           batch_normalization_52[0][0]
conv2d_48 (Conv2D)              (None, None, None, 3 10240       block35_6_ac[0][0]
conv2d_50 (Conv2D)              (None, None, None, 3 9216        activation_49[0][0]
conv2d_53 (Conv2D)              (None, None, None, 6 27648       activation_52[0][0]
batch_normalization_48 (BatchNo (None, None, None, 3 96          conv2d_48[0][0]
batch_normalization_50 (BatchNo (None, None, None, 3 96          conv2d_50[0][0]
batch_normalization_53 (BatchNo (None, None, None, 6 192         conv2d_53[0][0]
activation_48 (Activation)      (None, None, None, 3 0           batch_normalization_48[0][0]
activation_50 (Activation)      (None, None, None, 3 0           batch_normalization_50[0][0]
activation_53 (Activation)      (None, None, None, 6 0           batch_normalization_53[0][0]
block35_7_mixed (Concatenate)   (None, None, None, 1 0           activation_48[0][0]
                                                                 activation_50[0][0]
                                                                 activation_53[0][0]
block35_7_conv (Conv2D)         (None, None, None, 3 41280       block35_7_mixed[0][0]
block35_7 (Lambda)              (None, None, None, 3 0           block35_6_ac[0][0]
                                                                 block35_7_conv[0][0]
block35_7_ac (Activation)       (None, None, None, 3 0           block35_7[0][0]
conv2d_57 (Conv2D)              (None, None, None, 3 10240       block35_7_ac[0][0]
batch_normalization_57 (BatchNo (None, None, None, 3 96          conv2d_57[0][0]
activation_57 (Activation)      (None, None, None, 3 0           batch_normalization_57[0][0]
conv2d_55 (Conv2D)              (None, None, None, 3 10240       block35_7_ac[0][0]
conv2d_58 (Conv2D)              (None, None, None, 4 13824       activation_57[0][0]
batch_normalization_55 (BatchNo (None, None, None, 3 96          conv2d_55[0][0]
batch_normalization_58 (BatchNo (None, None, None, 4 144         conv2d_58[0][0]
activation_55 (Activation)      (None, None, None, 3 0           batch_normalization_55[0][0]
activation_58 (Activation)      (None, None, None, 4 0           batch_normalization_58[0][0]
conv2d_54 (Conv2D)              (None, None, None, 3 10240       block35_7_ac[0][0]
conv2d_56 (Conv2D)              (None, None, None, 3 9216        activation_55[0][0]
conv2d_59 (Conv2D)              (None, None, None, 6 27648       activation_58[0][0]
batch_normalization_54 (BatchNo (None, None, None, 3 96          conv2d_54[0][0]
batch_normalization_56 (BatchNo (None, None, None, 3 96          conv2d_56[0][0]
batch_normalization_59 (BatchNo (None, None, None, 6 192         conv2d_59[0][0]
activation_54 (Activation)      (None, None, None, 3 0           batch_normalization_5
                                                                 4[0][0]
```