

```
pi@raspberrypi:~ $ sudo apt update
Get:1 http://archive.raspberrypi.org/debian buster InRelease [32.6 kB]
Get:2 http://raspbian.raspberrypi.org/raspbian buster InRelease [15.0 kB]
Get:3 http://raspbian.raspberrypi.org/raspbian buster/main armhf Packages [13.0 MB]
Get:4 http://archive.raspberrypi.org/debian buster/main armhf Packages [393 kB]
Fetched 13.5 MB in 7s (1,971 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
183 packages can be upgraded. Run 'apt list --upgradable' to see them.
N: Repository 'http://archive.raspberrypi.org/debian buster InRelease' changed its 'Suite' value from 'testing' to 'oldstable'
pi@raspberrypi:~ $ sudo apt install python3-scipy
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  python3-decorator
Suggested packages:
  python-scipy-doc
The following NEW packages will be installed:
  python3-decorator python3-scipy
0 upgraded, 2 newly installed, 0 to remove and 183 not upgraded.
Need to get 8,925 kB of archives.
After this operation, 38.0 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-decorator all 4.3.0-1.1 [14.5 kB]
Get:2 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-scipy armhf 1.1.0-7 [8,910 kB]
Fetched 8,925 kB in 1s (9,921 kB/s)
Selecting previously unselected package python3-decorator.
(Reading database ... 104610 files and directories currently installed.)
Preparing to unpack .../python3-decorator_4.3.0-1.1_all.deb ...
Unpacking python3-decorator (4.3.0-1.1) ...
Selecting previously unselected package python3-scipy.
Preparing to unpack .../python3-scipy_1.1.0-7_armhf.deb ...
Unpacking python3-scipy (1.1.0-7) ...
Setting up python3-decorator (4.3.0-1.1) ...
Setting up python3-scipy (1.1.0-7) ...
pi@raspberrypi:~ $ sudo apt install python3-matplotlib
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  fonts-lyx libjs-jquery-ui python-matplotlib-data python3-cycler python3-dateutil python3-kiwisolver
  python3-pyparsing ttf-bitstream-vera
Suggested packages:
  libjs-jquery-ui-docs python-cycler-doc dvipng inkscape ipython3 python-matplotlib-doc
  python3-cairocffi python3-gi-cairo python3-gobject python3-nose python3-pyqt4 python3-sip
  python3-tornado texlive-extra-utils texlive-latex-extra ttf-staypuft python-pyparsing-doc
The following NEW packages will be installed:
  fonts-lyx libjs-jquery-ui python-matplotlib-data python3-cycler python3-dateutil python3-kiwisolver
  python3-matplotlib python3-pyparsing ttf-bitstream-vera
0 upgraded, 9 newly installed, 0 to remove and 183 not upgraded.
Need to get 10.4 MB of archives.
After this operation, 28.9 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://raspbian.mirror.constant.com/raspbian buster/main armhf fonts-lyx all 2.3.2-1 [199 kB]
Get:2 http://raspbian.mirror.constant.com/raspbian buster/main armhf libjs-jquery-ui all 1.12.1+dfsg-5 [232 kB]
Get:3 http://raspbian.mirror.constant.com/raspbian buster/main armhf ttf-bitstream-vera all 1.10-8 [352 kB]
Get:4 http://raspbian.mirror.constant.com/raspbian buster/main armhf python-matplotlib-data all 3.0.2-2 [4,138 kB]
Get:5 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-cycler all 0.10.0-1 [7,556 B]
Get:6 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-dateutil all 2.7.3-3 [64.5 kB]
Get:7 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-kiwisolver armhf 1.0.1-2+b1 [53.3 kB]
Get:8 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-pyparsing all 2.2.0+dfsg1-2 [89.6 kB]
