

In [19]:

```
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 sns
import os
```

In [20]:

```
epochs = 75 # quantidade de vezes a ser executado o algoritmo, uma epoch é quanto toda
batch = 32 # número de amostras que será carregado a cada execução
```

In [21]:

```
#carrega o modelo da ResNet50V2 com os pesos aprendidos no treino da ImageNet sem a c
base_model = tf.keras.applications.ResNet50V2(weights='imagenet', include_top=False)
```

In [22]:

```
#O restante do modelo e suas camadas são discutidos a seguir
#x recebe o final da inception v3
x=base_model.output
```

In [23]:

```
#Nova configuração para o modelo

#Adiciona apos x uma camada AveragePooling2D e atribui este no a x novamente (logo x
x=tf.keras.layers.GlobalAveragePooling2D()(x)

#Adiciona apos x uma camada densa com 37 neurônios com funcao de ativacao relu. Atrib
x=tf.keras.layers.Dense(128,activation='relu')(x)

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

#Adiciona apos x uma camada densa com 128 neurônios com funcao de ativacao relu. Atri
x=tf.keras.layers.Dense(128,activation='relu')(x)

#Adiciona apos x os neurônios 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 neurônios (sete classes) com funcao de ativac
preds=tf.keras.layers.Dense(7,activation='softmax')(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_1		
Layer (type)	Output Shape	Param #	Connected to
=====			
input_2 (InputLayer)	(None, None, None, 0		
conv1_pad (ZeroPadding2D)	(None, None, None, 3	0	input_2[0][0]
conv1_conv (Conv2D)	(None, None, None, 6	9472	conv1_pad[0][0]
pool1_pad (ZeroPadding2D)	(None, None, None, 6	0	conv1_conv[0][0]
pool1_pool (MaxPooling2D)	(None, None, None, 6	0	pool1_pad[0][0]
conv2_block1_preact_bn (BatchNo	(None, None, None, 6	256	pool1_pool[0][0]
conv2_block1_preact_relu (Activ	(None, None, None, 6	0	conv2_block1_preact_b
n[0][0]			
conv2_block1_1_conv (Conv2D)	(None, None, None, 6	4096	conv2_block1_preact_r
elu[0][0]			
conv2_block1_1_bn (BatchNormali	(None, None, None, 6	256	conv2_block1_1_conv
[0][0]			
conv2_block1_1_relu (Activation	(None, None, None, 6	0	conv2_block1_1_bn[0]
[0]			
conv2_block1_2_pad (ZeroPadding	(None, None, None, 6	0	conv2_block1_1_relu
[0][0]			
conv2_block1_2_conv (Conv2D)	(None, None, None, 6	36864	conv2_block1_2_pad[0]
[0]			
conv2_block1_2_bn (BatchNormali	(None, None, None, 6	256	conv2_block1_2_conv
[0][0]			
conv2_block1_2_relu (Activation	(None, None, None, 6	0	conv2_block1_2_bn[0]
[0]			
conv2_block1_0_conv (Conv2D)	(None, None, None, 2	16640	conv2_block1_preact_r
elu[0][0]			
conv2_block1_3_conv (Conv2D)	(None, None, None, 2	16640	conv2_block1_2_relu
[0][0]			
conv2_block1_out (Add)	(None, None, None, 2	0	conv2_block1_0_conv
[0][0]			conv2_block1_3_conv
conv2_block2_preact_bn (BatchNo	(None, None, None, 2	1024	conv2_block1_out[0]
[0]			
conv2_block2_preact_relu (Activ	(None, None, None, 2	0	conv2_block2_preact_b
