

```
In [ ]: %pip install ipykernel
        %pip install opencv-python
        %pip install keras
        %pip install scikit-learn
        %pip install tensorflow
        %pip install matplotlib
```

Requirement already satisfied: ipykernel in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (6.29.4)

Requirement already satisfied: comm>=0.1.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (0.2.2)

Requirement already satisfied: debugpy>=1.6.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (1.8.1)

Requirement already satisfied: ipython>=7.23.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (8.25.0)

Requirement already satisfied: jupyter-client>=6.1.12 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (8.6.2)

Requirement already satisfied: jupyter-core!=5.0.\*,>=4.12 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (5.7.2)

Requirement already satisfied: matplotlib-inline>=0.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (0.1.7)

Requirement already satisfied: nest-asyncio in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (1.6.0)

Requirement already satisfied: packaging in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (24.1)

Requirement already satisfied: psutil in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (5.9.8)

Requirement already satisfied: pyzmq>=24 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (26.0.3)

Requirement already satisfied: tornado>=6.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (6.4.1)

Requirement already satisfied: traitlets>=5.4.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipykernel) (5.14.3)

Requirement already satisfied: decorator in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (5.1.1)

Requirement already satisfied: jedi>=0.16 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (0.19.1)

Requirement already satisfied: prompt-toolkit<3.1.0,>=3.0.41 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (3.0.47)

Requirement already satisfied: pygments>=2.4.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (2.18.0)

Requirement already satisfied: stack-data in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (0.6.3)

Requirement already satisfied: exceptiongroup in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (1.2.1)

Requirement already satisfied: typing-extensions>=4.6 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (4.12.2)

Requirement already satisfied: pexpect>4.3 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from ipython>=7.23.1->ipykernel) (4.9.0)

Requirement already satisfied: python-dateutil>=2.8.2 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from jupyter-client>=6.1.12->ipykernel) (2.9.0.post0)

Requirement already satisfied: platformdirs>=2.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from jupyter-core!=5.0.\*,>=4.12->ipykernel) (4.2.2)

Requirement already satisfied: parso<0.9.0,>=0.8.3 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from jedi>=0.16->ipython>=7.23.1->ipykernel) (0.8.4)

Requirement already satisfied: ptyprocess>=0.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from pexpect>4.3->ipython>=7.23.1->ipykernel) (0.7.0)

Requirement already satisfied: wcwidth in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from prompt-toolkit<3.1.0,>=3.0.41->ipython>=7.23.1->ipykernel) (0.2.13)

Requirement already satisfied: six>=1.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from python-dateutil>=2.8.2->jupyter-client>=6.1.12->ipykernel) (1.16.0)

Requirement already satisfied: executing>=1.2.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel) (2.0.1)

Requirement already satisfied: asttokens>=2.1.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel) (2.4.1)

Requirement already satisfied: pure-eval in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from stack-data->ipython>=7.23.1->ipykernel) (0.2.2)

Note: you may need to restart the kernel to use updated packages.

Requirement already satisfied: opencv-python in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (4.10.0.82)

Requirement already satisfied: numpy>=1.21.2 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicasPercepcionComputacional/.venv/lib/python3.10/site-packages (from opencv-python) (1.26.4)

Note: you may need to restart the kernel to use updated packages.

Requirement already satisfied: keras in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (3.3.3)

Requirement already satisfied: absl-py in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (2.1.0)

Requirement already satisfied: numpy in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (1.26.4)

Requirement already satisfied: rich in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (13.7.1)

Requirement already satisfied: namex in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (0.0.8)

Requirement already satisfied: h5py in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (3.11.0)

Requirement already satisfied: optree in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (0.11.0)

Requirement already satisfied: ml-dtypes in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from keras) (0.3.2)

Requirement already satisfied: typing-extensions>=4.0.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from optree->keras) (4.12.2)

Requirement already satisfied: markdown-it-py>=2.2.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from rich->keras) (3.0.0)

Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from rich->keras) (2.18.0)

Requirement already satisfied: mdurl~=0.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from markdown-it-py>=2.2.0->rich->keras) (0.1.2)

Note: you may need to restart the kernel to use updated packages.

Requirement already satisfied: scikit-learn in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (1.5.0)

Requirement already satisfied: numpy>=1.19.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from scikit-learn) (1.26.4)

Requirement already satisfied: scipy>=1.6.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from scikit-learn) (1.13.1)

Requirement already satisfied: joblib>=1.2.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from scikit-learn) (1.4.2)

Requirement already satisfied: threadpoolctl>=3.1.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspercepcionComputacional/.venv/lib/python3.10/site-packages (from scikit-lear

n) (3.5.0)

Note: you may need to restart the kernel to use updated packages.