Get:9 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-matplotlib armhf 3.0.2-2 [5,282 kB]
Fetched 10.4 MB in 3s (3,901 kB/s)
Selecting previously unselected package fonts-lyx.
(Reading database ... 105625 files and directories currently installed.)
Preparing to unpack .../0-fonts-lyx_2.3.2-1_all.deb ...
Unpacking fonts-lyx (2.3.2-1) ...
Selecting previously unselected package libjs-jquery-ui.
Preparing to unpack .../1-libjs-jquery-ui_1.12.1+dfsg-5_all.deb ...
Unpacking libjs-jquery-ui (1.12.1+dfsg-5) ...
Selecting previously unselected package ttf-bitstream-vera.
Preparing to unpack .../2-ttf-bitstream-vera_1.10-8_all.deb ...
Unpacking ttf-bitstream-vera (1.10-8) ...
Selecting previously unselected package python-matplotlib-data.
Preparing to unpack .../3-python-matplotlib-data_3.0.2-2_all.deb ...
Unpacking python-matplotlib-data (3.0.2-2) ...
Selecting previously unselected package python3-cycler.
Preparing to unpack .../4-python3-cycler_0.10.0-1_all.deb ...
Unpacking python3-cycler (0.10.0-1) ...
Selecting previously unselected package python3-dateutil.
Preparing to unpack .../5-python3-dateutil_2.7.3-3_all.deb ...
Unpacking python3-dateutil (2.7.3-3) ...
Selecting previously unselected package python3-kiwisolver.
Preparing to unpack .../6-python3-kiwisolver_1.0.1-2+b1_armhf.deb ...
Unpacking python3-kiwisolver (1.0.1-2+b1) ...
Selecting previously unselected package python3-pyparsing.
Preparing to unpack .../7-python3-pyparsing_2.2.0+dfsg1-2_all.deb ...
Unpacking python3-pyparsing (2.2.0+dfsg1-2) ...
Selecting previously unselected package python3-matplotlib.
Preparing to unpack .../8-python3-matplotlib_3.0.2-2_armhf.deb ...
Unpacking python3-matplotlib (3.0.2-2) ...
Setting up ttf-bitstream-vera (1.10-8) ...
Setting up fonts-lyx (2.3.2-1) ...
```

```
pi@raspberrypi:~$ sudo apt install python3-pandas
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libaec0 libblosc1 libhdf5-103 libsz2 python-tables-data python3-numexpr python3-pandas-lib python3-tables
  python3-tables-lib python3-tz
Suggested packages:
  python-pandas-doc python-tables-doc python3-netcdf4 vitables
The following NEW packages will be installed:
  libaec0 libblosc1 libhdf5-103 libsz2 python-tables-data python3-numexpr python3-pandas python3-pandas-lib
  python3-tables python3-tables-lib python3-tz
0 upgraded, 11 newly installed, 0 to remove and 183 not upgraded.
Need to get 6,941 kB of archives.
After this operation, 39.0 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://raspbian.mirror.constant.com/raspbian buster/main armhf libaec0 armhf 1.0.2-1 [21.3 kB]
Get:2 http://raspbian.mirror.constant.com/raspbian buster/main armhf libblosc1 armhf 1.15.1+ds1-1 [33.7 kB]
Get:3 http://raspbian.mirror.constant.com/raspbian buster/main armhf libsz2 armhf 1.0.2-1 [6,640 B]
Get:4 http://raspbian.mirror.constant.com/raspbian buster/main armhf libhdf5-103 armhf 1.10.4+repack-10 [1,259 kB]
Get:5 http://raspbian.mirror.constant.com/raspbian buster/main armhf python-tables-data all 3.4.4-2 [53.1 kB]
Get:6 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-numexpr armhf 2.6.9-1 [147 kB]
Get:7 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-tz all 2019.1-1 [27.1 kB]
Get:8 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-pandas-lib armhf 0.23.3+dfsg-3 [2,912 ki
]
Get:9 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-pandas all 0.23.3+dfsg-3 [1,750 kB]
Get:10 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-tables-lib armhf 3.4.4-2 [388 kB]