n[0][0]			
conv2_block2_1_conv (Conv2D)	(None, None, None, 6	16384	conv2_block2_preact_r
elu[0][0]			
conv2_block2_1_bn (BatchNormali	(None, None, None, 6	256	conv2_block2_1_conv
[0][0]			
conv2_block2_1_relu (Activation	(None, None, None, 6	0	conv2_block2_1_bn[0]
[0]			
conv2_block2_2_pad (ZeroPadding	(None, None, None, 6	0	conv2_block2_1_relu
[0][0]			
conv2_block2_2_conv (Conv2D)	(None, None, None, 6	36864	conv2_block2_2_pad[0]
[0]			
conv2_block2_2_bn (BatchNormali	(None, None, None, 6	256	conv2_block2_2_conv
[0][0]			
conv2_block2_2_relu (Activation	(None, None, None, 6	0	conv2_block2_2_bn[0]
[0]			
conv2_block2_3_conv (Conv2D)	(None, None, None, 2	16640	conv2_block2_2_relu
[0][0]			
conv2_block2_out (Add)	(None, None, None, 2	0	conv2_block1_out[0]
[0][0]			conv2_block2_3_conv
conv2_block3_preact_bn (BatchNo	(None, None, None, 2	1024	conv2_block2_out[0]
[0]			
conv2_block3_preact_relu (Activ	(None, None, None, 2	0	conv2_block3_preact_b
n[0][0]			
conv2_block3_1_conv (Conv2D)	(None, None, None, 6	16384	conv2_block3_preact_r
elu[0][0]			
conv2_block3_1_bn (BatchNormali	(None, None, None, 6	256	conv2_block3_1_conv
[0][0]			
conv2_block3_1_relu (Activation	(None, None, None, 6	0	conv2_block3_1_bn[0]
[0]			
conv2_block3_2_pad (ZeroPadding	(None, None, None, 6	0	conv2_block3_1_relu
[0][0]			
conv2_block3_2_conv (Conv2D)	(None, None, None, 6	36864	conv2_block3_2_pad[0]
[0]			
conv2_block3_2_bn (BatchNormali	(None, None, None, 6	256	conv2_block3_2_conv
[0][0]			
conv2_block3_2_relu (Activation	(None, None, None, 6	0	conv2_block3_2_bn[0]
[0]			
max_pooling2d_3 (MaxPooling2D)	(None, None, None, 2	0	conv2_block2_out[0]
[0]			
conv2_block3_3_conv (Conv2D)	(None, None, None, 2	16640	conv2_block3_2_relu
[0][0]			
conv2_block3_out (Add)	(None, None, None, 2	0	max_pooling2d_3[0][0]
[0][0]			conv2_block3_3_conv
conv3_block1_preact_bn (BatchNo	(None, None, None, 2	1024	conv2_block3_out[0]
[0]			
conv3_block1_preact_relu (Activ	(None, None, None, 2	0	conv3_block1_preact_b
n[0][0]			
conv3_block1_1_conv (Conv2D)	(None, None, None, 1	32768	conv3_block1_preact_r
elu[0][0]			
conv3_block1_1_bn (BatchNormali	(None, None, None, 1	512	conv3_block1_1_conv
[0][0]			
conv3_block1_1_relu (Activation	(None, None, None, 1	0	conv3_block1_1_bn[0]
[0]			
conv3_block1_2_pad (ZeroPadding	(None, None, None, 1	0	conv3_block1_1_relu
[0][0]			
conv3_block1_2_conv (Conv2D)	(None, None, None, 1	147456	conv3_block1_2_pad[0]
[0]			
conv3_block1_2_bn (BatchNormali	(None, None, None, 1	512	conv3_block1_2_conv
[0][0]			
conv3_block1_2_relu (Activation	(None, None, None, 1	0	conv3_block1_2_bn[0]
[0]			
conv3_block1_0_conv (Conv2D)	(None, None, None, 5	131584	conv3_block1_preact_r
elu[0][0]			
conv3_block1_3_conv (Conv2D)	(None, None, None, 5	66048	conv3_block1_2_relu
[0][0]			
conv3_block1_out (Add)	(None, None, None, 5	0	conv3_block1_0_conv
[0][0]			conv3_block1_3_conv
