Notebook

September 3, 2022

[1]:
```
#PROYECTO FINAL TRATAMIENTO DE DATOS

##Francisco Salazar H.
```

[2]:
```
import tensorflow as tf
import os
```

[3]:
```
gpus = tf.config.experimental.list_physical_devices('GPU')
for gpu in gpus:
    tf.config.experimental.set_memory_growth(gpu, True)
```

[4]:
```
tf.config.list_physical_devices('GPU')
```

[4]:
```
[]
```

[5]:
```
import cv2
import imghdr
from matplotlib import pyplot as plt
```

[6]:
```
data_dir = 'Data/Entrenamiento'
```

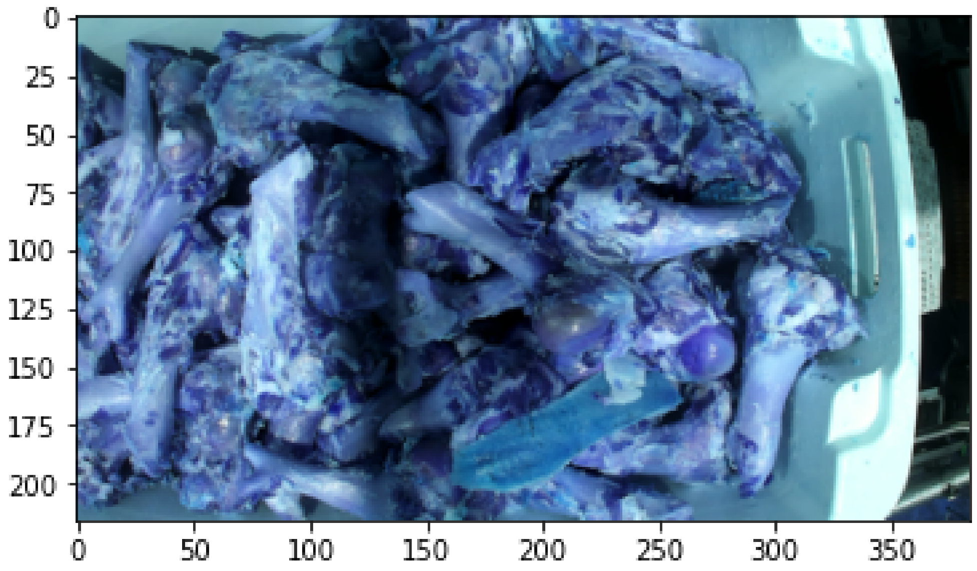
[7]:
```
img = cv2.imread(os.path.join(data_dir,'CLASS_02',␣
 ↪'05-CAPTURE_20220421_053226_860.png' ))
```

[8]:
```
img.shape
```

[8]:
```
(216, 384, 3)
```

[9]:
```
plt.imshow(img)
```

[9]:
```
<matplotlib.image.AxesImage at 0x27b37486520>
```



[10]:
```
#Load Data
```

[11]:
```
import numpy as np
from matplotlib import pyplot as plt
```

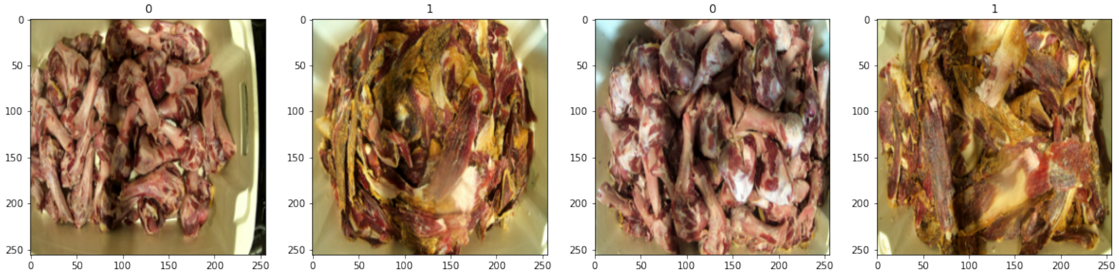
[12]:
```
data = tf.keras.utils.image_dataset_from_directory(data_dir)
```

```
Found 275 files belonging to 2 classes.
```