Get:11 http://raspbian.mirror.constant.com/raspbian buster/main armhf python3-tables all 3.4.4-2 [342 kB]
Fetched 6,941 kB in 3s (2,258 kB/s)
Selecting previously unselected package libaec0:armhf.
(Reading database ... 106763 files and directories currently installed.)
Preparing to unpack .../00-libaec0_1.0.2-1_armhf.deb ...
Unpacking libaec0:armhf (1.0.2-1) ...
Selecting previously unselected package libblosc1.
Preparing to unpack .../01-libblosc1_1.15.1+ds1-1_armhf.deb ...
Unpacking libblosc1 (1.15.1+ds1-1) ...
Selecting previously unselected package libsz2:armhf.
Preparing to unpack .../02-libsz2_1.0.2-1_armhf.deb ...
Unpacking libsz2:armhf (1.0.2-1) ...
Selecting previously unselected package libhdf5-103:armhf.
Preparing to unpack .../03-libhdf5-103_1.10.4+repack-10_armhf.deb ...
Unpacking libhdf5-103:armhf (1.10.4+repack-10) ...
Selecting previously unselected package python-tables-data.
Preparing to unpack .../04-python-tables-data_3.4.4-2_all.deb ...
Unpacking python-tables-data (3.4.4-2) ...
Selecting previously unselected package python3-numexpr.
Preparing to unpack .../05-python3-numexpr_2.6.9-1_armhf.deb ...
Unpacking python3-numexpr (2.6.9-1) ...
Selecting previously unselected package python3-tz.
Preparing to unpack .../06-python3-tz_2019.1-1_all.deb ...
Unpacking python3-tz (2019.1-1) ...
Selecting previously unselected package python3-pandas-lib.
Preparing to unpack .../07-python3-pandas-lib_0.23.3+dfsg-3_armhf.deb ...
Unpacking python3-pandas-lib (0.23.3+dfsg-3) ...
Selecting previously unselected package python3-pandas.
Preparing to unpack .../08-python3-pandas_0.23.3+dfsg-3_all.deb ...
Unpacking python3-pandas (0.23.3+dfsg-3) ...
Selecting previously unselected package python3-tables-lib.
Preparing to unpack .../09-python3-tables-lib_3.4.4-2_armhf.deb ...
Unpacking python3-tables-lib (3.4.4-2) ...
Selecting previously unselected package python3-tables.
Preparing to unpack .../10-python3-tables_3.4.4-2_all.deb ...
Unpacking python3-tables (3.4.4-2) ...
Setting up python3-pandas-lib (0.23.3+dfsg-3) ...
Setting up libaec0:armhf (1.0.2-1) ...
Setting up python3-tz (2019.1-1) ...
```

```
pi@raspberrypi:~$ sudo apt install libopenblas-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libopenblas-base
The following NEW packages will be installed:
  libopenblas-base libopenblas-dev
0 upgraded, 2 newly installed, 0 to remove and 183 not upgraded.
Need to get 3,845 kB of archives.
After this operation, 26.2 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://raspbian.mirror.constant.com/raspbian buster/main armhf libopenblas-base armhf 0.3.5+ds-3+rpil [1,980 kB]
]
Get:2 http://raspbian.mirror.constant.com/raspbian buster/main armhf libopenblas-dev armhf 0.3.5+ds-3+rpil [1,865 kB]
Fetched 3,845 kB in 1s (4,423 kB/s)
Selecting previously unselected package libopenblas-base:armhf.
(Reading database ... 107811 files and directories currently installed.)
Preparing to unpack .../libopenblas-base_0.3.5+ds-3+rpil_armhf.deb ...
Unpacking libopenblas-base:armhf (0.3.5+ds-3+rpil) ...
Selecting previously unselected package libopenblas-dev:armhf.
Preparing to unpack .../libopenblas-dev_0.3.5+ds-3+rpil_armhf.deb ...
Unpacking libopenblas-dev:armhf (0.3.5+ds-3+rpil) ...
Setting up libopenblas-base:armhf (0.3.5+ds-3+rpil) ...
update-alternatives: using /usr/lib/arm-linux-gnueabi/libblas.so.3 to provide /usr/lib/arm-linux-gnueabi/libblas.so.3 (libblas.so.3-arm-linux-gnueabi) in auto mode