conv3_block2_preact_bn (BatchNo	(None, None, None, 5	2048	conv3_block1_out[0]
[0]			
conv3_block2_preact_relu (Activ	(None, None, None, 5	0	conv3_block2_preact_b
n[0][0]			
conv3_block2_1_conv (Conv2D)	(None, None, None, 1	65536	conv3_block2_preact_r
elu[0][0]			
conv3_block2_1_bn (BatchNormali	(None, None, None, 1	512	conv3_block2_1_conv
[0][0]			
conv3_block2_1_relu (Activation	(None, None, None, 1	0	conv3_block2_1_bn[0]
[0]			
conv3_block2_2_pad (ZeroPadding	(None, None, None, 1	0	conv3_block2_1_relu
[0][0]			
conv3_block2_2_conv (Conv2D)	(None, None, None, 1	147456	conv3_block2_2_pad[0]
[0]			
conv3_block2_2_bn (BatchNormali	(None, None, None, 1	512	conv3_block2_2_conv
[0][0]			
conv3_block2_2_relu (Activation	(None, None, None, 1	0	conv3_block2_2_bn[0]
[0]			
conv3_block2_3_conv (Conv2D)	(None, None, None, 5	66048	conv3_block2_2_relu
[0][0]			
conv3_block2_out (Add)	(None, None, None, 5	0	conv3_block1_out[0]
[0]			conv3_block2_3_conv
conv3_block3_preact_bn (BatchNo	(None, None, None, 5	2048	conv3_block2_out[0]
[0]			
conv3_block3_preact_relu (Activ	(None, None, None, 5	0	conv3_block3_preact_b
n[0][0]			
conv3_block3_1_conv (Conv2D)	(None, None, None, 1	65536	conv3_block3_preact_r
elu[0][0]			
conv3_block3_1_bn (BatchNormali	(None, None, None, 1	512	conv3_block3_1_conv
[0][0]			
conv3_block3_1_relu (Activation	(None, None, None, 1	0	conv3_block3_1_bn[0]
[0]			
conv3_block3_2_pad (ZeroPadding	(None, None, None, 1	0	conv3_block3_1_relu
[0][0]			
conv3_block3_2_conv (Conv2D)	(None, None, None, 1	147456	conv3_block3_2_pad[0]
[0]			
conv3_block3_2_bn (BatchNormali	(None, None, None, 1	512	conv3_block3_2_conv
[0][0]			
conv3_block3_2_relu (Activation	(None, None, None, 1	0	conv3_block3_2_bn[0]
[0]			
conv3_block3_3_conv (Conv2D)	(None, None, None, 5	66048	conv3_block3_2_relu
[0][0]			
conv3_block3_out (Add)	(None, None, None, 5	0	conv3_block2_out[0]
[0]			conv3_block3_3_conv
conv3_block4_preact_bn (BatchNo	(None, None, None, 5	2048	conv3_block3_out[0]
[0]			
conv3_block4_preact_relu (Activ	(None, None, None, 5	0	conv3_block4_preact_b
n[0][0]			
conv3_block4_1_conv (Conv2D)	(None, None, None, 1	65536	conv3_block4_preact_r
elu[0][0]			
conv3_block4_1_bn (BatchNormali	(None, None, None, 1	512	conv3_block4_1_conv
[0][0]			
conv3_block4_1_relu (Activation	(None, None, None, 1	0	conv3_block4_1_bn[0]
[0]			
conv3_block4_2_pad (ZeroPadding	(None, None, None, 1	0	conv3_block4_1_relu
[0][0]			
conv3_block4_2_conv (Conv2D)	(None, None, None, 1	147456	conv3_block4_2_pad[0]
[0]			
conv3_block4_2_bn (BatchNormali	(None, None, None, 1	512	conv3_block4_2_conv
[0][0]			
conv3_block4_2_relu (Activation	(None, None, None, 1	0	conv3_block4_2_bn[0]
[0]			
max_pooling2d_4 (MaxPooling2D)	(None, None, None, 5	0	conv3_block3_out[0]
[0]			
conv3_block4_3_conv (Conv2D)	(None, None, None, 5	66048	conv3_block4_2_relu
[0][0]			