[13]:
```
data_iterator = data.as_numpy_iterator()
```

[14]:
```
batch = data_iterator.next()
```

[51]:
```
fig, ax = plt.subplots(ncols=4, figsize=(20,20))
for idx, img in enumerate(batch[0][:4]):
    ax[idx].imshow(img.astype(int))
    ax[idx].title.set_text(batch[1][idx])
```



[52]:

```
#Scale Data
```

[53]:

```
data = data.map(lambda x,y: (x/255, y))
```

[54]:

```
#Split Data
```

[55]:

```
train_size = int(len(data)*.7)
val_size = int(len(data)*.2)
test_size = int(len(data)*.1)
```

[56]:

```
train = data.take(train_size)
val = data.skip(train_size).take(val_size)
test = data.skip(train_size+val_size).take(test_size)
```

[57]:

```
#Build a Deep Learning Model
```

[58]:

```
train
```

[58]:

```
<TakeDataset element_spec=(TensorSpec(shape=(None, 256, 256, 3),
dtype=tf.float32, name=None), TensorSpec(shape=(None,), dtype=tf.int32,
name=None))>
```

[59]:

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dense, Flatten,␣
 ↪Dropout
```

[61]:

```
model = Sequential()
```

[62]:

```
model.add(Conv2D(64, (3,3), 1, activation='relu', input_shape=(256,256,3)))
model.add(MaxPooling2D())
model.add(Conv2D(32, (3,3), 1, activation='relu'))
model.add(MaxPooling2D())
model.add(Conv2D(16, (3,3), 1, activation='relu'))
model.add(MaxPooling2D())
model.add(Flatten())
model.add(Dense(256, activation='relu'))
model.add(Dense(1, activation='sigmoid'))
```

[63]:

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

[64]:

```
model.summary()
```

```
Model: "sequential_2"

_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_3 (Conv2D)           (None, 254, 254, 64)      1792
 max_pooling2d_3 (MaxPooling  (None, 127, 127, 64)     0
 2D)

 conv2d_4 (Conv2D)           (None, 125, 125, 32)      18464

 max_pooling2d_4 (MaxPooling  (None, 62, 62, 32)       0
 2D)

 conv2d_5 (Conv2D)           (None, 60, 60, 16)        4624

 max_pooling2d_5 (MaxPooling  (None, 30, 30, 16)       0
 2D)

 flatten_1 (Flatten)         (None, 14400)             0

 dense_2 (Dense)             (None, 256)               3686656

 dense_3 (Dense)             (None, 1)                 257

=================================================================
Total params: 3,711,793
Trainable params: 3,711,793
Non-trainable params: 0
_________________________________________________________________
```

[65]:
```
#Train
```

[66]:
```
logdir='logs'
```

[67]:
```
tensorboard_callback = tf.keras.callbacks.TensorBoard(log_dir=logdir)
```

[68]:
```
train
```

[68]:
```
<TakeDataset element_spec=(TensorSpec(shape=(None, 256, 256, 3),
dtype=tf.float32, name=None), TensorSpec(shape=(None,), dtype=tf.int32,
name=None))>
```

[69]:
```
hist = model.fit(train, epochs=20, validation_data=val,␣
 ↪callbacks=[tensorboard_callback])
```

```
Epoch 1/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.3021 - val_loss: 0.0000e+00 - val_accuracy: 0.1875
Epoch 2/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2552 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 3/40
```

```
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 4/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.0938
Epoch 5/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2188 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 6/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.3125
Epoch 7/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 8/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.2500
Epoch 9/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2083 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 10/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 11/40
6/6 [==============================] - 10s 2s/step - loss: 0.0000e+00 -
accuracy: 0.1927 - val_loss: 0.0000e+00 - val_accuracy: 0.2812
Epoch 12/40
6/6 [==============================] - 10s 2s/step - loss: 0.0000e+00 -
accuracy: 0.2031 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 13/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.1927 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 14/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 15/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.3125
Epoch 16/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2448 - val_loss: 0.0000e+00 - val_accuracy: 0.2500
Epoch 17/40
6/6 [==============================] - 10s 2s/step - loss: 0.0000e+00 -
accuracy: 0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.3438
Epoch 18/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.2812
Epoch 19/40
```