update-alternatives: using /usr/lib/arm-linux-gnueabi/liblapack.so.3 to provide /usr/lib/arm-linux-gnueabi/liblapack.so.3 (liblapack.so.3-arm-linux-gnueabi) in auto mode
Setting up libopenblas-dev:armhf (0.3.5+ds-3+rpil) ...
update-alternatives: using /usr/lib/arm-linux-gnueabi/libblas.so to provide /usr/lib/arm-linux-gnueabi/libblas.so (libblas.so-arm-linux-gnueabi) in auto mode
update-alternatives: using /usr/lib/arm-linux-gnueabi/liblapack.so to provide /usr/lib/arm-linux-gnueabi/liblapack.so (liblapack.so-arm-linux-gnueabi) in auto mode
Processing triggers for libc-bin (2.28-10+rpil) ...
```

```
pi@raspberrypi:~$ sudo apt install libatlas-base-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libatlas3-base
Suggested packages:
  libatlas-doc liblapack-doc
The following NEW packages will be installed:
  libatlas-base-dev libatlas3-base
0 upgraded, 2 newly installed, 0 to remove and 183 not upgraded.
Need to get 5,365 kB of archives.
After this operation, 32.1 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://raspbian.mirror.constant.com/raspbian buster/main armhf libatlas3-base armhf 3.10.3-8+rpil [2,399 kB]
Get:2 http://raspbian.mirror.constant.com/raspbian buster/main armhf libatlas-base-dev armhf 3.10.3-8+rpil [2,966 kB]
Fetched 5,365 kB in 1s (6,934 kB/s)
Selecting previously unselected package libatlas3-base:armhf.
(Reading database ... 107842 files and directories currently installed.)
Preparing to unpack .../libatlas3-base_3.10.3-8+rpil_armhf.deb ...
Unpacking libatlas3-base:armhf (3.10.3-8+rpil) ...
Selecting previously unselected package libatlas-base-dev:armhf.
Preparing to unpack .../libatlas-base-dev_3.10.3-8+rpil_armhf.deb ...
Unpacking libatlas-base-dev:armhf (3.10.3-8+rpil) ...
Setting up libatlas3-base:armhf (3.10.3-8+rpil) ...
Setting up libatlas-base-dev:armhf (3.10.3-8+rpil) ...
Processing triggers for libc-bin (2.28-10+rpil) ...
pi@raspberrypi:~$ sudo pip3 install --only-binary :all: -U scikit-learn
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting scikit-learn
  Downloading https://www.piwheels.org/simple/scikit-learn/scikit_learn-1.0.2-cp37-cp37m-linux_armv7l.whl (10.1MB)
    100% |#####| 10.1MB 45kB/s
Requirement already satisfied, skipping upgrade: numpy>=1.14.6 in /usr/lib/python3/dist-packages (from scikit-learn) (1.16.2)
Collecting threadpoolctl>=2.0.0 (from scikit-learn)
  Downloading https://files.pythonhosted.org/packages/61/cf/6e354304bcb9c6413c4e02a747b600061c21d38ba51e7e544ac7bc66a
ecc/threadpoolctl-3.1.0-py3-none-any.whl
Collecting joblib>=0.11 (from scikit-learn)
  Downloading https://files.pythonhosted.org/packages/3e/d5/0163eb0cfa0b673aa4fe1cd3ea9d8a81ea0f32e50807b0c295871e4aa
b2e/joblib-1.1.0-py2.py3-none-any.whl (306kB)
    100% |#####| 307kB 1.4MB/s
Requirement already satisfied, skipping upgrade: scipy>=1.1.0 in /usr/lib/python3/dist-packages (from scikit-learn) (1.1.0)
Installing collected packages: threadpoolctl, joblib, scikit-learn
Successfully installed joblib-1.1.0 scikit-learn-1.0.2 threadpoolctl-3.1.0
pi@raspberrypi:~$ sudo pip3 install -U tensorflow
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting tensorflow
  Downloading https://www.piwheels.org/simple/tensorflow/tensorflow-1.14.0-cp37-none-linux_armv7l.whl (79.6MB)
    100% |#####| 79.6MB 5.7kB/s
Collecting tensorboard<2.1.0,>=2.0.0 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/76/54/99b9d5d52d5cb732f099baaaf7740403e83fe6b0cedde940fabd2b13d