conv3_block4_out (Add)	(None, None, None, 5	0	conv3_block4_3_conv
[0][0]			
conv4_block1_preact_bn (BatchNo	(None, None, None, 5	2048	conv3_block4_out[0]
[0]			
conv4_block1_preact_relu (Activ	(None, None, None, 5	0	conv4_block1_preact_b
n[0][0]			
conv4_block1_1_conv (Conv2D)	(None, None, None, 2	131072	conv4_block1_preact_r
elu[0][0]			
conv4_block1_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block1_1_conv
[0]			
conv4_block1_1_relu (Activatio	(None, None, None, 2	0	conv4_block1_1_bn[0]
[0]			
conv4_block1_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block1_1_relu
[0][0]			
conv4_block1_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block1_2_pad[0]
[0]			
conv4_block1_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block1_2_conv
[0][0]			
conv4_block1_2_relu (Activation	(None, None, None, 2	0	conv4_block1_2_bn[0]
[0]			
conv4_block1_0_conv (Conv2D)	(None, None, None, 1	525312	conv4_block1_preact_r
elu[0][0]			
conv4_block1_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block1_2_relu
[0][0]			
conv4_block1_out (Add)	(None, None, None, 1	0	conv4_block1_0_conv
[0][0]			conv4_block1_3_conv
conv4_block2_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block1_out[0]
[0]			
conv4_block2_preact_relu (Activ	(None, None, None, 1	0	conv4_block2_preact_b
n[0][0]			
conv4_block2_1_conv (Conv2D)	(None, None, None, 2	262144	conv4_block2_preact_r
elu[0][0]			
conv4_block2_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block2_1_conv
[0]			
conv4_block2_1_relu (Activation	(None, None, None, 2	0	conv4_block2_1_bn[0]
[0]			
conv4_block2_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block2_1_relu
[0][0]			
conv4_block2_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block2_2_pad[0]
[0]			
conv4_block2_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block2_2_conv
[0][0]			
conv4_block2_2_relu (Activation	(None, None, None, 2	0	conv4_block2_2_bn[0]
[0]			
conv4_block2_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block2_2_relu
[0][0]			
conv4_block2_out (Add)	(None, None, None, 1	0	conv4_block1_out[0]
[0]			conv4_block2_3_conv
conv4_block3_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block2_out[0]
[0]			
conv4_block3_preact_relu (Activ	(None, None, None, 1	0	conv4_block3_preact_b
n[0][0]			
conv4_block3_1_conv (Conv2D)	(None, None, None, 2	262144	conv4_block3_preact_r
elu[0][0]			
conv4_block3_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block3_1_conv
[0]			
conv4_block3_1_relu (Activation	(None, None, None, 2	0	conv4_block3_1_bn[0]
[0]			
conv4_block3_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block3_1_relu
[0][0]			
conv4_block3_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block3_2_pad[0]
[0]			
conv4_block3_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block3_2_conv
[0][0]			
conv4_block3_2_relu (Activation	(None, None, None, 2	0	conv4_block3_2_bn[0]
[0]			