```
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 20/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2188 - val_loss: 0.0000e+00 - val_accuracy: 0.1875
Epoch 21/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2083 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 22/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.1875
Epoch 23/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2083 - val_loss: 0.0000e+00 - val_accuracy: 0.1875
Epoch 24/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2135 - val_loss: 0.0000e+00 - val_accuracy: 0.0938
Epoch 25/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 26/40
6/6 [==============================] - 10s 2s/step - loss: 0.0000e+00 -
accuracy: 0.2188 - val_loss: 0.0000e+00 - val_accuracy: 0.1562
Epoch 27/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.1875 - val_loss: 0.0000e+00 - val_accuracy: 0.2500
Epoch 28/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2188 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 29/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.1875
Epoch 30/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2448 - val_loss: 0.0000e+00 - val_accuracy: 0.3125
Epoch 31/40
6/6 [==============================] - 9s 1s/step - loss: 0.0000e+00 - accuracy:
0.2448 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 32/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2083 - val_loss: 0.0000e+00 - val_accuracy: 0.2500
Epoch 33/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2031 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 34/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 35/40
```

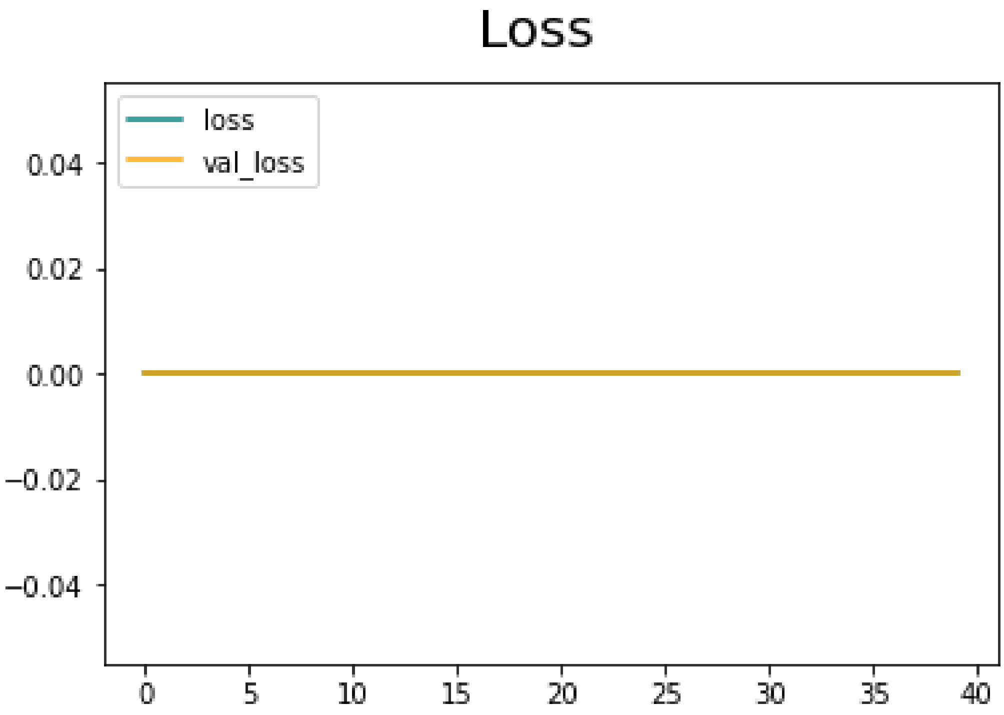
```
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2344 - val_loss: 0.0000e+00 - val_accuracy: 0.1250
Epoch 36/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2083 - val_loss: 0.0000e+00 - val_accuracy: 0.2812
Epoch 37/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.2188
Epoch 38/40
6/6 [==============================] - 8s 1s/step - loss: 0.0000e+00 - accuracy:
0.2031 - val_loss: 0.0000e+00 - val_accuracy: 0.2812
Epoch 39/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2292 - val_loss: 0.0000e+00 - val_accuracy: 0.2500
Epoch 40/40
6/6 [==============================] - 9s 2s/step - loss: 0.0000e+00 - accuracy:
0.2240 - val_loss: 0.0000e+00 - val_accuracy: 0.3125
```

[70]:

```
#Plot Performance
```

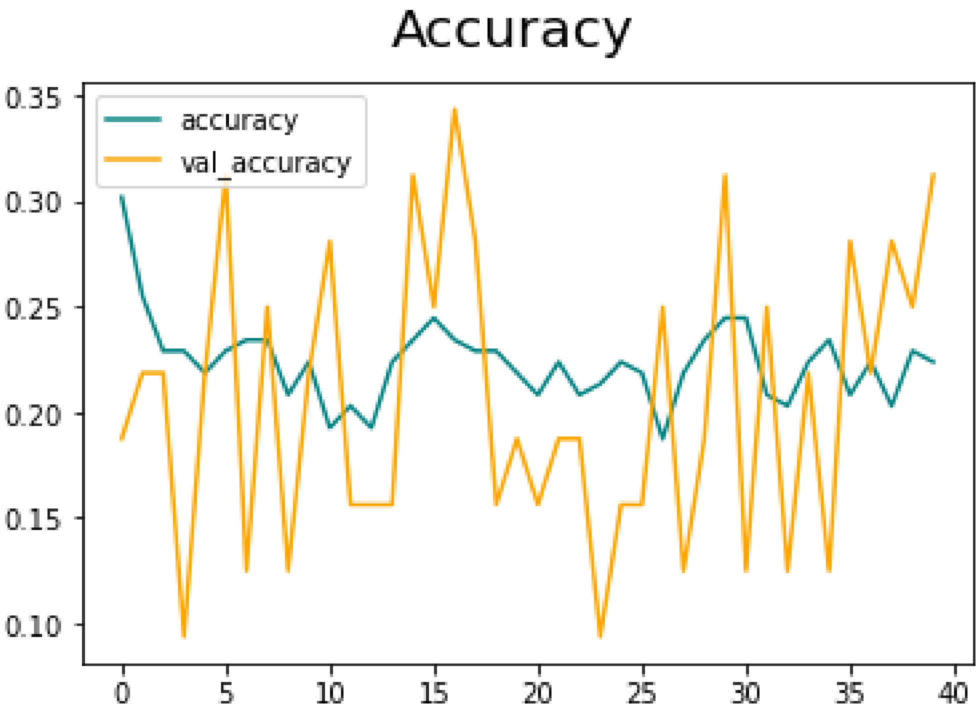
[71]:

```
fig = plt.figure()
plt.plot(hist.history['loss'], color='teal', label='loss')
plt.plot(hist.history['val_loss'], color='orange', label='val_loss')
fig.suptitle('Loss', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```



[72]:

```
fig = plt.figure()
plt.plot(hist.history['accuracy'], color='teal', label='accuracy')
plt.plot(hist.history['val_accuracy'], color='orange', label='val_accuracy')
fig.suptitle('Accuracy', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```



[73]:

```
#Evaluate
```

[74]:

```
from tensorflow.keras.metrics import Precision, Recall, BinaryAccuracy
```

[75]:

```
pre = Precision()
re = Recall()
acc = BinaryAccuracy()
```

[76]:

```
for batch in test.as_numpy_iterator():
    X, y = batch
    yhat = model.predict(X)
    pre.update_state(y, yhat)
    re.update_state(y, yhat)
    acc.update_state(y, yhat)
```

[77]:

```
print(pre.result(), re.result(), acc.result())
```

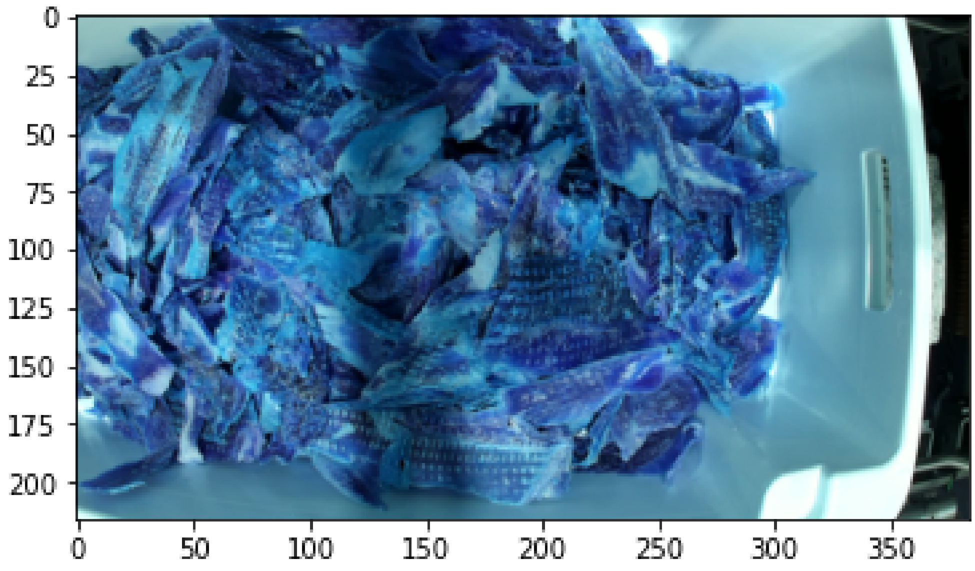
```
tf.Tensor(0.0, shape=(), dtype=float32) tf.Tensor(0.0, shape=(), dtype=float32)
tf.Tensor(0.0, shape=(), dtype=float32)
```

[78]:

```
#Test
```

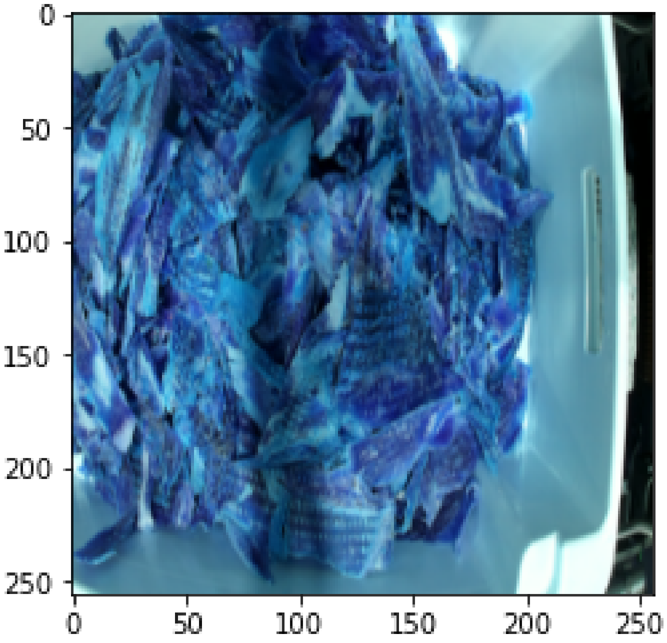
[79]:

```
img = cv2.imread('clase3.png')
plt.imshow(img)
plt.show()
```



[80]:

```
resize = tf.image.resize(img, (256,256))
plt.imshow(resize.numpy().astype(int))
plt.show()
```



```
[81]: yhat = model.predict(np.expand_dims(resize/255, 0))
```

```
1/1 [==============================] - 0s 68ms/step
```

```
[82]: yhat
```

```
[82]: array([[0.]], dtype=float32)
```

```
[84]: if yhat > 0.5:
          print(f'Clase predecida 2')
      else:
          print(f'Clase predecida 3')
```

```
Clase predecida 3
```