75a/tensorboard-2.0.2-py3-none-any.whl (3.8MB)
    100% |#####| 3.8MB 119kB/s
Collecting keras-applications>=1.0.8 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/71/e3/19762dfdc62877ae9102edf6342d71b28fbfd9dea32df96a882ce099b
03f/Keras_Applications-1.0.8-py3-none-any.whl (50kB)
    100% |#####| 51kB 3.4MB/s
Requirement already satisfied, skipping upgrade: wheel>=0.26; python_version >= "3" in /usr/lib/python3/dist-packages (from tensorflow) (0.32.3)
Collecting astor>=0.6.0 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/c3/88/97ee84f48fa04fbd6750e62dceafba6c63c81b7ac1420856c8dcc0a
3f9/astor-0.8.1-py2.py3-none-any.whl
Collecting protobuf>=3.6.1 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/ef/c8/2e7f7feaf804b7206e6cc8fa3f0f49834a78f7cb127813d2c45e42d5f
7bf/protobuf-3.20.1-py2.py3-none-any.whl (162kB)
    100% |#####| 163kB 2.5MB/s
Requirement already satisfied, skipping upgrade: numpy<2.0,>=1.16.0 in /usr/lib/python3/dist-packages (from tensorflow) (1.16.2)
Collecting termcolor>=1.1.0 (from tensorflow)
  Downloading https://www.piwheels.org/simple/termcolor/termcolor-1.1.0-py3-none-any.whl
Collecting keras-preprocessing>=1.0.5 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/79/4c/7c3275a01e2ef9368a992926ab932b33b13d55794881e3573482b37
8a7/Keras_Preprocessing-1.1.2-py2.py3-none-any.whl (42kB)
    100% |#####| 51kB 4.0MB/s
Collecting wrapt>=1.11.1 (from tensorflow)
  Downloading https://www.piwheels.org/simple/wrapt/wrapt-1.14.1-cp37-cp37m-linux_armv7l.whl (51kB)
    100% |#####| 51kB 304kB/s
Collecting absl-py>=0.7.0 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/2c/03/e3e19d3faf430ede32e41221b294e37952e06acc96781c417ac25d4a0
324/absl_py-1.0.0-py3-none-any.whl (126kB)
    100% |#####| 133kB 2.9MB/s
Collecting google-pasta>=0.1.6 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/a3/de/c648ef6835192e6e2cc03f40b19eeda4382c49b5bafb43d8b931c4c7
4ac/google_pasta-0.2.0-py3-none-any.whl (57kB)
    100% |#####| 61kB 3.7MB/s
Collecting opt-einsum>=2.3.2 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/bc/19/404708a7e54ad2798907210462fd950c3442ea51acc8790f3da48d2be
e8b/opt_einsum-3.3.0-py3-none-any.whl (65kB)
    100% |#####| 71kB 3.0MB/s
Collecting gast>=0.2.2 (from tensorflow)
  Downloading https://www.piwheels.org/simple/gast/gast-0.2.2-py3-none-any.whl
Collecting tensorflow-estimator<1.15.0rc0,>=1.14.0rc0 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/3c/d5/21860a5b11caaf0678fbc8319341b0ae21a07156911132e0e71bffd05
10d/tensorflow_estimator-1.14.0-py2.py3-none-any.whl (488kB)
    100% |#####| 491kB 898kB/s
Collecting grpcio>=1.8.6 (from tensorflow)
  Downloading https://files.pythonhosted.org/packages/36/33/38f723ea814cabe8d4184aca9840ff0cc0ac7419dff6113b853edd137
20c/grpcio-1.46.1-cp37-cp37m-linux_armv7l.whl (67.4MB)
    100% |#####| 67.4MB 6.7kB/s
Requirement already satisfied, skipping upgrade: six>=1.10.0 in /usr/lib/python3/dist-packages (from tensorflow) (1.12.0)
Collecting google-auth<2,>=1.6.3 (from tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/fb/7a/1b3eb54caee1b8c73c2c3645f78a382eca4805a301a30c64a078e736e
446/google_auth-1.35.0-py2.py3-none-any.whl (152kB)
    100% |#####| 153kB 2.6MB/s
Collecting setuptools>=41.0.0 (from tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/0f/dba055d3696c63fff7430bbc5f337454ac66711d91965f08146784afe
cad/setuputils-62.2.0-py3-none-any.whl (1.1MB)
    100% |#####| 1.1MB 390kB/s
```