conv4_block3_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block3_2_relu
[0][0]			
conv4_block3_out (Add)	(None, None, None, 1	0	conv4_block2_out[0]
[0]			conv4_block3_3_conv
conv4_block4_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block3_out[0]
[0]			
conv4_block4_preact_relu (Activ	(None, None, None, 1	0	conv4_block4_preact_b
n[0][0]			
conv4_block4_1_conv (Conv2D)	(None, None, None, 2	262144	conv4_block4_preact_r
elu[0][0]			
conv4_block4_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block4_1_conv
[0]			
conv4_block4_1_relu (Activation	(None, None, None, 2	0	conv4_block4_1_bn[0]
[0]			
conv4_block4_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block4_1_relu
[0][0]			
conv4_block4_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block4_2_pad[0]
[0]			
conv4_block4_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block4_2_conv
[0][0]			
conv4_block4_2_relu (Activation	(None, None, None, 2	0	conv4_block4_2_bn[0]
[0]			
conv4_block4_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block4_2_relu
[0][0]			
conv4_block4_out (Add)	(None, None, None, 1	0	conv4_block3_out[0]
[0]			conv4_block4_3_conv
conv4_block5_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block4_out[0]
[0]			
conv4_block5_preact_relu (Activ	(None, None, None, 1	0	conv4_block5_preact_b
n[0][0]			
conv4_block5_1_conv (Conv2D)	(None, None, None, 2	262144	conv4_block5_preact_r
elu[0][0]			
conv4_block5_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block5_1_conv
[0]			
conv4_block5_1_relu (Activation	(None, None, None, 2	0	conv4_block5_1_bn[0]
[0]			
conv4_block5_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block5_1_relu
[0][0]			
conv4_block5_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block5_2_pad[0]
[0]			
conv4_block5_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block5_2_conv
[0][0]			
conv4_block5_2_relu (Activatio	(None, None, None, 2	0	conv4_block5_2_bn[0]
[0]			
conv4_block5_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block5_2_relu
[0][0]			
conv4_block5_out (Add)	(None, None, None, 1	0	conv4_block4_out[0]
[0]			conv4_block5_3_conv
conv4_block6_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block5_out[0]
[0]			
conv4_block6_preact_relu (Activ	(None, None, None, 1	0	conv4_block6_preact_b
n[0][0]			
conv4_block6_1_conv (Conv2D)	(None, None, None, 2	262144	conv4_block6_preact_r
elu[0][0]			
conv4_block6_1_bn (BatchNormali	(None, None, None, 2	1024	conv4_block6_1_conv
[0]			
conv4_block6_1_relu (Activation	(None, None, None, 2	0	conv4_block6_1_bn[0]
[0]			
conv4_block6_2_pad (ZeroPadding	(None, None, None, 2	0	conv4_block6_1_relu
[0][0]			
conv4_block6_2_conv (Conv2D)	(None, None, None, 2	589824	conv4_block6_2_pad[0]
[0]			
conv4_block6_2_bn (BatchNormali	(None, None, None, 2	1024	conv4_block6_2_conv
[0][0]			
conv4_block6_2_relu (Activation	(None, None, None, 2	0	conv4_block6_2_bn[0]
