

Notebook

September 3, 2022

```
[2]: !pip install tensorflow tensorflow-gpu opencv-python matplotlib
```

Requirement already satisfied: tensorflow in c:\users\franc\anaconda3\lib\site-packages (2.9.2)

Collecting tensorflow-gpu

Using cached tensorflow_gpu-2.9.2-cp39-cp39-win_amd64.whl (444.1 MB)

Collecting opencv-python

Using cached opencv_python-4.6.0.66-cp36-abi3-win_amd64.whl (35.6 MB)

Requirement already satisfied: matplotlib in c:\users\franc\anaconda3\lib\site-packages (3.5.1)

Requirement already satisfied: tensorflow-estimator<2.10.0,>=2.9.0rc0 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (2.9.0)

Requirement already satisfied: libclang>=13.0.0 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (14.0.6)

Requirement already satisfied: tensorboard<2.10,>=2.9 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (2.9.1)

Requirement already satisfied: astunparse>=1.6.0 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.6.3)

Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (3.3.0)

Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (0.26.0)

Requirement already satisfied: six>=1.12.0 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.16.0)

Requirement already satisfied: gast<=0.4.0,>=0.2.1 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (0.4.0)

Requirement already satisfied: numpy>=1.20 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.21.5)

Requirement already satisfied: packaging in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (21.3)

Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.42.0)

Requirement already satisfied: google-pasta>=0.1.1 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (0.2.0)

Requirement already satisfied: protobuf<3.20,>=3.9.2 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (3.19.1)

Requirement already satisfied: flatbuffers<2,>=1.12 in c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.12)

Requirement already satisfied: keras<2.10.0,>=2.9.0rc0 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (2.9.0)

Requirement already satisfied: typing-extensions>=3.6.6 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (4.1.1)

Requirement already satisfied: keras-preprocessing>=1.1.1 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.1.2)

Requirement already satisfied: termcolor>=1.1.0 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.1.0)

Requirement already satisfied: wrapt>=1.11.0 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.12.1)

Requirement already satisfied: setuptools in c:\users\franc\anaconda3\lib\site-
packages (from tensorflow) (61.2.0)

Requirement already satisfied: h5py>=2.9.0 in c:\users\franc\anaconda3\lib\site-
packages (from tensorflow) (3.6.0)

Requirement already satisfied: absl-py>=1.0.0 in
c:\users\franc\anaconda3\lib\site-packages (from tensorflow) (1.2.0)

Requirement already satisfied: kiwisolver>=1.0.1 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (1.3.2)

Requirement already satisfied: python-dateutil>=2.7 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (2.8.2)

Requirement already satisfied: pillow>=6.2.0 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (9.0.1)

Requirement already satisfied: pyparsing>=2.2.1 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (3.0.4)

Requirement already satisfied: cycycler>=0.10 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (0.11.0)

Requirement already satisfied: fonttools>=4.22.0 in
c:\users\franc\anaconda3\lib\site-packages (from matplotlib) (4.25.0)

Requirement already satisfied: wheel<1.0,>=0.23.0 in
c:\users\franc\anaconda3\lib\site-packages (from astunparse>=1.6.0->tensorflow)
(0.37.1)

Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (0.6.1)

Requirement already satisfied: requests<3,>=2.21.0 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (2.27.1)

Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (1.8.1)

Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (0.4.6)

Requirement already satisfied: google-auth<3,>=1.6.3 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (1.33.0)

Requirement already satisfied: werkzeug>=1.0.1 in
c:\users\franc\anaconda3\lib\site-packages (from

```

tensorboard<2.10,>=2.9->tensorflow) (2.0.3)
Requirement already satisfied: markdown>=2.6.8 in
c:\users\franc\anaconda3\lib\site-packages (from
tensorboard<2.10,>=2.9->tensorflow) (3.3.4)
Requirement already satisfied: pyasn1-modules>=0.2.1 in
c:\users\franc\anaconda3\lib\site-packages (from google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow) (0.2.8)
Requirement already satisfied: rsa<5,>=3.1.4 in
c:\users\franc\anaconda3\lib\site-packages (from google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow) (4.7.2)
Requirement already satisfied: cachetools<5.0,>=2.0.0 in
c:\users\franc\anaconda3\lib\site-packages (from google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow) (4.2.2)
Requirement already satisfied: requests-oauthlib>=0.7.0 in
c:\users\franc\anaconda3\lib\site-packages (from google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.10,>=2.9->tensorflow) (1.3.1)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in
c:\users\franc\anaconda3\lib\site-packages (from pyasn1-modules>=0.2.1->google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow) (0.4.8)
Requirement already satisfied: certifi>=2017.4.17 in
c:\users\franc\anaconda3\lib\site-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow) (2021.10.8)
Requirement already satisfied: idna<4,>=2.5 in
c:\users\franc\anaconda3\lib\site-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow) (3.3)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in
c:\users\franc\anaconda3\lib\site-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow) (1.26.9)
Requirement already satisfied: charset-normalizer~=2.0.0 in
c:\users\franc\anaconda3\lib\site-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow) (2.0.4)
Requirement already satisfied: oauthlib>=3.0.0 in
c:\users\franc\anaconda3\lib\site-packages (from requests-
oauthlib>=0.7.0->google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.10,>=2.9->tensorflow) (3.2.0)
Installing collected packages: tensorflow-gpu, opencv-python

ERROR: Could not install packages due to an OSError: [WinError 5] Acceso
denegado: 'C:\\Users\\franc\\anaconda3\\Lib\\site-
packages\\tensorflow\\compiler\\tf2tensorrt\\_pywrap_py_utils.pyd'
Consider using the `--user` option or check the permissions.