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Collecting markdown>=2.6.8 (from tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/f3/df/ca72f352e15b6f8ce32b74af029f1189abfffb906f7c137501ffe69c98a65/Markdown-3.3.7-py3-none-any.whl (97kB)
    100% |████████████████████| 102kB 3.5MB/s
Collecting google-auth-oauthlib<0.5,>=0.4.1 (from tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/b1/0e/0636cc1448a7abc444fb1b3a63655e294e0d2d49092dc3de05241be6d43c/google_auth_oauthlib-0.4.6-py2.py3-none-any.whl
Requirement already satisfied, skipping upgrade: requests<3,>=2.21.0 in /usr/lib/python3/dist-packages (from tensorboard<2.1.0,>=2.0.0->tensorflow) (2.21.0)
Requirement already satisfied, skipping upgrade: werkzeug>=0.11.15 in /usr/lib/python3/dist-packages (from tensorboard<2.1.0,>=2.0.0->tensorflow) (0.14.1)
Collecting h5py (from keras-applications>=1.0.8->tensorflow)
  Downloading https://www.piwheels.org/simple/h5py/h5py-3.6.0-cp37m-linux_armv7l.whl (5.4MB)
    100% |████████████████████| 5.4MB 83kB/s
Collecting pyasn1-modules>=0.2.1 (from google-auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/95/de/214830a981892a3e286c3794f41ae67a4495df1108c3da8a9f62159b9a9d/pyasn1_modules-0.2.8-py2.py3-none-any.whl (155kB)
    100% |████████████████████| 163kB 2.5MB/s
Collecting cachetools<5.0,>=2.0.0 (from google-auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/ea/cl/4740af52db75e6dbdd57fc7e9478439815bbac549c1c05881be27d19a17d/cachetools-4.2.4-py3-none-any.whl
Collecting rsa<5,>=3.1.4; python_version >= "3.6" (from google-auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/30/ab/8fd9e88e6fa5ec41afca995938bbefb72195278e0cfc5bd76a4f29b23fb2/rsa-4.8-py3-none-any.whl
Collecting importlib-metadata>=4.4; python_version < "3.10" (from markdown>=2.6.8->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/92/f2/c48787ca7d1e20daa185e1b6b2d4e16acd2fb5e0320bc50ffc89b91fa4d7/importlib_metadata-4.11.3-py3-none-any.whl
Requirement already satisfied, skipping upgrade: requests-oauthlib>=0.7.0 in /usr/lib/python3/dist-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.1.0,>=2.0.0->tensorflow) (1.0.0)
Collecting cached-property; python_version < "3.8" (from h5py->keras-applications>=1.0.8->tensorflow)
  Downloading https://files.pythonhosted.org/packages/48/19/f2090f7dad41e225c7f2326e4cfe6fff49e57ded5b53636c9551f86b069/cached_property-1.5.2-py2.py3-none-any.whl
Collecting pyasn1<0.5.0,>=0.4.6 (from pyasn1-modules>=0.2.1->google-auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/62/1e/a94a8d635fa3ce4cfc7f506003548d0a2447ae76fd5ca53932970fe3053f/pyasn1-0.4.8-py2.py3-none-any.whl (77kB)
    100% |████████████████████| 81kB 3.6MB/s
Collecting typing-extensions>=3.6.4; python_version < "3.8" (from importlib-metadata>=4.4; python_version < "3.10"->markdown>=2.6.8->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/75/e1/932e06004039dd670c9d5e1df0cd606bf46e29a28e65d5b28e894ea29c9/typing_extensions-4.2.0-py3-none-any.whl
Collecting zipp>=0.5 (from importlib-metadata>=4.4; python_version < "3.10"->markdown>=2.6.8->tensorboard<2.1.0,>=2.0.0->tensorflow)
  Downloading https://files.pythonhosted.org/packages/80/0e/16a7ee38617aab6a624e95948d314097cc2669edae9b02ded53309941cfc/zipp-3.8.0-py3-none-any.whl
Installing collected packages: grpcio, pyasn1, pyasn1-modules, cachetools, rsa, setuptools, google-auth, typing-extensions, zipp, importlib-metadata, markdown, google-auth-oauthlib, absl-py, protobuf, tensorboard, cached-property, h5py, keras-applications, astor, termcolor, keras-preprocessing, wrapt, google-pasta, opt-einsum, gast, tensorflow-estimator, tensorflow
Found existing installation: setuptools 40.8.0
Not uninstalling setuptools at /usr/lib/python3/dist-packages, outside environment /usr
Can't uninstall 'setuptools'. No files were found to uninstall.
Found existing installation: wrapt 1.10.11
Not uninstalling wrapt at /usr/lib/python3/dist-packages, outside environment /usr
Can't uninstall 'wrapt'. No files were found to uninstall.
Successfully installed absl-py-1.0.0 astor-0.8.1 cached-property-1.5.2 cachetools-4.2.4 gast-0.2.2 google-auth-1.35.0 google-auth-oauthlib-0.4.6 google-pasta-0.2.0 grpcio-1.46.1 h5py-3.6.0 importlib-metadata-4.11.3 keras-applications-1.0.8 keras-preprocessing-1.1.2 markdown-3.3.7 opt-einsum-3.3.0 protobuf-3.20.1 pyasn1-0.4.8 pyasn1-modules-0.2.8 rsa-4.8 setuptools-62.2.0 tensorboard-2.0.2 tensorflow-1.14.0 tensorflow-estimator-1.14.0 termcolor-1.1.0 typing-extensions-4.2.0 wrapt-1.14.1 zipp-3.8.0