Requirement already satisfied: tensorflow in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (2.16.1)

Requirement already satisfied: absl-py>=1.0.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(2.1.0)

Requirement already satisfied: astunparse>=1.6.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(1.6.3)

Requirement already satisfied: flatbuffers>=23.5.26 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(24.3.25)

Requirement already satisfied: gast!=0.5.0,!0.5.1,!0.5.2,>=0.2.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (0.5.4)

Requirement already satisfied: google-pasta>=0.1.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(0.2.0)

Requirement already satisfied: h5py>=3.10.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (3.11.0)

Requirement already satisfied: libclang>=13.0.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (18.1.1)

(18.1.1)

Requirement already satisfied: ml-dtypes~=0.3.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(0.3.2)

Requirement already satisfied: opt-einsum>=2.3.2 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(3.3.0)

Requirement already satisfied: packaging in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (24.1)

Requirement already satisfied: protobuf!=4.21.0,!4.21.1,!4.21.2,!4.21.3,!4.21.4,!4.21.5,<5.0.0dev,>=3.20.3 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (4.25.3)

Requirement already satisfied: requests<3,>=2.21.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(2.32.3)

Requirement already satisfied: setuptools in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (70.0.0)

Requirement already satisfied: six>=1.12.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (1.16.0)

Requirement already satisfied: termcolor>=1.1.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow)

(2.4.0)

Requirement already satisfied: typing-extensions>=3.6.6 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (4.12.2)

Requirement already satisfied: wrapt>=1.11.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (1.16.0)

Requirement already satisfied: grpcio<2.0,>=1.24.3 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (1.64.1)

Requirement already satisfied: tensorboard<2.17,>=2.16 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (2.16.2)

Requirement already satisfied: keras>=3.0.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (3.3.3)

Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (0.37.0)

Requirement already satisfied: numpy<2.0.0,>=1.23.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorflow) (1.26.4)

Requirement already satisfied: wheel<1.0,>=0.23.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from astunparse>=1.6.0->tensorflow) (0.43.0)

Requirement already satisfied: rich in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from keras>=3.0.0->tensorflow) (13.7.1)

Requirement already satisfied: namex in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from keras>=3.0.0->tensorflow) (0.0.8)

Requirement already satisfied: optree in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from keras>=3.0.0->tensorflow) (0.11.0)

Requirement already satisfied: charset-normalizer<4,>=2 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from requests<3,>=2.21.0->tensorflow) (3.3.2)

Requirement already satisfied: idna<4,>=2.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from requests<3,>=2.21.0->tensorflow) (3.7)

Requirement already satisfied: urllib3<3,>=1.21.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from requests<3,>=2.21.0->tensorflow) (2.2.1)

Requirement already satisfied: certifi>=2017.4.17 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicaspPercepcionComputacional/.venv/lib/python3.10/site-packages (from requests<3,>=2.21.0->tensorflow) (2024.6.2)

Requirement already satisfied: markdown>=2.6.8 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorboard<2.17,>=2.16->tensorflow) (3.6)

Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorboard<2.17,>=2.16->tensorflow) (0.7.2)

Requirement already satisfied: werkzeug>=1.0.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from tensorboard<2.17,>=2.16->tensorflow) (3.0.3)

Requirement already satisfied: MarkupSafe>=2.1.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from werkzeug>=1.0.1->tensorboard<2.17,>=2.16->tensorflow) (2.1.5)

Requirement already satisfied: markdown-it-py>=2.2.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from rich->keras>=3.0.0->tensorflow) (3.0.0)

Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from rich->keras>=3.0.0->tensorflow) (2.18.0)

Requirement already satisfied: mdurl~0.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from markdown-it-py>=2.2.0->rich->keras>=3.0.0->tensorflow) (0.1.2)

Note: you may need to restart the kernel to use updated packages.

