Elfonze@raspberrypi:~ $ sudo apt install python3-venv

Reading package lists... Done

Building dependency tree... Done

Reading state information... Done

python3-venv is already the newest version (3.11.2-1+b1).

0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

Elfonze@raspberrypi:~ $ python3 -m venv path/to/venv

Elfonze@raspberrypi:~ $ source path/to/venv/bin/activate

(venv) Elfonze@raspberrypi:~ $ pip install tensorflow

Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple

Collecting tensorflow

Downloading tensorflow-2.15.0-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (2.2 kB)

Collecting tensorflow-cpu-aws==2.15.0

Downloading tensorflow\_cpu\_aws-2.15.0-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (211.9 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 211.9/211.9 MB 410.6 kB/s eta 0:00:00

Collecting absl-py>=1.0.0

Downloading https://www.piwheels.org/simple/absl-py/absl\_py-2.0.0-py3-none-any.whl (130 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 130.2/130.2 kB 195.7 kB/s eta 0:00:00

Collecting astunparse>=1.6.0

Downloading https://www.piwheels.org/simple/astunparse/astunparse-1.6.3-py2.py3-none-any.whl (12 kB)

Collecting flatbuffers>=23.5.26

Downloading https://www.piwheels.org/simple/flatbuffers/flatbuffers-20181003210633-py2.py3-none-any.whl (14 kB)

Collecting gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1

Downloading https://www.piwheels.org/simple/gast/gast-0.5.4-py3-none-any.whl (19 kB)

Collecting google-pasta>=0.1.1

Downloading https://www.piwheels.org/simple/google-pasta/google\_pasta-0.2.0-py3-none-any.whl (57 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 57.5/57.5 kB 167.0 kB/s eta 0:00:00

Collecting h5py>=2.9.0

Downloading h5py-3.10.0-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (9.1 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 9.1/9.1 MB 535.7 kB/s eta 0:00:00

Collecting libclang>=13.0.0

Downloading libclang-16.0.6-1-py2.py3-none-manylinux2014\_aarch64.whl (22.2 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 22.2/22.2 MB 450.0 kB/s eta 0:00:00

Collecting ml-dtypes~=0.2.0

Downloading ml\_dtypes-0.2.0-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (1.0 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.0/1.0 MB 619.4 kB/s eta 0:00:00

Collecting numpy<2.0.0,>=1.23.5

Downloading numpy-1.26.2-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (14.2 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 14.2/14.2 MB 624.9 kB/s eta 0:00:00

Collecting opt-einsum>=2.3.2

Downloading https://www.piwheels.org/simple/opt-einsum/opt\_einsum-3.3.0-py3-none-any.whl (65 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 65.5/65.5 kB 266.8 kB/s eta 0:00:00

Collecting packaging

Downloading https://www.piwheels.org/simple/packaging/packaging-23.2-py3-none-any.whl (53 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 53.0/53.0 kB 1.8 MB/s eta 0:00:00

Collecting 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

Downloading protobuf-4.25.1-cp37-abi3-manylinux2014\_aarch64.whl (293 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 293.7/293.7 kB 517.2 kB/s eta 0:00:00

Requirement already satisfied: setuptools in ./path/to/venv/lib/python3.11/site-packages (from tensorflow-cpu-aws==2.15.0->tensorflow) (66.1.1)

Collecting six>=1.12.0

Downloading https://www.piwheels.org/simple/six/six-1.16.0-py2.py3-none-any.whl (11 kB)

Collecting termcolor>=1.1.0

Downloading https://www.piwheels.org/simple/termcolor/termcolor-2.4.0-py3-none-any.whl (7.7 kB)

Collecting typing-extensions>=3.6.6

Downloading https://www.piwheels.org/simple/typing-extensions/typing\_extensions-4.9.0-py3-none-any.whl (32 kB)

Collecting wrapt<1.15,>=1.11.0

Downloading wrapt-1.14.1-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (78 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 78.5/78.5 kB 561.1 kB/s eta 0:00:00

Collecting tensorflow-io-gcs-filesystem>=0.23.1

Downloading tensorflow\_io\_gcs\_filesystem-0.35.0-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (3.0 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 3.0/3.0 MB 559.6 kB/s eta 0:00:00

Collecting grpcio<2.0,>=1.24.3

Downloading grpcio-1.60.0-cp311-cp311-manylinux\_2\_17\_aarch64.whl (5.1 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.1/5.1 MB 680.6 kB/s eta 0:00:00