pi@raspberrypi:~$ sudo pip3 install -U keras==2.3.1
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting keras==2.3.1
  Downloading https://files.pythonhosted.org/packages/ad/fd/6bfe87920d7f4fd475acd28500a42482b6b84479832bdc0fe9e589a60ceb/Keras-2.3.1-py2.py3-none-any.whl (377kB)
    100% |████████████████████| 378kB 1.1MB/s
Requirement already satisfied, skipping upgrade: scipy>=0.14 in /usr/lib/python3/dist-packages (from keras==2.3.1) (1.1.0)
Requirement already satisfied, skipping upgrade: six>=1.9.0 in /usr/lib/python3/dist-packages (from keras==2.3.1) (1.12.0)
Requirement already satisfied, skipping upgrade: h5py in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (3.6.0)
Requirement already satisfied, skipping upgrade: keras-applications>=1.0.6 in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (1.0.8)
Requirement already satisfied, skipping upgrade: numpy>=1.9.1 in /usr/lib/python3/dist-packages (from keras==2.3.1) (1.16.2)
Requirement already satisfied, skipping upgrade: keras-preprocessing>=1.0.5 in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (1.1.2)
Collecting pyyaml (from keras==2.3.1)
  Downloading https://www.piwheels.org/simple/pyyaml/PyYAML-6.0-cp37m-linux_armv7l.whl (45kB)
    100% |████████████████████| 51kB 281kB/s
Requirement already satisfied, skipping upgrade: cached-property; python_version < "3.8" in /usr/local/lib/python3.7/dist-packages (from h5py->keras==2.3.1) (1.5.2)
Installing collected packages: pyyaml, keras
Successfully installed keras-2.3.1 pyyaml-6.0

```