[0]			
max_pooling2d_5 (MaxPooling2D)	(None, None, None, 1	0	conv4_block5_out[0]
[0]			
conv4_block6_3_conv (Conv2D)	(None, None, None, 1	263168	conv4_block6_2_relu
[0][0]			
conv4_block6_out (Add)	(None, None, None, 1	0	max_pooling2d_5[0][0]
[0][0]			conv4_block6_3_conv
conv5_block1_preact_bn (BatchNo	(None, None, None, 1	4096	conv4_block6_out[0]
[0]			
conv5_block1_preact_relu (Activ	(None, None, None, 1	0	conv5_block1_preact_b
n[0][0			

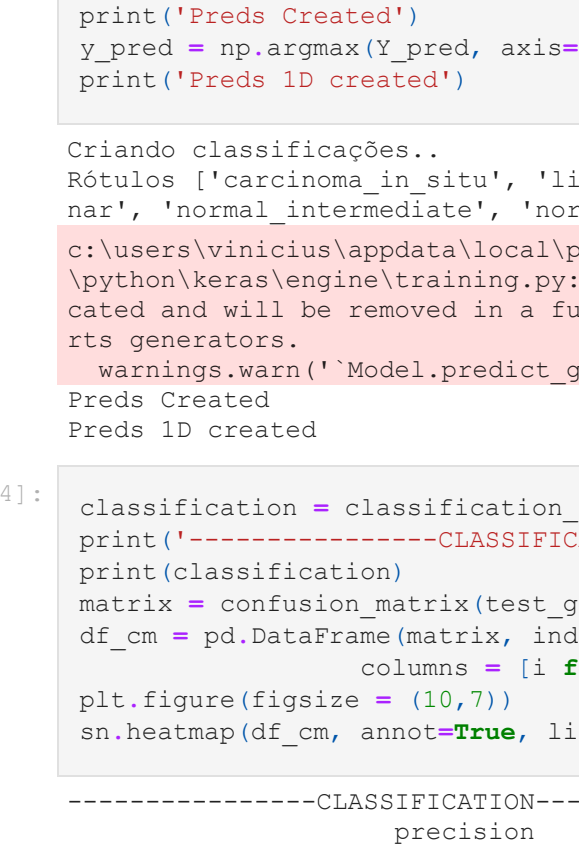


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22/22 [=====] - 60s 3s/step - loss: 1.6858 - accuracy: 0.3190
Epoch 5/75
22/22 [=====] - 59s 3s/step - loss: 1.6410 - accuracy: 0.3710
Epoch 6/75
22/22 [=====] - 59s 3s/step - loss: 1.5832 - accuracy: 0.4006
Epoch 7/75
22/22 [=====] - 59s 3s/step - loss: 1.5602 - accuracy: 0.4134
Epoch 8/75
22/22 [=====] - 59s 3s/step - loss: 1.5334 - accuracy: 0.3854
Epoch 9/75
22/22 [=====] - 59s 3s/step - loss: 1.4004 - accuracy: 0.4817
Epoch 10/75
22/22 [=====] - 60s 3s/step - loss: 1.4838 - accuracy: 0.4236
Epoch 11/75
22/22 [=====] - 61s 3s/step - loss: 1.4552 - accuracy: 0.4376
Epoch 12/75
22/22 [=====] - 59s 3s/step - loss: 1.3879 - accuracy: 0.4831
Epoch 13/75
22/22 [=====] - 59s 3s/step - loss: 1.4182 - accuracy: 0.4720
Epoch 14/75
22/22 [=====] - 59s 3s/step - loss: 1.3859 - accuracy: 0.4586
Epoch 15/75
22/22 [=====] - 59s 3s/step - loss: 1.3083 - accuracy: 0.5487
Epoch 16/75
22/22 [=====] - 60s 3s/step - loss: 1.3434 - accuracy: 0.4967
Epoch 17/75
22/22 [=====] - 59s 3s/step - loss: 1.2920 - accuracy: 0.5160
Epoch 18/75
22/22 [=====] - 60s 3s/step - loss: 1.2728 - accuracy: 0.5510
Epoch 19/75
22/22 [=====] - 60s 3s/step - loss: 1.2529 - accuracy: 0.5278
Epoch 20/75
22/22 [=====] - 64s 3s/step - loss: 1.1927 - accuracy: 0.5552
Epoch 21/75
22/22 [=====] - 63s 3s/step - loss: 1.1816 - accuracy: 0.5374
Epoch 22/75
22/22 [=====] - 59s 3s/step - loss: 1.1225 - accuracy: 0.5698
Epoch 23/75
22/22 [=====] - 62s 3s/step - loss: 1.1499 - accuracy: 0.5746
Epoch 24/75
22/22 [=====] - 61s 3s/step - loss: 1.1372 - accuracy: 0.5646
Epoch 25/75
22/22 [=====] - 59s 3s/step - loss: 1.1744 - accuracy: 0.5396
Epoch 26/75
22/22 [=====] - 60s 3s/step - loss: 1.0150 - accuracy: 0.6118
Epoch 27/75
22/22 [=====] - 61s 3s/step - loss: 1.0693 - accuracy: 0.5995
Epoch 28/75
22/22 [=====] - 68s 3s/step - loss: 1.0085 - accuracy: 0.6431
Epoch 29/75
22/22 [=====] - 59s 3s/step - loss: 1.0884 - accuracy: 0.5934
Epoch 30/75
22/22 [=====] - 59s 3s/step - loss: 1.0394 - accuracy: 0.5638
Epoch 31/75
22/22 [=====] - 59s 3s/step - loss: 1.0894 - accuracy: 0.6031
Epoch 32/75
22/22 [=====] - 59s 3s/step - loss: 0.9829 - accuracy: 0.6136
Epoch 33/75
22/22 [=====] - 59s 3s/step - loss: 0.9888 - accuracy: 0.6406
Epoch 34/75
22/22 [=====] - 59s 3s/step - loss: 0.9420 - accuracy: 0.6424
Epoch 35/75