```

[3]: `!pip list`

Package	Version
abs1-py	1.2.0
aiohttp	3.8.1

aiosignal	1.2.0
alabaster	0.7.12
anaconda-client	1.9.0
anaconda-navigator	2.2.0
anaconda-project	0.10.2
anyio	3.5.0
appdirs	1.4.4
argon2-cffi	21.3.0
argon2-cffi-bindings	21.2.0
arrow	1.2.2
astroid	2.6.6
astropy	5.0.4
asttokens	2.0.5
astunparse	1.6.3
async-timeout	4.0.1
atomicwrites	1.4.0
attrs	21.4.0
Automat	20.2.0
autopep8	1.6.0
Babel	2.9.1
backcall	0.2.0
backports.functools-lru-cache	1.6.4
backports.tempfile	1.0
backports.weakref	1.0.post1
bcrypt	3.2.0
beautifulsoup4	4.11.1
binaryornot	0.4.4
bitarray	2.4.1
bkcharts	0.2
black	19.10b0
bleach	4.1.0
bokeh	2.4.2
boto3	1.21.32
botocore	1.24.32
Bottleneck	1.3.4
brotlipy	0.7.0
cachetools	4.2.2
certifi	2021.10.8
cffi	1.15.0
chardet	4.0.0
charset-normalizer	2.0.4
click	8.0.4
cloudpickle	2.0.0
clyent	1.2.2
colorama	0.4.4
colorcet	2.0.6
comtypes	1.1.10
conda	4.13.0

conda-build	3.21.8
conda-content-trust	0+unknown
conda-pack	0.6.0
conda-package-handling	1.8.1
conda-repo-cli	1.0.4
conda-token	0.3.0
conda-verify	3.4.2
constantly	15.1.0
cookiecutter	1.7.3
cryptography	3.4.8
cssselect	1.1.0
cycler	0.11.0
Cython	0.29.28
cytoolz	0.11.0
daal4py	2021.5.0
dask	2022.2.1
datashader	0.13.0
datashape	0.5.4
debugpy	1.5.1
decorator	5.1.1
defusedxml	0.7.1
diff-match-patch	20200713
distributed	2022.2.1
docutils	0.17.1
entrypoints	0.4
et-xmlfile	1.1.0
executing	0.8.3
fastjsonschema	2.15.1
filelock	3.6.0
flake8	3.9.2
Flask	1.1.2
flatbuffers	1.12
fonttools	4.25.0
frozenset	1.2.0
fsspec	2022.2.0
future	0.18.2
gast	0.4.0
gensim	4.1.2
glob2	0.7
google-api-core	1.25.1
google-auth	1.33.0
google-auth-oauthlib	0.4.6
google-cloud-core	1.7.1
google-cloud-storage	1.31.0
google-crc32c	1.1.2
google-pasta	0.2.0
google-resumable-media	1.3.1
googleapis-common-protos	1.53.0