```
pi@raspberrypi:~/iot/lesson8 $ nano plt_final.py
```

```
GNU nano 3.2
```

```
plt_final.py
```

```
import matplotlib.pyplot as plt
from pandas import *
from scipy import stats

data = read_csv('rpidata1.csv')
x = data['CPU Usage %']
y = data['Temperature C']

# Time series
plt.plot(y, 'r', lw=2, label='Temperature C')
plt.plot(x, 'b', lw=2, label='CPU Usage %')
plt.xticks([209,452,703,957],['21:00','21:30','22:00','22:30'])
plt.xlabel('Time')
plt.legend(loc='lower center')
plt.title('Iotu 2017-04-28')

# Histogram of CPU usage
plt.figure()
num_bins = 35
n, bins, patches = plt.hist(x, num_bins, density=1, facecolor='blue', alpha=0.5)
plt.xlabel('CPU Usage %')
plt.ylabel('Probability')
plt.title('Iotu 2017-04-28')

# Histogram of temperature
plt.figure()
num_bins = 30
n, bins, patches = plt.hist(y, num_bins, density=1, facecolor='red', alpha=0.5)
plt.xlabel('Temperature C')
plt.ylabel('Probability')
plt.title('Iotu 2017-04-28')

# Horizontal box plot of CPU usage
plt.figure()
plt.boxplot(x, 0, '+', 0)
plt.xlabel('CPU Usage %')
plt.title('Iotu 2017-04-28')

# Vertical box plot of temperature
plt.figure()
plt.boxplot(y, 0, '+')
plt.ylabel('Temperature C')
plt.title('Iotu 2017-04-28')

# Scatter diagram with a linear regression line
plt.figure()
slope, intercept, r_value, p_value, std_err = stats.linregress(x, y)
plt.xlabel('CPU Usage %')
plt.ylabel('Temperature C')
plt.plot(x, y, 'bo')
l = [slope * i + intercept for i in x]
plt.plot(x, l, 'r', lw=2)
plt.title('Iotu 2017-04-28')

plt.show()
```

```
GNU nano 3.2
```

```
import matplotlib.pyplot as plt
from pandas import *
from scipy import stats
from sklearn.model_selection import cross_val_predict
from sklearn import linear_model

X = read_csv('rpidata1.csv', usecols=[1])
X = X.assign(t = X.index)
y = read_csv('rpidata1.csv', usecols=[2])
lr = linear_model.LinearRegression()
predicted = cross_val_predict(lr, X, y, cv=10)
plt.plot(y, predicted, 'ro')
plt.plot([y.min(), y.max()], [y.min(), y.max()], 'b-', lw=2)
plt.xlabel('Temperature C')
plt.ylabel('Predicted')
plt.title('Iotu 2017-12-17')

plt.show()
```

Unable to init server: Could not connect: Connection refused
Unable to init server: Could not connect: Connection refused

(plt_final.py:1769): Gdk-CRITICAL **: 07:19:17.187: gdk_cursor_new_for_display: assertion 'GDK_IS_DISPLAY (display)' failed

(plt_final.py:1769): Gdk-CRITICAL **: 07:19:17.190: gdk_cursor_new_for_display: assertion 'GDK_IS_DISPLAY (display)' failed

Traceback (most recent call last):

```
File "plt_final.py", line 2, in <module>
  from pandas import *
File "/usr/lib/python3/dist-packages/pandas/__init__.py", line 57, in <module>
  from pandas.io.api import *
File "/usr/lib/python3/dist-packages/pandas/io/api.py", line 19, in <module>
  from pandas.io.packers import read_msgpack, to_msgpack
File "/usr/lib/python3/dist-packages/pandas/io/packers.py", line 69, in <module>
  from pandas.util._move import (
ValueError: module functions cannot set METH_CLASS or METH_STATIC
```

Unable to init server: Could not connect: Connection refused
Unable to init server: Could not connect: Connection refused

(plt_cv2.py:1775): Gdk-CRITICAL **: 07:19:58.056: gdk_cursor_new_for_display: assertion 'GDK_IS_DISPLAY (display)' failed

(plt_cv2.py:1775): Gdk-CRITICAL **: 07:19:58.059: gdk_cursor_new_for_display: assertion 'GDK_IS_DISPLAY (display)' failed

Traceback (most recent call last):

```
File "plt_cv2.py", line 2, in <module>
  from pandas import *
File "/usr/lib/python3/dist-packages/pandas/__init__.py", line 57, in <module>
  from pandas.io.api import *
File "/usr/lib/python3/dist-packages/pandas/io/api.py", line 19, in <module>
  from pandas.io.packers import read_msgpack, to_msgpack
File "/usr/lib/python3/dist-packages/pandas/io/packers.py", line 69, in <module>
  from pandas.util._move import (
ValueError: module functions cannot set METH_CLASS or METH_STATIC
```