22/22 [=====] - 59s 3s/step - loss: 0.9212 - accuracy: 0.6801
Epoch 36/75
22/22 [=====] - 59s 3s/step - loss: 0.9082 - accuracy: 0.6841
Epoch 37/75
22/22 [=====] - 59s 3s/step - loss: 0.8913 - accuracy: 0.6636
Epoch 38/75
22/22 [=====] - 59s 3s/step - loss: 0.9087 - accuracy: 0.6632
Epoch 39/75
22/22 [=====] - 59s 3s/step - loss: 0.8864 - accuracy: 0.6833
Epoch 40/75
22/22 [=====] - 60s 3s/step - loss: 0.8412 - accuracy: 0.7040
Epoch 41/75
22/22 [=====] - 59s 3s/step - loss: 0.8968 - accuracy: 0.6587
Epoch 42/75
22/22 [=====] - 59s 3s/step - loss: 0.7475 - accuracy: 0.7555
Epoch 43/75
22/22 [=====] - 59s 3s/step - loss: 0.7912 - accuracy: 0.7164
Epoch 44/75
22/22 [=====] - 59s 3s/step - loss: 0.8110 - accuracy: 0.6964
Epoch 45/75
22/22 [=====] - 59s 3s/step - loss: 0.7732 - accuracy: 0.7182
Epoch 46/75
22/22 [=====] - 59s 3s/step - loss: 0.7226 - accuracy: 0.7643
Epoch 47/75
22/22 [=====] - 59s 3s/step - loss: 0.7021 - accuracy: 0.7604
Epoch 48/75
22/22 [=====] - 59s 3s/step - loss: 0.7152 - accuracy: 0.7544
Epoch 49/75
22/22 [=====] - 59s 3s/step - loss: 0.6632 - accuracy: 0.7784
Epoch 50/75
22/22 [=====] - 59s 3s/step - loss: 0.7030 - accuracy: 0.7472
Epoch 51/75
22/22 [=====] - 59s 3s/step - loss: 0.6877 - accuracy: 0.7893
Epoch 52/75
22/22 [=====] - 61s 3s/step - loss: 0.6538 - accuracy: 0.7828
Epoch 53/75
22/22 [=====] - 59s 3s/step - loss: 0.6122 - accuracy: 0.7974
Epoch 54/75
22/22 [=====] - 59s 3s/step - loss: 0.6505 - accuracy: 0.7798
Epoch 55/75
22/22 [=====] - 59s 3s/step - loss: 0.6290 - accuracy: 0.7830
Epoch 56/75
22/22 [=====] - 59s 3s/step - loss: 0.6311 - accuracy: 0.7575
Epoch 57/75
22/22 [=====] - 60s 3s/step - loss: 0.6638 - accuracy: 0.7911
Epoch 58/75
22/22 [=====] - 59s 3s/step - loss: 0.6128 - accuracy: 0.8105
Epoch 59/75
22/22 [=====] - 59s 3s/step - loss: 0.6219 - accuracy: 0.8135
Epoch 60/75
22/22 [=====] - 59s 3s/step - loss: 0.5832 - accuracy: 0.8127
Epoch 61/75
22/22 [=====] - 59s 3s/step - loss: 0.5242 - accuracy: 0.8395
Epoch 62/75
22/22 [=====] - 59s 3s/step - loss: 0.5554 - accuracy: 0.8406
Epoch 63/75
22/22 [=====] - 59s 3s/step - loss: 0.5491 - accuracy: 0.8127
Epoch 64/75
22/22 [=====] - 59s 3s/step - loss: 0.5716 - accuracy: 0.8100
Epoch 65/75
22/22 [=====] - 59s 3s/step - loss: 0.4827 - accuracy: 0.8407
Epoch 66/75
22/22 [=====] - 59s 3s/step - loss: 0.5324 - accuracy: 0.8346
Epoch 67/75
22/22 [=====] - 59s 3s/step - loss: 0.5140 - accuracy: 0.8177
Epoch 68/75
22/22 [=====] - 59s 3s/step - loss: 0.4884 - accuracy: 0.8392
Epoch 69/75
22/22 [=====] - 59s 3s/step - loss: 0.4597 - accuracy: 0.8444
Epoch 70/75
22/22 [=====] - 59s 3s/step - loss: 0.4635 - accuracy: 0.8420
Epoch 71/75
22/22 [=====] - 59s 3s/step - loss: 0.4712 - accuracy: 0.8574
Epoch 72/75
22/22 [=====] - 60s 3s/step - loss: 0.4633 - accuracy: 0.8510
Epoch 73/75
22/22 [=====] - 59s 3s/step - loss: 0.4498 - accuracy: 0.8657
Epoch 74/75