Requirement already satisfied: matplotlib in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (3.9.0)

Requirement already satisfied: contourpy>=1.0.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (1.2.1)

Requirement already satisfied: cycler>=0.10 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (0.12.1)

Requirement already satisfied: fonttools>=4.22.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (4.53.0)

Requirement already satisfied: kiwisolver>=1.3.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (1.4.5)

Requirement already satisfied: numpy>=1.23 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (1.26.4)

Requirement already satisfied: packaging>=20.0 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (24.1)

Requirement already satisfied: pillow>=8 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (10.3.0)

Requirement already satisfied: pyparsing>=2.3.1 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicapercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib)

(3.1.2)

Requirement already satisfied: python-dateutil>=2.7 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from matplotlib) (2.9.0.post0)

Requirement already satisfied: six>=1.5 in /home/walmache/MEGA/autoCapacitacion/Maestria-IA/1.percepcionComputacional/repos/practicassPercepcionComputacional/.venv/lib/python3.10/site-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)

Note: you may need to restart the kernel to use updated packages.

```
In [ ]: import os
import cv2
import numpy as np
from keras.applications import VGG16
from keras.models import Sequential
from keras.layers import Dense, Flatten
from keras.utils import to_categorical
from sklearn.model_selection import train_test_split
from tensorflow.keras.layers import Dropout
from tensorflow.keras.callbacks import EarlyStopping
```

```
In [ ]: def load_images(folder):
    images = []
    labels = []
    for filename in os.listdir(folder):
        img = cv2.imread(os.path.join(folder, filename))
        if img is not None:
            img = cv2.resize(img, (224, 224)) # Cambiamos la dimensión p
            images.append(img)
            if 'Wilfrido' in folder:
                labels.append(1)
            elif 'Otros' in folder:
                labels.append(0)
    return images, labels

dogs_images, dogs_labels = load_images('Data/Wilfrido')
cats_images, cats_labels = load_images('Data/Otros')

# Combinamos los arrays de perros y gatos
images = np.array(dogs_images + cats_images)
labels = np.array(dogs_labels + cats_labels)

# One-hot encoding de las etiquetas
labels = to_categorical(labels)
```

```
In [ ]: X_train, X_test, y_train, y_test = train_test_split(images, labels, test_
```

```
In [ ]: # Definimos el callback de EarlyStopping
early_stopping = EarlyStopping(monitor='val_loss', patience=3)
```

```
In [ ]: # Cargamos la red VGG16, asegurándonos de que se dejan fuera las capas su
baseModel = VGG16(weights="imagenet", include_top=False, input_shape=(224

# Construimos la capa que se colocará en la parte superior del modelo bas
model = Sequential()
model.add(baseModel)
model.add(Flatten())
model.add(Dense(256, activation='relu'))
```



```

model.add(Dropout(0.5)) # Agregamos una capa de Dropout con una tasa de
model.add(Dense(2, activation='softmax')) # Dos clases (perro y gato), p

# Congelamos las capas del modelo base para que no se actualicen durante
for layer in baseModel.layers:
    layer.trainable = False

# Compilamos el modelo
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=

# Entrenamos el modelo
model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=4, b

# Evaluamos el modelo
loss, accuracy = model.evaluate(X_test, y_test)
print(f'Loss: {loss}')
print(f'Accuracy: {accuracy}')

```

Epoch 1/4

14/14 ————— 110s 8s/step - accuracy: 0.8278 - loss: 4.9977  
- val\_accuracy: 0.9907 - val\_loss: 2.3960

Epoch 2/4

14/14 ————— 107s 8s/step - accuracy: 1.0000 - loss: 0.0000e  
+00 - val\_accuracy: 0.9907 - val\_loss: 1.5743

Epoch 3/4

14/14 ————— 111s 8s/step - accuracy: 0.9995 - loss: 0.0025  
- val\_accuracy: 0.9907 - val\_loss: 1.0092

Epoch 4/4

14/14 ————— 109s 8s/step - accuracy: 0.9982 - loss: 0.0970  
- val\_accuracy: 0.9907 - val\_loss: 0.9342

4/4 ————— 22s 5s/step - accuracy: 0.9911 - loss: 0.8991

Loss: 0.9341806769371033

Accuracy: 0.9907407164573669

```

In [ ]: # Exportamos en modelo
model.save('modelo_clasificacion_perros_gatos.h5')

```

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save\_model(model)`. This file format is considered legacy . We recommend using instead the native Keras format, e.g. `model.save('my\_model.keras')` or `keras.saving.save\_model(model, 'my\_model.keras')`.

```

In [ ]: # Cargamos el modelo
from keras.models import load_model
model_cargado = load_model('modelo_clasificacion_perros_gatos.h5')

```

WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile\_metrics` will be empty until you train or evaluate the model.

```

In [ ]: # Hacemos una predicción con una nueva imagen para comprobar que el model
target='actor.jpg'
#target='wilfrido3.jpg'
img = cv2.imread(target)
img = cv2.resize(img, (224, 224))
img = np.expand_dims(img, axis=0)
pred = model.predict(img)
print(pred)