greenlet	1.1.1
grpcio	1.42.0
h5py	3.6.0
HeapDict	1.0.1
holoviews	1.14.8
hvplot	0.7.3
hyperlink	21.0.0
idna	3.3
imagecodecs	2021.8.26
imageio	2.9.0
imagesize	1.3.0
importlib-metadata	4.11.3
incremental	21.3.0
inflection	0.5.1
iniconfig	1.1.1
intake	0.6.5
intervaltree	3.1.0
ipykernel	6.9.1
ipython	8.2.0
ipython-genutils	0.2.0
ipywidgets	7.6.5
isort	5.9.3
itemadapter	0.3.0
itemloaders	1.0.4
itsdangerous	2.0.1
jdcal	1.4.1
jedi	0.18.1
Jinja2	2.11.3
jinja2-time	0.2.0
jmespath	0.10.0
joblib	1.1.0
json5	0.9.6
jsonschema	4.4.0
jupyter	1.0.0
jupyter-client	6.1.12
jupyter-console	6.4.0
jupyter-core	4.9.2
jupyter-server	1.13.5
jupyterlab	3.3.2
jupyterlab-pygments	0.1.2
jupyterlab-server	2.10.3
jupyterlab-widgets	1.0.0
keras	2.9.0
Keras-Preprocessing	1.1.2
keyring	23.4.0
kiwisolver	1.3.2
lazy-object-proxy	1.6.0
libarchive-c	2.9

libclang	14.0.6
llvmlite	0.38.0
locket	0.2.1
lxml	4.8.0
Markdown	3.3.4
MarkupSafe	2.0.1
matplotlib	3.5.1
matplotlib-inline	0.1.2
mccabe	0.6.1
menuinst	1.4.18
mistune	0.8.4
mkl-fft	1.3.1
mkl-random	1.2.2
mkl-service	2.4.0
mock	4.0.3
mpmath	1.2.1
msgpack	1.0.2
multidict	5.1.0
multipledispatch	0.6.0
munkres	1.1.4
mypy-extensions	0.4.3
navigator-updater	0.2.1
nbclassic	0.3.5
nbclient	0.5.13
nbconvert	6.4.4
nbformat	5.3.0
nest-asyncio	1.5.5
networkx	2.7.1
nltk	3.7
nose	1.3.7
notebook	6.4.8
numba	0.55.1
numexpr	2.8.1
numpy	1.21.5
numpydoc	1.2
oauthlib	3.2.0
olefile	0.46
openpyxl	3.0.9
opt-einsum	3.3.0
packaging	21.3
pandas	1.4.2
pandocfilters	1.5.0
panel	0.13.0
param	1.12.0
paramiko	2.8.1
parsel	1.6.0
parso	0.8.3
partd	1.2.0

pathspec	0.7.0
patsy	0.5.2
pep8	1.7.1
pexpect	4.8.0
pickleshare	0.7.5
Pillow	9.0.1
pip	21.2.4
pkginfo	1.8.2
plotly	5.6.0
pluggy	1.0.0
poyo	0.5.0
prometheus-client	0.13.1
prompt-toolkit	3.0.20
Protego	0.1.16
protobuf	3.19.1
psutil	5.8.0
ptyprocess	0.7.0
pure-eval	0.2.2
py	1.11.0
pyasn1	0.4.8
pyasn1-modules	0.2.8
pycodestyle	2.7.0
pycosat	0.6.3
pycparser	2.21
pyct	0.4.6
pycurl	7.44.1
PyDispatcher	2.0.5
pydocstyle	6.1.1
pyerfa	2.0.0
pyflakes	2.3.1
Pygments	2.11.2
PyHamcrest	2.0.2
PyJWT	2.1.0
pylint	2.9.6
pyls-spyder	0.4.0
PyNaCl	1.4.0
pyodbc	4.0.32
pyOpenSSL	21.0.0
pyparsing	3.0.4
pyreadline	2.1
pyrsistent	0.18.0
PySocks	1.7.1
pytest	7.1.1
python-dateutil	2.8.2
python-lsp-black	1.0.0
python-lsp-jsonrpc	1.0.0
python-lsp-server	1.2.4
python-slugify	5.0.2

python-snappy	0.6.0
pytz	2021.3
pyviz-comms	2.0.2
PyWavelets	1.3.0
pywin32	302
pywin32-ctypes	0.2.0
pywinpty	2.0.2
PyYAML	6.0
pymzml	22.3.0
QDarkStyle	3.0.2
qstylizer	0.1.10
QtAwesome	1.0.3
qtconsole	5.3.0
QtPy	2.0.1
queuelib	1.5.0
regex	2022.3.15
requests	2.27.1
requests-file	1.5.1
requests-oauthlib	1.3.1
rope	0.22.0
rsa	4.7.2
Rtree	0.9.7
ruamel-yaml-conda	0.15.100
s3transfer	0.5.0
scikit-image	0.19.2
scikit-learn	1.0.2
scikit-learn-intelext	2021.20220215.102710
scipy	1.7.3
Scrapy	2.6.1
seaborn	0.11.2
Send2Trash	1.8.0
service-identity	18.1.0
setuptools	61.2.0
sip	4.19.13
six	1.16.0
smart-open	5.1.0
sniffio	1.2.0
snowballstemmer	2.2.0
sortedcollections	2.1.0
sortedcontainers	2.4.0
soupsieve	2.3.1
Sphinx	4.4.0
sphinxcontrib-applehelp	1.0.2
sphinxcontrib-devhelp	1.0.2
sphinxcontrib-htmlhelp	2.0.0
sphinxcontrib-jsmath	1.0.1
sphinxcontrib-qthelp	1.0.3
sphinxcontrib-serializinghtml	1.1.5