22/22 [=====] - 59s 3s/step - loss: 0.4247 - accuracy: 0.8613
Epoch 75/75
22/22 [=====] - 59s 3s/step - loss: 0.4542 - accuracy: 0.8327
- val_loss: 1.1992 - val_accuracy: 0.5417
```

```
In [30]: #Avaliando o modelo
loss_train, train_acc = model.evaluate_generator(train_generator, steps=step_size_train)
loss_test, test_acc = model.evaluate_generator(test_generator, steps=step_size_test)
print('Train: %.3f, Test: %.3f' % (train_acc, test_acc))
```

```
c:\users\vinicius\appdata\local\programs\python\python39\lib\site-packages\tensorflow\python\keras\engine\training.py:1973: UserWarning: Model.evaluate_generator is deprecated and will be removed in a future version. Please use 'Model.evaluate', which supports generators.
warnings.warn('Model.evaluate_generator' is deprecated and '
```

```
In [31]: #Apresentando resultados em graficos
plt.title('Loss')
plt.plot(history.history['loss'], label='train')
plt.plot(history.history['val_loss'], label='test')
plt.legend()
plt.show()
```



```
In [32]: # Criando graficos para visualizaçao dos resultados
print()
plt.title('Accuracy')
plt.plot(history.history['accuracy'], label='train')
plt.plot(history.history['val_accuracy'], label='test')
plt.legend()
plt.show()
```



```
In [33]: print('Criando classificações..')
labels = os.listdir('database')
print('Rotulas', labels)
#criando estruturas para métricas de avaliação, processo um pouco mais demorado
Y_pred = model.predict_generator(test_generator)
print('Preds Created')
y_pred = np.argmax(Y_pred, axis=1)
print('Preds 1D created')
```

```
Criando classificações..
Rotulas ['carcinoma_in_situ', 'light_dysplastic', 'moderate_dysplastic', 'normal_columnar', 'normal_intermediate', 'normal_superficial', 'severe_dysplastic']
c:\users\vinicius\appdata\local\programs\python\python39\lib\site-packages\tensorflow\python\keras\engine\training.py:2001: UserWarning: Model.predict_generator is deprecated and will be removed in a future version. Please use 'Model.evaluate', which supports generators.
warnings.warn('Model.predict_generator' is deprecated and '
```

```
In [34]: classification = classification_report(test_generator.classes, y_pred, target_names=labels)
print('-----CLASSIFICATION-----')
print(classification)
matrix = confusion_matrix(test_generator.classes, y_pred)
df_cm = pd.DataFrame(matrix, index = [i for i in range(7)],
                      columns = [i for i in range(7)])
plt.figure(figsize = (10,7))
sn.heatmap(df_cm, annot=True, linewidth=2.5)
```

-----CLASSIFICATION-----				
	precision	recall	f1-score	support
carcinoma_in_situ	0.09	0.13	0.11	15
light_dysplastic	0.12	0.16	0.14	19
moderate_dysplastic	0.19	0.19	0.19	16
normal_columnar	0.00	0.00	0.00	11
normal_intermediate	0.12	0.14	0.13	7
normal_superficial	0.17	0.12	0.14	8
severe_dysplastic	0.12	0.10	0.11	21
accuracy			0.12	97
macro avg	0.12	0.12	0.12	
weighted avg	0.12	0.12	0.12	97



```
In [35]:
```