```

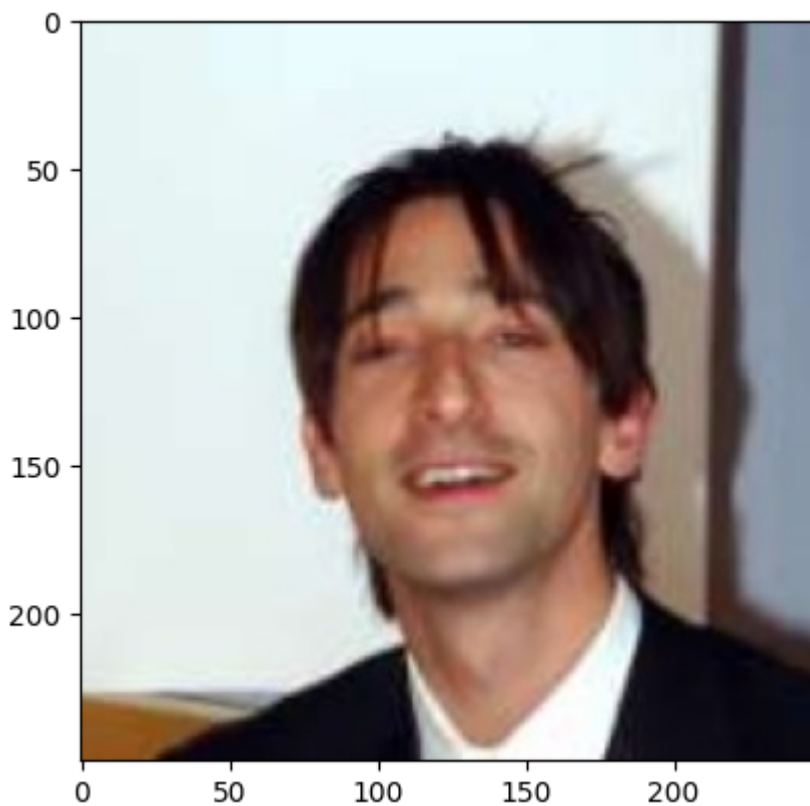
```
1/1 ————— 0s 190ms/step
[[1. 0.]]
1/1 ————— 0s 190ms/step
[[1. 0.]]
```

```
In [ ]: # Mostramos la etiqueta de la predicción
if pred[0][0] > pred[0][1]:
    print('Otros')
else:
    print('Wilfrido')

# Mostramos la imagen con la etiqueta en el notebook
import matplotlib.pyplot as plt
img = cv2.imread(target)
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
```

Otros

```
Out [ ]: <matplotlib.image.AxesImage at 0x7a3f415ef1c0>
```



```
In [ ]: # Hacemos una predicción con una nueva imagen para comprobar que el model
#target='imagenPerro.jpg'
target='estatua.jpg'
img = cv2.imread(target)
img = cv2.resize(img, (224, 224))
img = np.expand_dims(img, axis=0)
pred = model.predict(img)
print(pred)
```

```
1/1 ————— 0s 154ms/step
[[1. 0.]]
1/1 ————— 0s 154ms/step
[[1. 0.]]
```

```
In [ ]: # Mostramos la etiqueta de la predicción
if pred[0][0] > pred[0][1]:
```

```
    print('Otros')
else:
    print('Wilfrido')

# Mostramos la imagen con la etiqueta en el notebook
import matplotlib.pyplot as plt
img = cv2.imread(target)
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
```

Otros

Out[ ]: <matplotlib.image.AxesImage at 0x7a3f41762650>



```
In [ ]: # Hacemos una predicci3n con una nueva imagen para comprobar que el model
#target='imagenPerro.jpg'
target='fotoNoCarpeta.jpg'
img = cv2.imread(target)
img = cv2.resize(img, (224, 224))
img = np.expand_dims(img, axis=0)
pred = model.predict(img)
print(pred)
```

1/1 ————— 0s 155ms/step

[[0. 1.]]

1/1 ————— 0s 155ms/step

[[0. 1.]]

```
In [ ]: # Mostramos la etiqueta de la predicci3n
if pred[0][0] > pred[0][1]:
    print('Otros')
else:
    print('Wilfrido')

# Mostramos la imagen con la etiqueta en el notebook
import matplotlib.pyplot as plt
img = cv2.imread(target)
```

```
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
```

Wilfrido

Out[ ]: <matplotlib.image.AxesImage at 0x7a3f417e1f00>