spyder	5.1.5
spyder-kernels	2.1.3
SQLAlchemy	1.4.32
stack-data	0.2.0
statsmodels	0.13.2
sympy	1.10.1
tables	3.6.1
tabulate	0.8.9
TBB	0.2
tblib	1.7.0
tenacity	8.0.1
tensorboard	2.9.1
tensorboard-data-server	0.6.1
tensorboard-plugin-wit	1.8.1
tensorflow	2.9.2
tensorflow-estimator	2.9.0
tensorflow-io-gcs-filesystem	0.26.0
termcolor	1.1.0
terminado	0.13.1
testpath	0.5.0
text-unidecode	1.3
textdistance	4.2.1
threadpoolctl	2.2.0
three-merge	0.1.1
tifffile	2021.7.2
tinycss	0.4
tldextract	3.2.0
toml	0.10.2
tomli	1.2.2
toolz	0.11.2
tornado	6.1
tqdm	4.64.0
traitlets	5.1.1
Twisted	22.2.0
twisted-iocpsupport	1.0.2
typed-ast	1.4.3
typing_extensions	4.1.1
ujson	5.1.0
Unidecode	1.2.0
urllib3	1.26.9
w3lib	1.21.0
watchdog	2.1.6
wcwidth	0.2.5
webencodings	0.5.1
websocket-client	0.58.0
Werkzeug	2.0.3
wheel	0.37.1
widgetsnbextension	3.5.2

win-inet-pton	1.1.0
win-unicode-console	0.5
wincertstore	0.2
wrapt	1.12.1
xarray	0.20.1
xlrd	2.0.1
XlsxWriter	3.0.3
xlwings	0.24.9
yapf	0.31.0
yaml	1.6.3
zict	2.0.0
zipp	3.7.0
zope.interface	5.4.0

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

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

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

```
[6]: []
```

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

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

```
[33]: os.listdir(os.path.join(data_dir, 'CLASS_02'))
```

```
[33]: ['05-CAPTURE_20220421_053226_860.png',
'05-CAPTURE_20220421_053523_498.png',
'05-CAPTURE_20220421_053558_105.png',
'05-CAPTURE_20220421_054132_775.png',
'10-CAPTURE_20220531_103042_241.png',
'10-CAPTURE_20220531_103052_843.png',
'10-CAPTURE_20220531_103326_275.png',
'10-CAPTURE_20220531_104101_771.png',
'10-CAPTURE_20220614_103335_077.png',
'10-CAPTURE_20220614_103346_079.png',
'10-CAPTURE_20220614_103804_934.png',
'10-CAPTURE_20220614_103823_738.png',
'14-CAPTURE_20220531_143820_956.png',
'14-CAPTURE_20220531_144356_826.png',
'14-CAPTURE_20220531_144422_832.png',
```

'14-CAPTURE_20220531_144511_642.png',
'14-CAPTURE_20220531_144702_465.png',
'14-CAPTURE_20220531_144730_671.png',
'14-CAPTURE_20220531_144747_875.png',
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'22-CAPTURE_20220620_225907_089.png',
'23-CAPTURE_20220418_232110_317.png',
'23-CAPTURE_20220418_233048_237.png',
'23-CAPTURE_20220425_232459_352.png',
'23-CAPTURE_20220425_232959_015.png',
'23-CAPTURE_20220425_233750_714.png',
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'23-CAPTURE_20220427_232522_397.png',
'23-CAPTURE_20220427_233624_936.png',
'23-CAPTURE_20220427_233646_941.png',
'23-CAPTURE_20220427_233751_954.png',
'23-CAPTURE_20220427_234016_985.png',
'23-CAPTURE_20220427_234147_004.png',
'23-CAPTURE_20220523_230511_738.png',
'23-CAPTURE_20220523_233400_301.png',
'23-CAPTURE_20220523_233512_716.png',
'23-CAPTURE_20220523_233635_334.png',
'23-CAPTURE_20220523_233843_360.png',
'23-CAPTURE_20220523_234033_983.png',
'23-CAPTURE_20220523_234051_987.png',
'23-CAPTURE_20220620_234041_015.png']