Collecting tensorboard<2.16,>=2.15

Downloading tensorboard-2.15.1-py3-none-any.whl (5.5 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.5/5.5 MB 630.7 kB/s eta 0:00:00

Collecting tensorflow-estimator<2.16,>=2.15.0

Downloading tensorflow\_estimator-2.15.0-py2.py3-none-any.whl (441 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 442.0/442.0 kB 533.6 kB/s eta 0:00:00

Collecting keras<2.16,>=2.15.0

Downloading https://www.piwheels.org/simple/keras/keras-2.15.0-py3-none-any.whl (1.7 MB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.7/1.7 MB 113.4 kB/s eta 0:00:00

Collecting wheel<1.0,>=0.23.0

Downloading https://www.piwheels.org/simple/wheel/wheel-0.42.0-py3-none-any.whl (65 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 65.4/65.4 kB 260.6 kB/s eta 0:00:00

Collecting google-auth<3,>=1.6.3

Downloading https://www.piwheels.org/simple/google-auth/google\_auth-2.25.2-py2.py3-none-any.whl (184 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 184.2/184.2 kB 45.5 kB/s eta 0:00:00

Collecting google-auth-oauthlib<2,>=0.5

Downloading https://www.piwheels.org/simple/google-auth-oauthlib/google\_auth\_oauthlib-1.2.0-py2.py3-none-any.whl (23 kB)

Collecting markdown>=2.6.8

Downloading https://www.piwheels.org/simple/markdown/Markdown-3.5.1-py3-none-any.whl (102 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 102.2/102.2 kB 283.3 kB/s eta 0:00:00

Collecting 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

Downloading protobuf-4.23.4-cp37-abi3-manylinux2014\_aarch64.whl (303 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 303.5/303.5 kB 617.6 kB/s eta 0:00:00

Collecting requests<3,>=2.21.0

Downloading https://www.piwheels.org/simple/requests/requests-2.31.0-py3-none-any.whl (62 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 62.6/62.6 kB 306.9 kB/s eta 0:00:00

Collecting tensorboard-data-server<0.8.0,>=0.7.0

Downloading tensorboard\_data\_server-0.7.2-py3-none-any.whl (2.4 kB)

Collecting werkzeug>=1.0.1

Downloading https://www.piwheels.org/simple/werkzeug/werkzeug-3.0.1-py3-none-any.whl (226 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 226.7/226.7 kB 243.2 kB/s eta 0:00:00

Collecting cachetools<6.0,>=2.0.0

Downloading https://www.piwheels.org/simple/cachetools/cachetools-5.3.2-py3-none-any.whl (9.3 kB)

Collecting pyasn1-modules>=0.2.1

Downloading https://www.piwheels.org/simple/pyasn1-modules/pyasn1\_modules-0.3.0-py2.py3-none-any.whl (181 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 181.3/181.3 kB 214.8 kB/s eta 0:00:00

Collecting rsa<5,>=3.1.4

Downloading rsa-4.9-py3-none-any.whl (34 kB)

Collecting requests-oauthlib>=0.7.0

Downloading https://www.piwheels.org/simple/requests-oauthlib/requests\_oauthlib-1.3.1-py2.py3-none-any.whl (28 kB)

Collecting charset-normalizer<4,>=2

Downloading charset\_normalizer-3.3.2-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (136 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 136.6/136.6 kB 759.4 kB/s eta 0:00:00

Collecting idna<4,>=2.5

Downloading https://www.piwheels.org/simple/idna/idna-3.6-py3-none-any.whl (61 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.6/61.6 kB 304.6 kB/s eta 0:00:00

Collecting urllib3<3,>=1.21.1

Downloading https://www.piwheels.org/simple/urllib3/urllib3-2.1.0-py3-none-any.whl (104 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 104.6/104.6 kB 288.6 kB/s eta 0:00:00

Collecting certifi>=2017.4.17

Downloading https://www.piwheels.org/simple/certifi/certifi-2023.11.17-py3-none-any.whl (162 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 162.5/162.5 kB 262.0 kB/s eta 0:00:00

Collecting MarkupSafe>=2.1.1

Downloading MarkupSafe-2.1.3-cp311-cp311-manylinux\_2\_17\_aarch64.manylinux2014\_aarch64.whl (28 kB)

Collecting pyasn1<0.6.0,>=0.4.6

Downloading https://www.piwheels.org/simple/pyasn1/pyasn1-0.5.1-py2.py3-none-any.whl (84 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 84.9/84.9 kB 181.1 kB/s eta 0:00:00