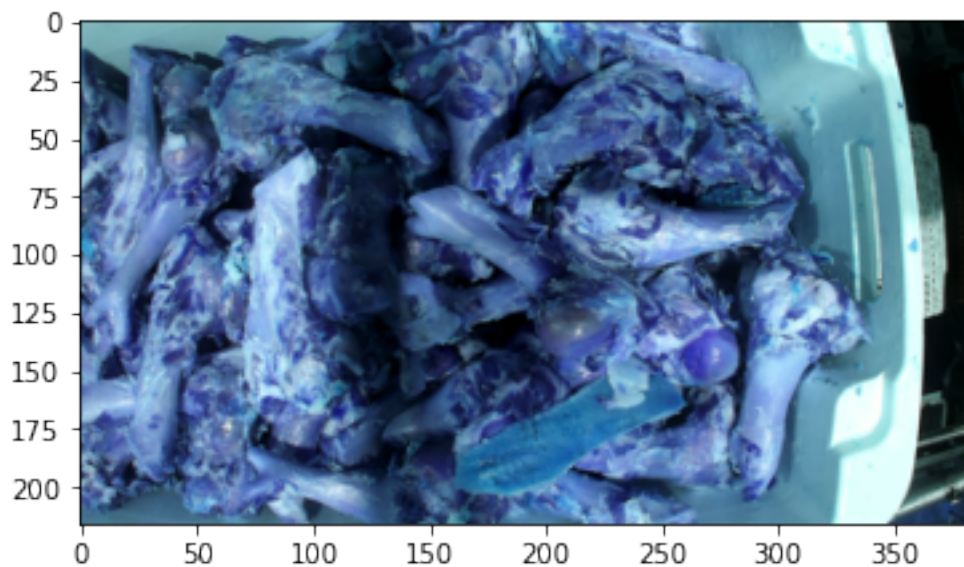
```
[34]: img = cv2.imread(os.path.join(data_dir, 'CLASS_02',  
    ↪ '05-CAPTURE_20220421_053226_860.png' ))
```

```
[35]: img.shape
```

```
[35]: (216, 384, 3)
```

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

```
[36]: <matplotlib.image.AxesImage at 0x152d24f9b20>
```



```
[37]: #Load Data
```

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

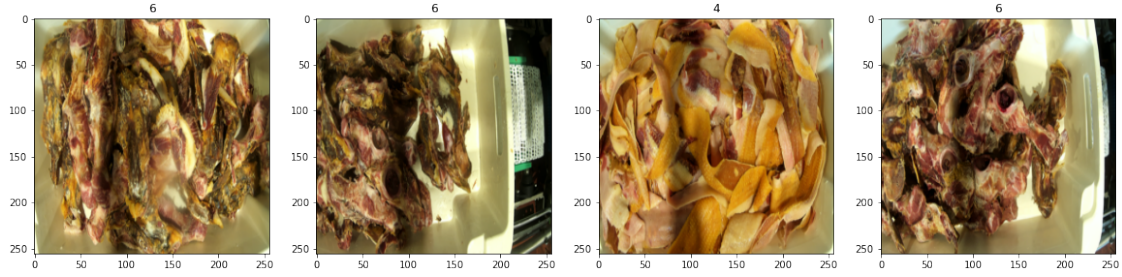
```
[39]: data = tf.keras.utils.image_dataset_from_directory(data_dir)
```

Found 1632 files belonging to 8 classes.

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

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

```
[43]: 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])
```



```
[44]: #Scale Data
```

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

```
[46]: data.as_numpy_iterator().next()
```

```
[46]: (array([[[[7.95098066e-01, 8.70588243e-01, 7.54901946e-01],
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```

[47]: *#Split Data*

```
[148]: train_size = int(len(data))
      val_size = int(len(data))
      test_size = int(len(data))
```

```
[149]: train_size
```

```
[149]: 51
```

```
[131]: val_size
```

```
[131]: 10
```

```
[132]: test_size
```

```
[132]: 5
```

```
[50]: train = data.take(train_size)
      val = data.skip(train_size).take(val_size)
      test = data.skip(train_size+val_size).take(test_size)
```

```
[51]: #Build a Deep Learning Model
```

```
[133]: train
```

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

```
[53]: from tensorflow.keras.models import Sequential
      from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dense, Flatten,
      ↪Dropout
```

```
[119]: model = Sequential()
```

```
[120]: model.add(Conv2D(32, (3,3), padding = "same", activation='relu',
      ↪input_shape=(256,256,3)))
      model.add(MaxPooling2D(pool_size=(2,2)))
      model.add(Conv2D(64, (3,3), activation='relu'))
      model.add(MaxPooling2D(pool_size=(2,2)))

      model.add(Flatten())
      model.add(Dense(256, activation='relu'))
      model.add(Dropout(0.5))
      model.add(Dense(8, activation='softmax'))
```

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

```
[139]: model.summary()
```

Model: "sequential_7"

Layer (type)	Output Shape	Param #
conv2d_26 (Conv2D)	(None, 256, 256, 32)	896
max_pooling2d_16 (MaxPooling2D)	(None, 128, 128, 32)	0
conv2d_27 (Conv2D)	(None, 126, 126, 64)	18496
max_pooling2d_17 (MaxPooling2D)	(None, 63, 63, 64)	0
flatten_7 (Flatten)	(None, 254016)	0
dense_14 (Dense)	(None, 256)	65028352
dropout_5 (Dropout)	(None, 256)	0
dense_15 (Dense)	(None, 8)	2056

=====
Total params: 65,049,800
Trainable params: 65,049,800
Non-trainable params: 0
=====

```
[140]: #Train
```

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

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

```
[145]: train
```

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

```
[144]: hist = model.fit(train, steps_per_epoch=250 ,epochs=20, validation_data=val)
```

Epoch 1/20

ValueError

Traceback (most recent call last)

Input In [144], in <cell line: 1>()

----> 1 hist =

```
model.fit(train, epochs=20, validation_data=val, callbacks=[tensorboard_callback])
```

File ~\anaconda3\lib\site-packages\keras\utils\traceback_utils.py:67, in

```
filter_traceback.<locals>.error_handler(*args, **kwargs)
```

```
65 except Exception as e: # pylint: disable=broad-except
```

```
66 filtered_tb = _process_traceback_frames(e.__traceback__)
```

---> 67 raise e.with_traceback(filtered_tb) from None

```
68 finally:
```

```
69 del filtered_tb
```

File ~\AppData\Local\Temp__autograph_generated_filelvud6gwt.py:15, in

```
outer_factory.<locals>.inner_factory.<locals>.tf__train_function(iterator)
```

```
13 try:
```

```
14     do_return = True
```

---> 15 retval_ = ag__.converted_call(ag__.ld(step_function), (ag__.

```
ld(self), ag__.ld(iterator)), None, fscope)
```

```
16 except:
```

```
17     do_return = False
```

ValueError: in user code:

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\training.py",  
line 1051, in train_function *
```

```
    return step_function(self, iterator)
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\training.py",  
line 1040, in step_function **
```

```
    outputs = model.distribute_strategy.run(run_step, args=(data,))
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\training.py",  
line 1030, in run_step **
```

```
    outputs = model.train_step(data)
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\training.py",  
line 890, in train_step
```

```
    loss = self.compute_loss(x, y, y_pred, sample_weight)
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\training.py",  
line 948, in compute_loss
```

```
    return self.compiled_loss(
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\engine\compile_utils  
py", line 201, in __call__
```

```
    loss_value = loss_obj(y_t, y_p, sample_weight=sw)
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\losses.py", line 139  
in __call__
```

```
    losses = call_fn(y_true, y_pred)
```

```
File "C:\Users\franc\anaconda3\lib\site-packages\keras\losses.py", line 243  
in call **
```

```
    return ag_fn(y_true, y_pred, **self._fn_kwargs)
```

```

File "C:\Users\franc\anaconda3\lib\site-packages\keras\losses.py", line
↪1787, in categorical_crossentropy
    return backend.categorical_crossentropy(
File "C:\Users\franc\anaconda3\lib\site-packages\keras\backend.py", line
↪5119, in categorical_crossentropy
    target.shape.assert_is_compatible_with(output.shape)

ValueError: Shapes (None, 1) and (None, 8) are incompatible

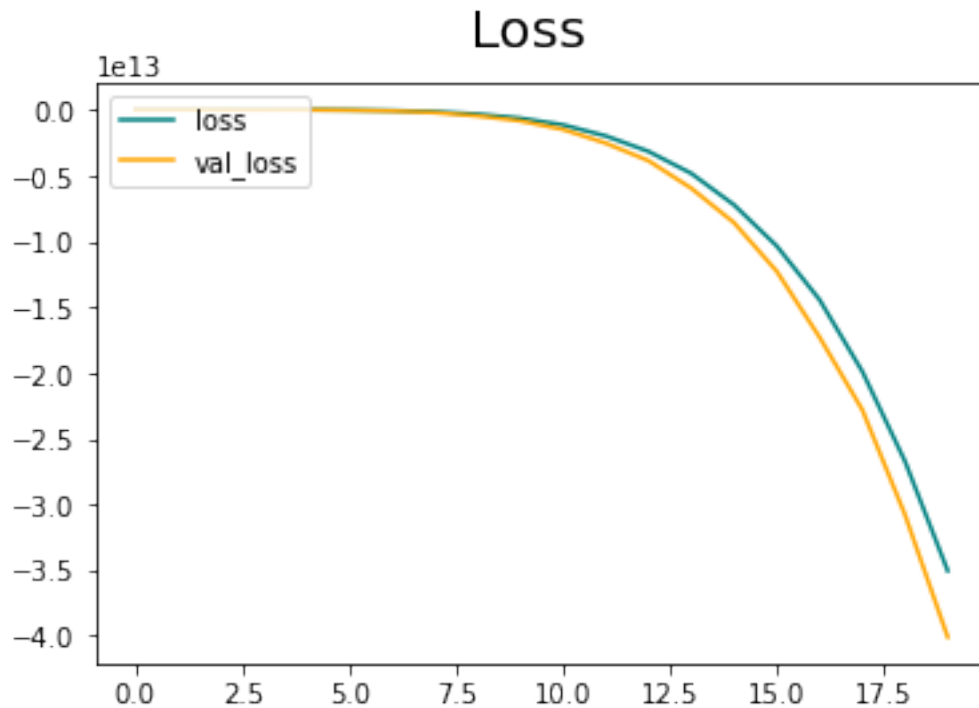
```

```
[62]: #Plot Performance
```

```

[63]: 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()