Collecting oauthlib>=3.0.0

Downloading https://www.piwheels.org/simple/oauthlib/oauthlib-3.2.2-py3-none-any.whl (151 kB)

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 151.7/151.7 kB 215.3 kB/s eta 0:00:00

Installing collected packages: libclang, flatbuffers, wrapt, wheel, urllib3, typing-extensions, termcolor, tensorflow-io-gcs-filesystem, tensorflow-estimator, tensorboard-data-server, six, pyasn1, protobuf, packaging, oauthlib, numpy, MarkupSafe, markdown, keras, idna, grpcio, gast, charset-normalizer, certifi, cachetools, absl-py, werkzeug, rsa, requests, pyasn1-modules, opt-einsum, ml-dtypes, h5py, google-pasta, astunparse, requests-oauthlib, google-auth, google-auth-oauthlib, tensorboard, tensorflow-cpu-aws, tensorflow

Successfully installed MarkupSafe-2.1.3 absl-py-2.0.0 astunparse-1.6.3 cachetools-5.3.2 certifi-2023.11.17 charset-normalizer-3.3.2 flatbuffers-20181003210633 gast-0.5.4 google-auth-2.25.2 google-auth-oauthlib-1.2.0 google-pasta-0.2.0 grpcio-1.60.0 h5py-3.10.0 idna-3.6 keras-2.15.0 libclang-16.0.6 markdown-3.5.1 ml-dtypes-0.2.0 numpy-1.26.2 oauthlib-3.2.2 opt-einsum-3.3.0 packaging-23.2 protobuf-4.23.4 pyasn1-0.5.1 pyasn1-modules-0.3.0 requests-2.31.0 requests-oauthlib-1.3.1 rsa-4.9 six-1.16.0 tensorboard-2.15.1 tensorboard-data-server-0.7.2 tensorflow-2.15.0 tensorflow-cpu-aws-2.15.0 tensorflow-estimator-2.15.0 tensorflow-io-gcs-filesystem-0.35.0 termcolor-2.4.0 typing-extensions-4.9.0 urllib3-2.1.0 werkzeug-3.0.1 wheel-0.42.0 wrapt-1.14.1

(venv) Elfonze@raspberrypi:~ $ python3

Python 3.11.2 (main, Mar 13 2023, 12:18:29) [GCC 12.2.0] on linux

Type "help", "copyright", "credits" or "license" for more information.

>>> import tensorflow as tf

>>> print(tf.\_\_version\_\_)

2.15.0

>>>

>>>

Add python code and save name.py extension

Go back

(venv) Elfonze@raspberrypi:~ $ ls

Bookshelf Documents Music Pictures Templates tensorflow.txt tf\_example.py Videos

Desktop Downloads path Public tensor\_flow\_ex\_try.py tensor.py tf\_example.py.save

(venv) Elfonze@raspberrypi:~ $ python3 tensor\_flow\_ex\_try.py

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-labels-idx1-ubyte.gz

29515/29515 [==============================] - 0s 1us/step

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-images-idx3-ubyte.gz

26421880/26421880 [==============================] - 14s 1us/step

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-labels-idx1-ubyte.gz

5148/5148 [==============================] - 0s 0us/step

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-images-idx3-ubyte.gz

4422102/4422102 [==============================] - 2s 0us/step

Model: "sequential"

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Layer (type) Output Shape Param #

=================================================================

dense (Dense) (None, 128) 100480

dropout (Dropout) (None, 128) 0

dense\_1 (Dense) (None, 10) 1290

=================================================================

=================================================================

Total params: 101770 (397.54 KB)

Trainable params: 101770 (397.54 KB)

Non-trainable params: 0 (0.00 Byte)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Epoch 1/5

1875/1875 [==============================] - 25s 13ms/step - loss: 0.5274 - sparse\_categorical\_accuracy: 0.8136

Epoch 2/5

1875/1875 [==============================] - 23s 12ms/step - loss: 0.4006 - sparse\_categorical\_accuracy: 0.8555

Epoch 3/5

1875/1875 [==============================] - 23s 12ms/step - loss: 0.3655 - sparse\_categorical\_accuracy: 0.8658

Epoch 4/5

1875/1875 [==============================] - 23s 12ms/step - loss: 0.3467 - sparse\_categorical\_accuracy: 0.8728

Epoch 5/5

1875/1875 [==============================] - 23s 12ms/step - loss: 0.3300 - sparse\_categorical\_accuracy: 0.8782

313/313 [==============================] - 2s 5ms/step - loss: 0.3575 - sparse\_categorical\_accuracy: 0.8739

Test accuracy: 0.8738999962806702