```



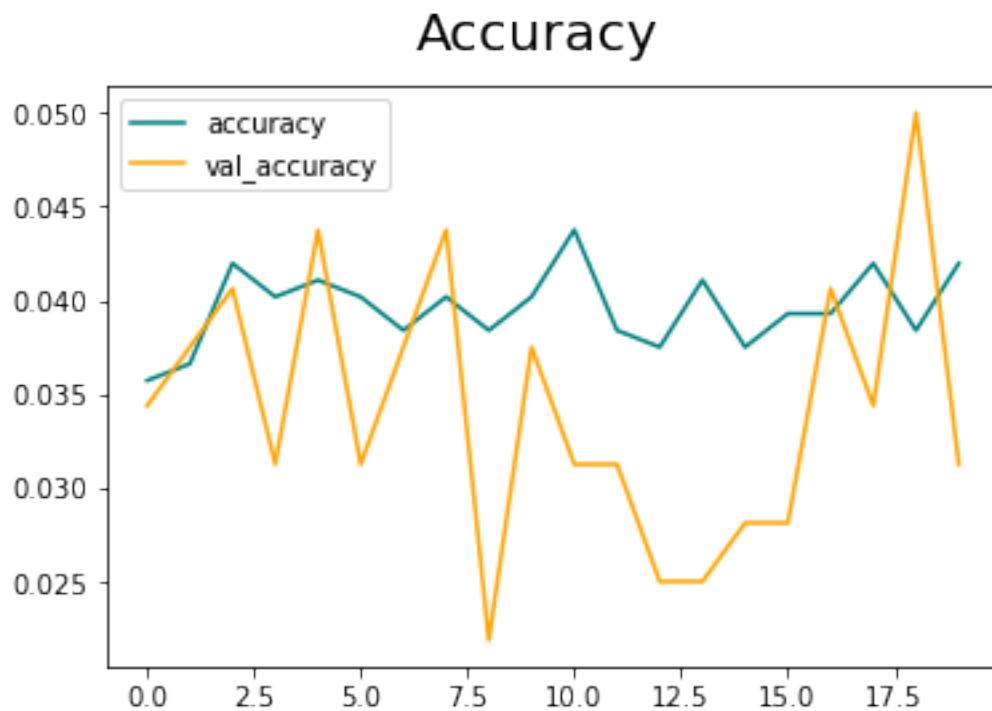
```

[64]: 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()
```



```
[65]: #Evaluate
```

```
[66]: from tensorflow.keras.metrics import Precision, Recall, BinaryAccuracy
```

```
[67]: pre = Precision()
      re = Recall()
      acc = BinaryAccuracy()
```

```
[68]: 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)
```

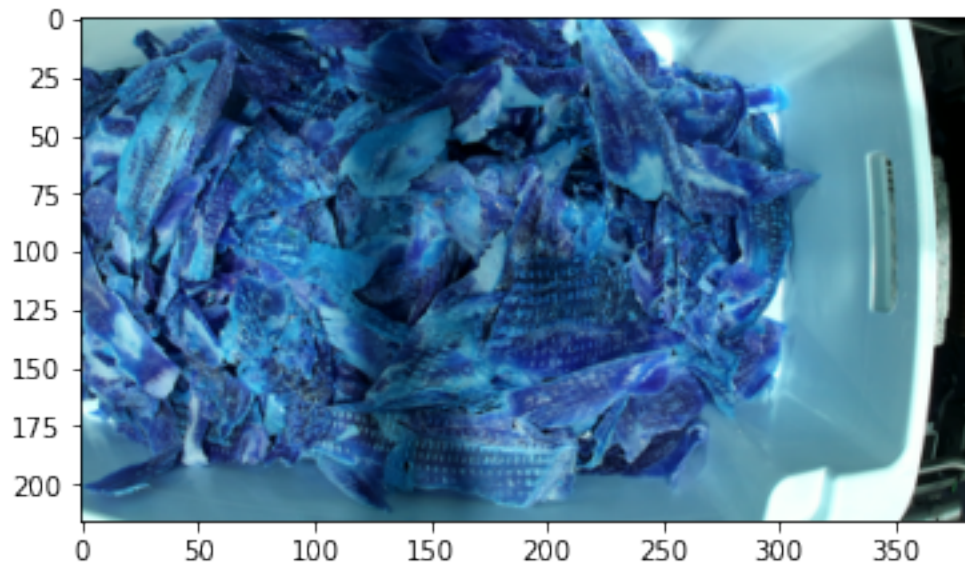
```
1/1 [=====] - 0s 174ms/step
1/1 [=====] - 0s 93ms/step
1/1 [=====] - 0s 92ms/step
1/1 [=====] - 0s 105ms/step
1/1 [=====] - 0s 112ms/step
```

```
[69]: print(pre.result(), re.result(), acc.result())
```

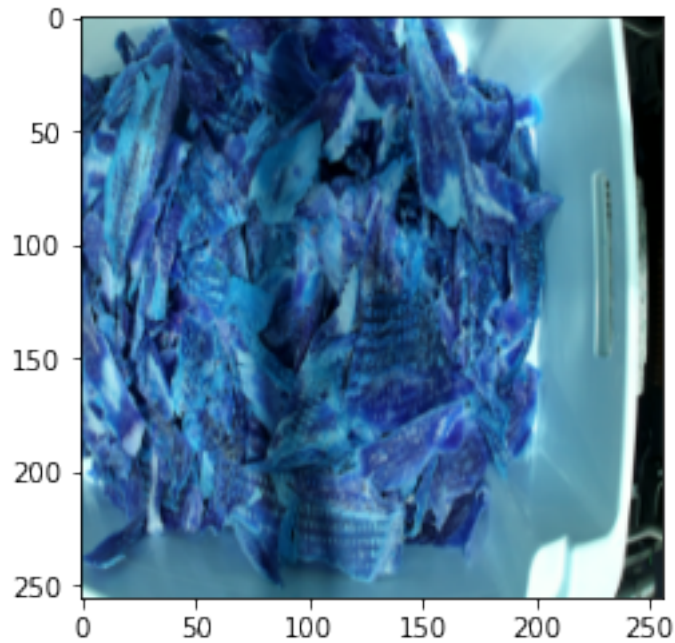
```
tf.Tensor(1.0, shape=(), dtype=float32) tf.Tensor(1.0, shape=(), dtype=float32)  
tf.Tensor(0.0375, shape=(), dtype=float32)
```

```
[70]: #Test
```

```
[77]: img = cv2.imread('clase3.png')  
plt.imshow(img)  
plt.show()
```



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



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

```
1/1 [=====] - 0s 19ms/step
```

```
[80]: yhat
```

```
[80]: array([[1.]], dtype=float32)
```

```
[81]: if yhat == 0:
      print("pred: 1")
      elif yhat == 1:
      print("pred: 2")
      elif yhat == 2:
      print("pred: 3")
      elif yhat == 3:
      print("pred: 4")
      elif yhat == 4:
      print("pred: 5")
      elif yhat == 5:
      print("pred: 6")
      elif yhat == 6:
      print("pred: 7")
      elif yhat == 7:
      print("pred: 8")
```

```
pred: 2
```

[]: