

Lab 8A: Examples

On Raspberry Pi, open a terminal and install Python packages as follows

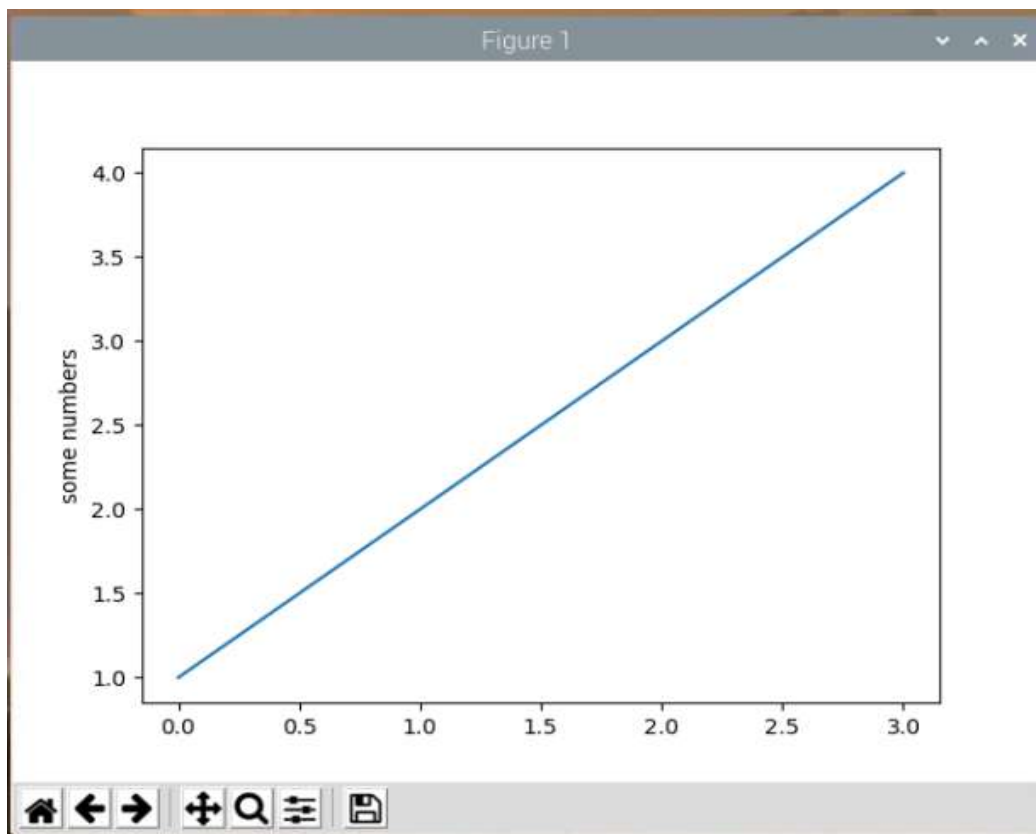
```
pi@Zhaoning: ~  
File Edit Tabs Help  
Requirement already satisfied, skipping upgrade: cachetools<5.0,>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from google-auth<2,>=1.6.3->tenso  
rboard<2.1.0,>=2.0.0->tensorflow) (4.1.1)  
Requirement already satisfied, skipping upgrade: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.7/dist-packages (from google-auth<2,>=1.6.3->tenso  
rboard<2.1.0,>=2.0.0->tensorflow) (0.2.8)  
Requirement already satisfied, skipping upgrade: rsa<5,>=3.1.4; python_version >= "3.5" in /usr/local/lib/python3.7/dist-packages (from google-auth  
<2,>=1.6.3->tensorflow<2.1.0,>=2.0.0->tensorflow) (4.0)  
Requirement already satisfied, skipping upgrade: certifi>=2017.4.17 in /usr/lib/python3/dist-packages (from requests<3,>=2.21.0->tensorflow<2.1.0,  
>=2.0.0->tensorflow) (2018.8.24)  
Requirement already satisfied, skipping upgrade: chardet<4,>=3.0.2 in /usr/lib/python3/dist-packages (from requests<3,>=2.21.0->tensorflow<2.1.0,>=2.0.  
>=2.0.0->tensorflow) (3.0.4)  
Requirement already satisfied, skipping upgrade: idna<3,>=2.5 in /usr/lib/python3/dist-packages (from requests<3,>=2.21.0->tensorflow<2.1.0,>=2.0.  
>=2.0.0->tensorflow) (2.6)  
Requirement already satisfied, skipping upgrade: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in /usr/lib/python3/dist-packages (from requests<3,>=2.21.  
>=2.0.0->tensorflow) (1.24.1)  
Requirement already satisfied, skipping upgrade: importlib-metadata; python_version < "3.8" in /usr/local/lib/python3.7/dist-packages (from markdow  
>=2.6.0->tensorflow<2.1.0,>=2.0.0->tensorflow) (2.0.0)  
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-&br/>>tensorflow<2.1.0,>=2.0.0->tensorflow) (1.0.0)  
Requirement already satisfied, skipping upgrade: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.7/dist-packages (from pyasn1-modules>=0.2.1->google  
-auth<2,>=1.6.3->tensorflow<2.1.0,>=2.0.0->tensorflow) (0.4.8)  
Requirement already satisfied, skipping upgrade: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata; python_version < "3.  
8"->markdown>=2.6.0->tensorflow<2.1.0,>=2.0.0->tensorflow) (3.4.0)  
Installing collected packages: grpcio, google-pasta, absl-py, gast, keras-preprocessing, wrapt, opt-einsum, h5py, keras-applications, astor, tensor  
board, tensorflow-estimator, termcolor, tensorflow  
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-0.11.0 astor-0.8.1 gast-0.2.2 google-pasta-0.2.0 grpcio-1.33.2 h5py-3.1.0 keras-applications-1.0.8 keras-preprocessi  
ng-1.1.2 opt-einsum-3.3.0 tensorflow-2.0.2 tensorflow-1.14.0 tensorflow-estimator-1.14.0 termcolor-1.1.0 wrapt-1.12.1  
pi@Zhaoning: ~ $ 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-a  
ny.whl (377kB)  
    100% |#####| 378kB 692kB/s  
Requirement already satisfied, skipping upgrade: h5py in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (3.1.0)  
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)  
Requirement already satisfied, skipping upgrade: numpy>=1.9.1 in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (1.19.4)  
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: pyyaml in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (5.3.1)  
Requirement already satisfied, skipping upgrade: six>=1.0.0 in /usr/local/lib/python3.7/dist-packages (from keras==2.3.1) (1.11.0)  
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: cached-property; python_version < "3.8" in /usr/local/lib/python3.7/dist-packages (from h5py->ker  
as==2.3.1) (1.5.2)  
Installing collected packages: keras  
Successfully installed keras-2.3.1  
pi@Zhaoning: ~ $
```

For Linux (most distributions have the X server installed), open a terminal

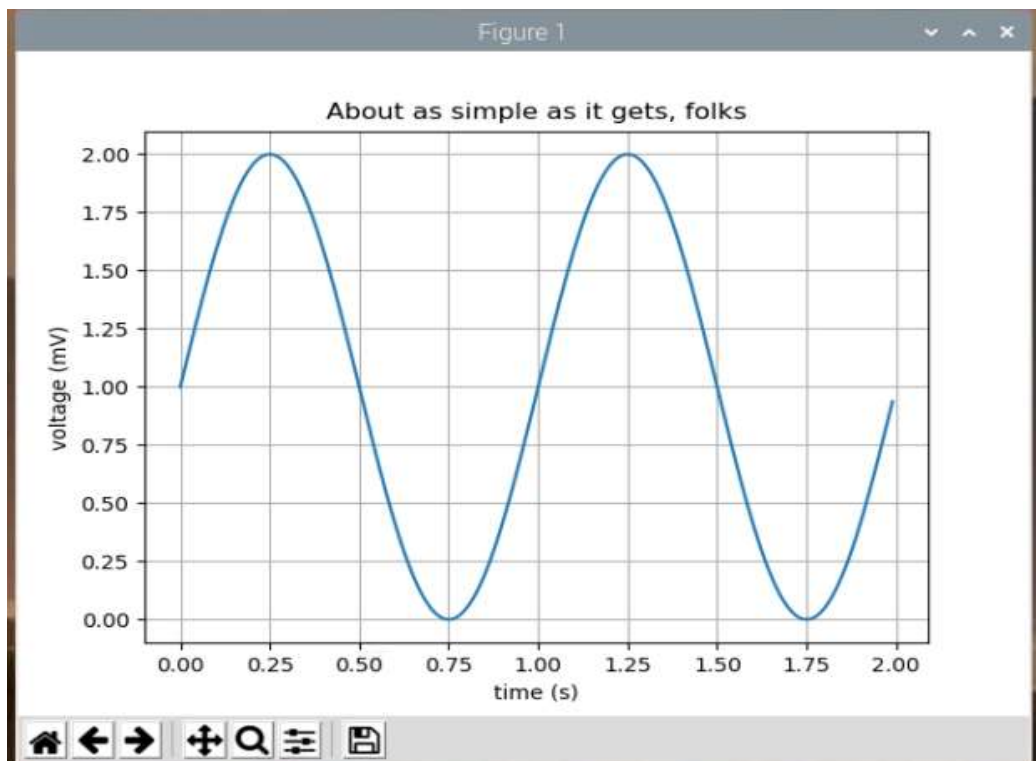
```
pi@Zhaoning:~ $ ssh -Y pi@192.168.1.169  
pi@192.168.1.169's password:  
Linux Zhaoning 5.4.72-v7l+ #1356 SMP Thu Oct 22 13:57:51 BST 2020 armv7l  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/*copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Sat Nov 7 18:49:12 2020 from 192.168.1.169  
pi@Zhaoning:~ $
```

Run Python code

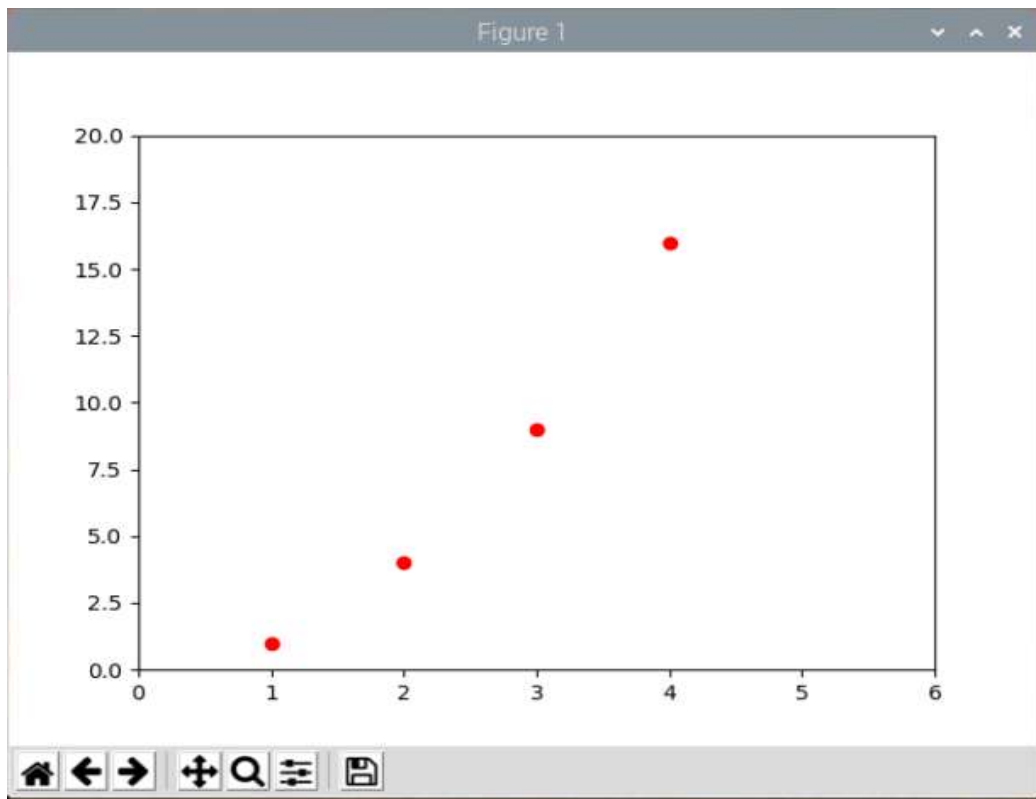
pyplot_simple.py



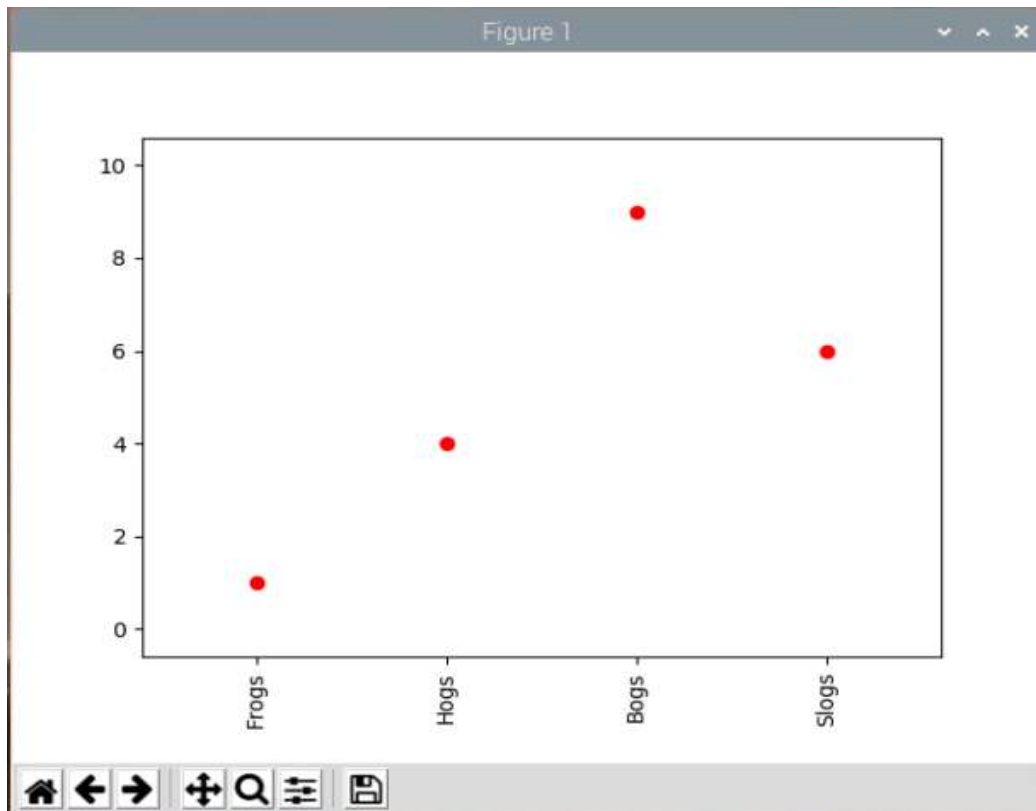
simple_plot.py



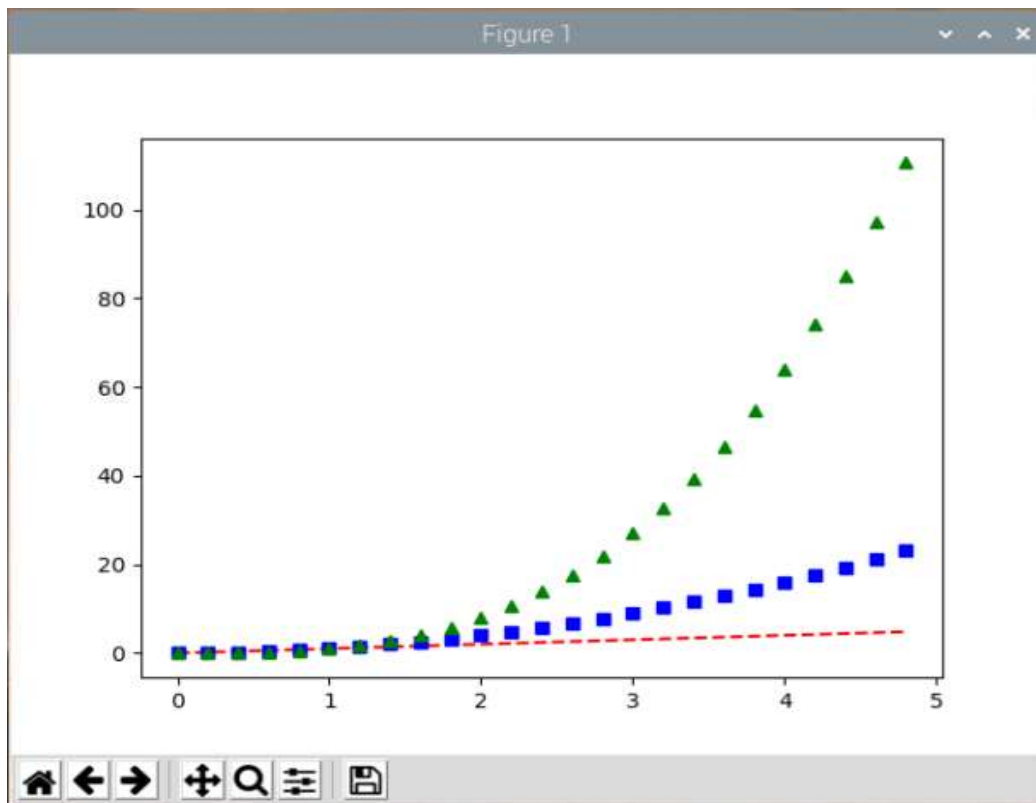
pyplot_formatstr.py



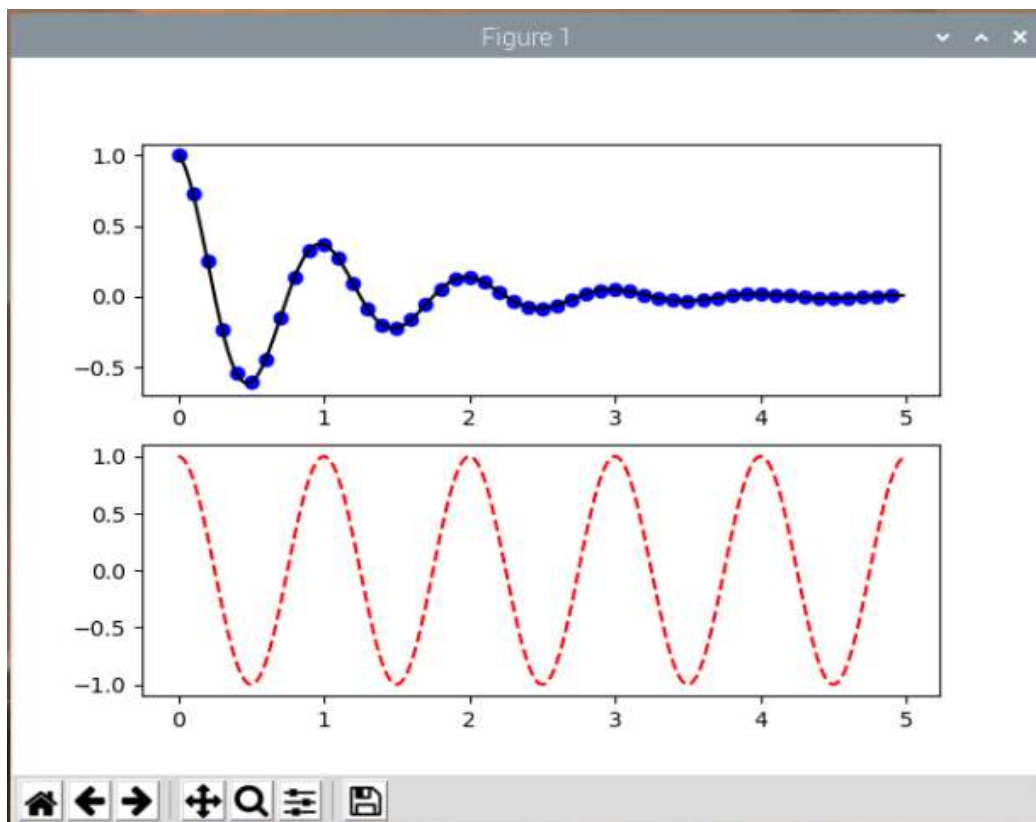
ticklabels_demo_rotation.py



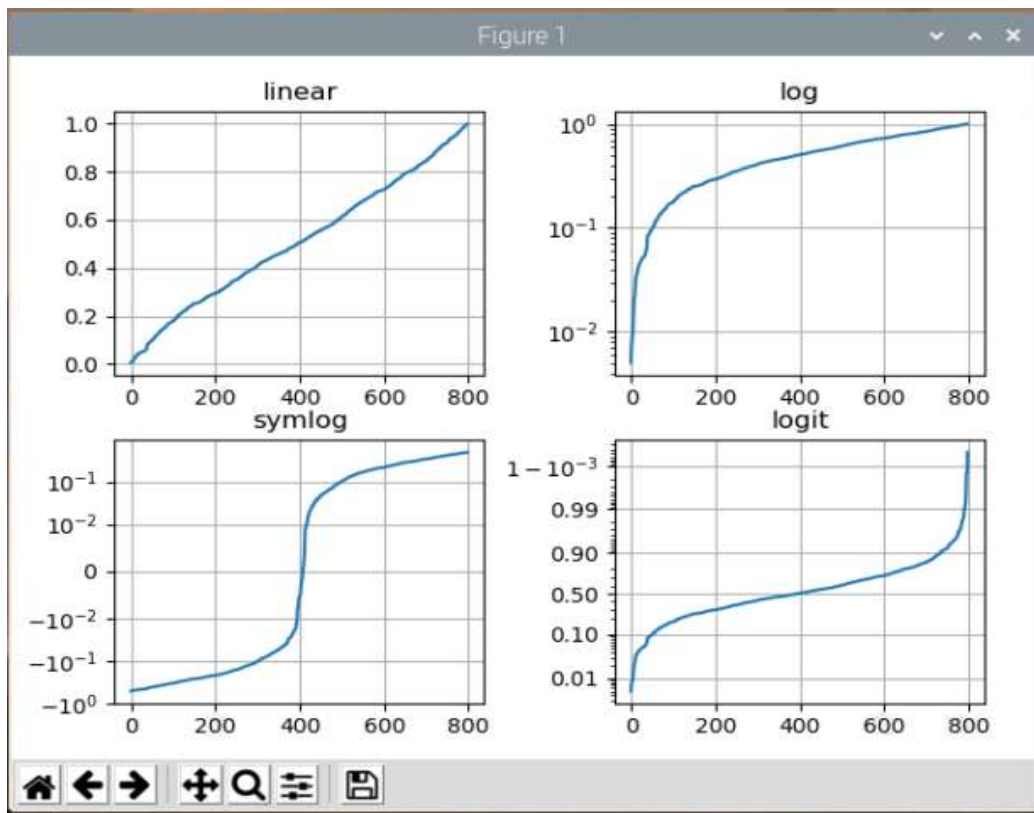
pyplot_three.py



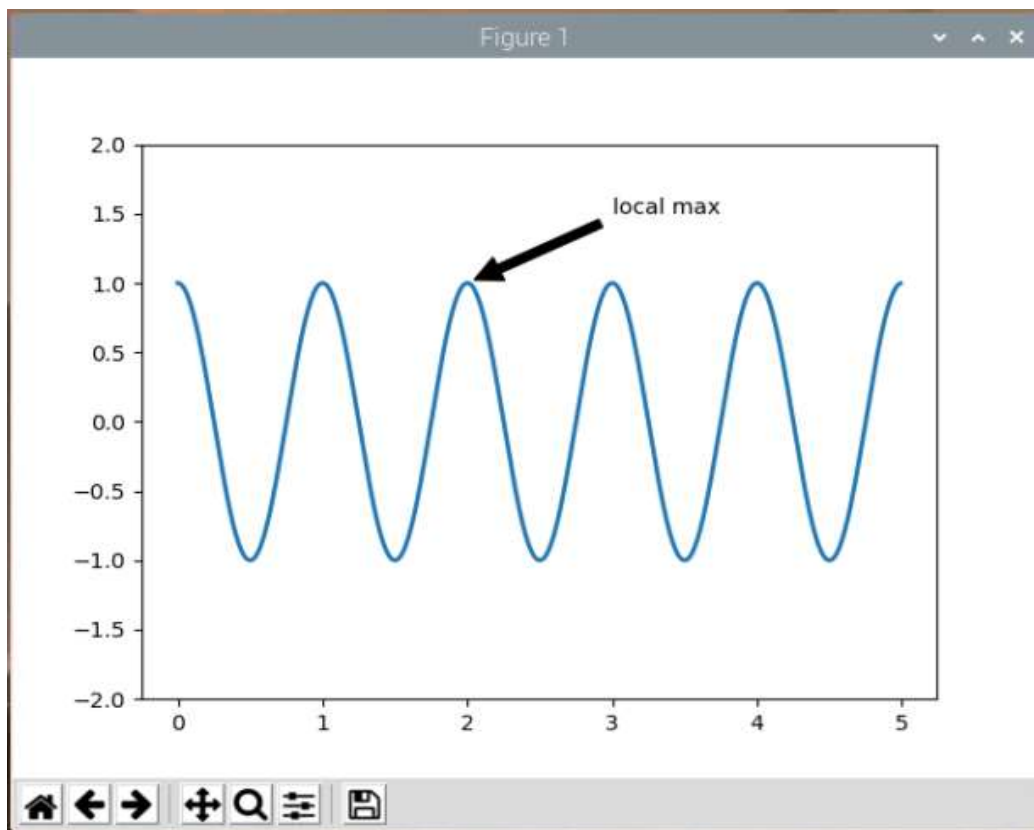
pyplot_two_subplots.py



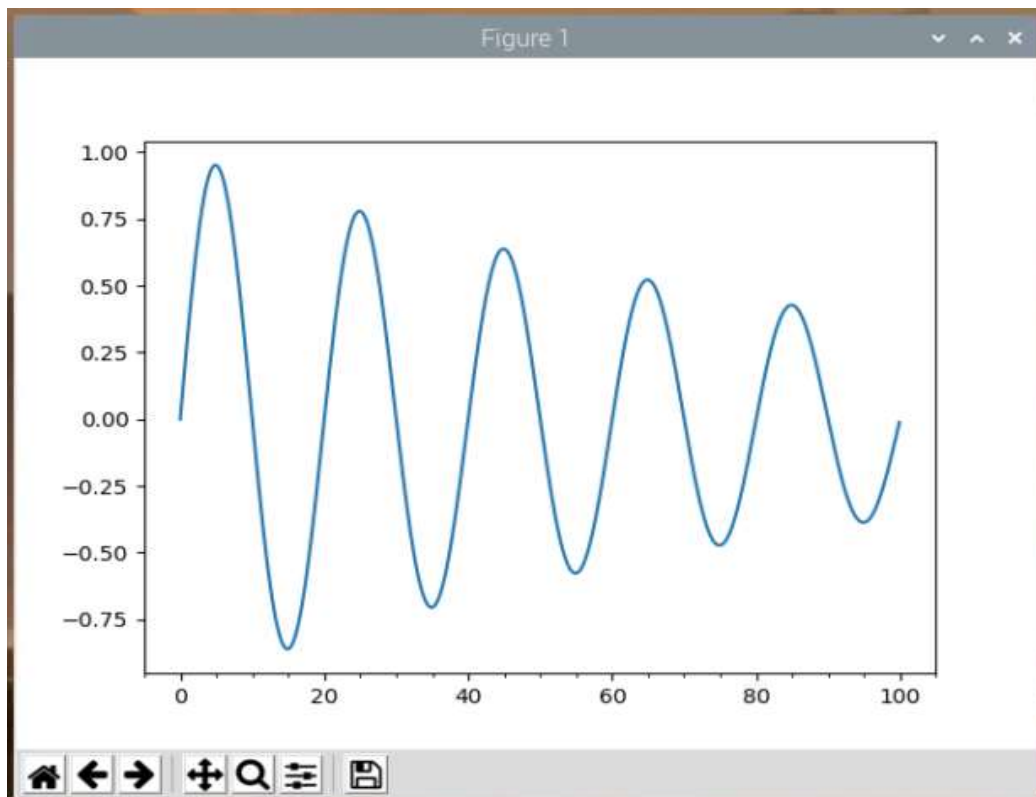
pyplot_scales.py



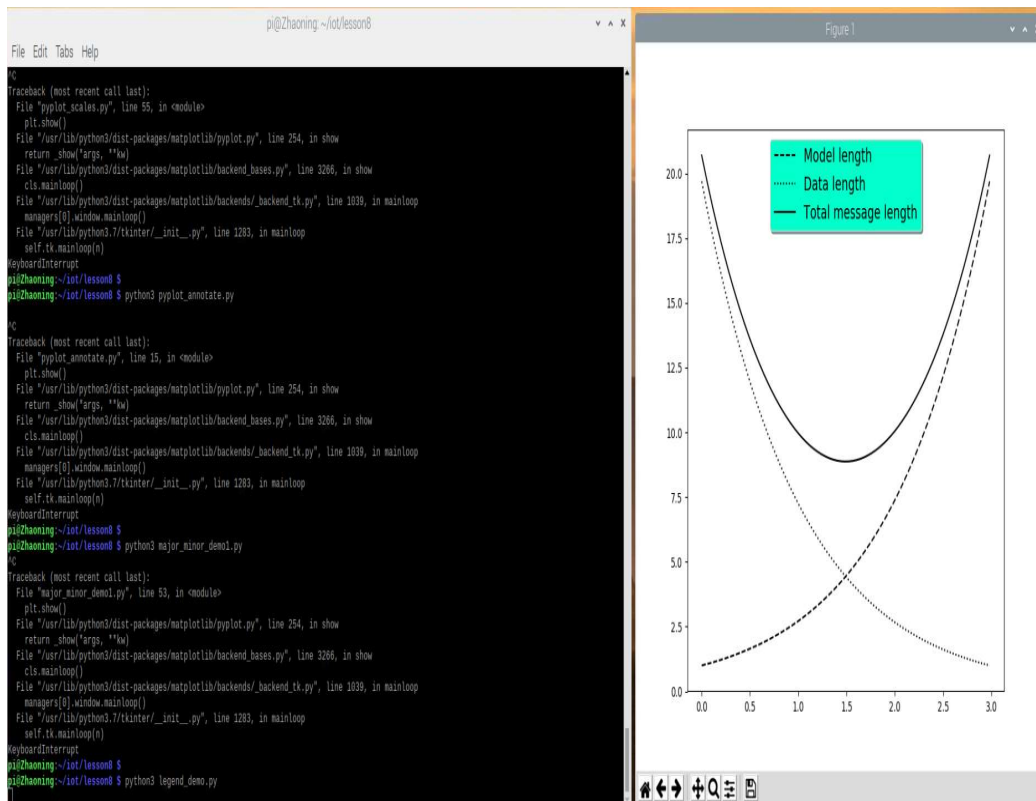
pyplot_annotate.py



major_minor_demo1.py



legend_demo.py

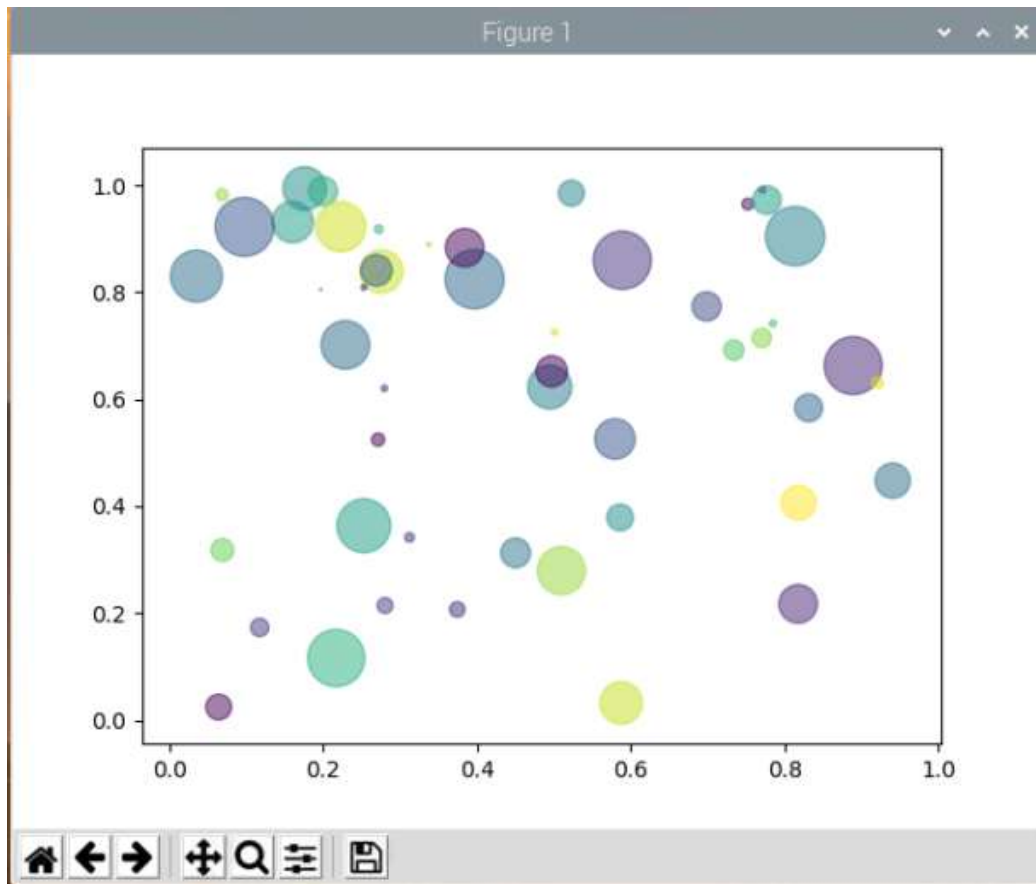


Lab 8B: Data Analysis

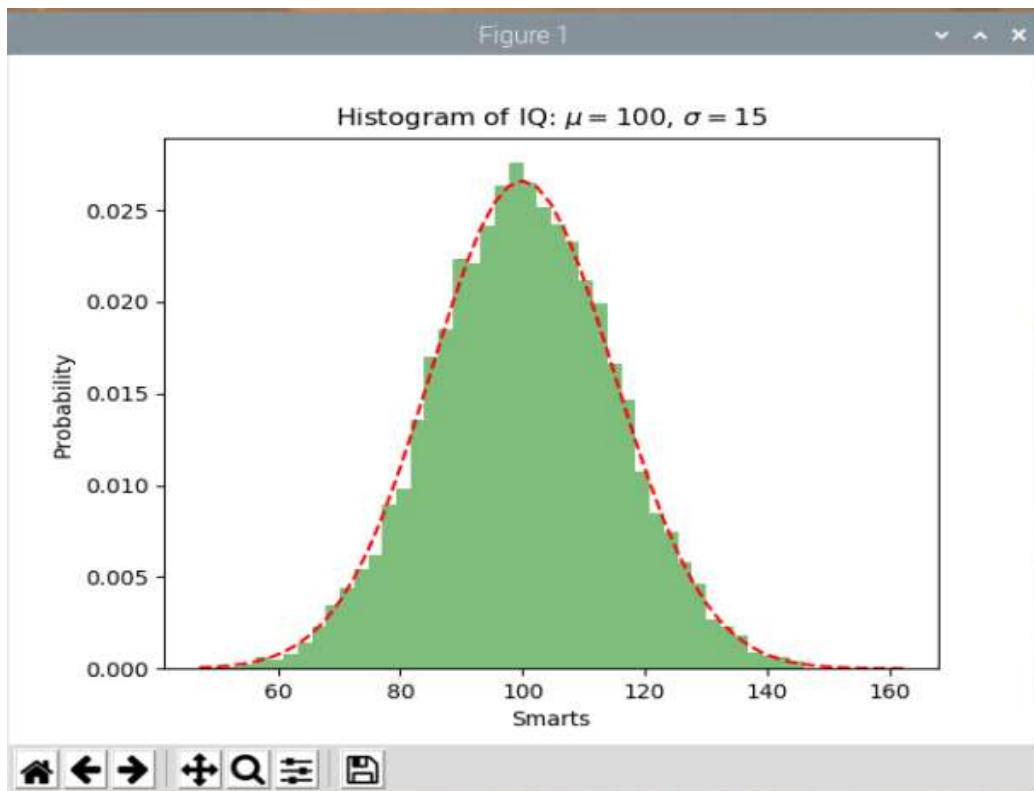
Histograms, box plots, regression, and classification

P.S.: When I did Lab 8A, I use control + C to close the figure window. But when I did Lab 8B, I found I can directly close that window with mouse instead of use keyboard.

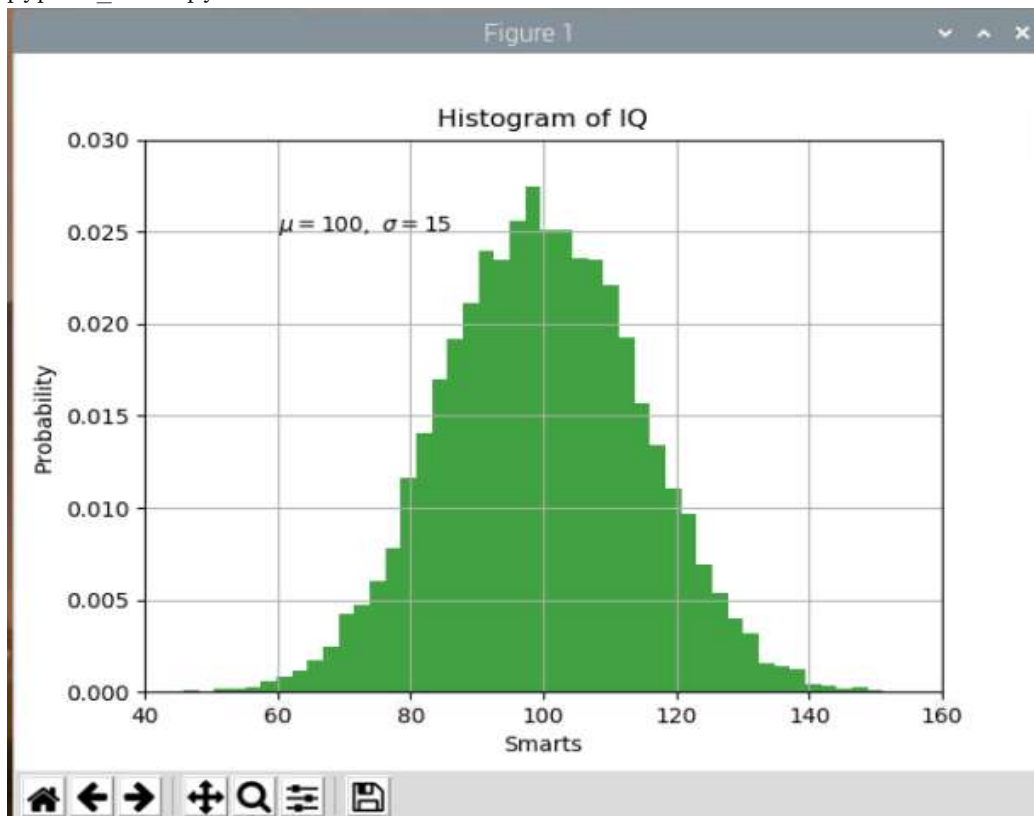
scatter_demo.py



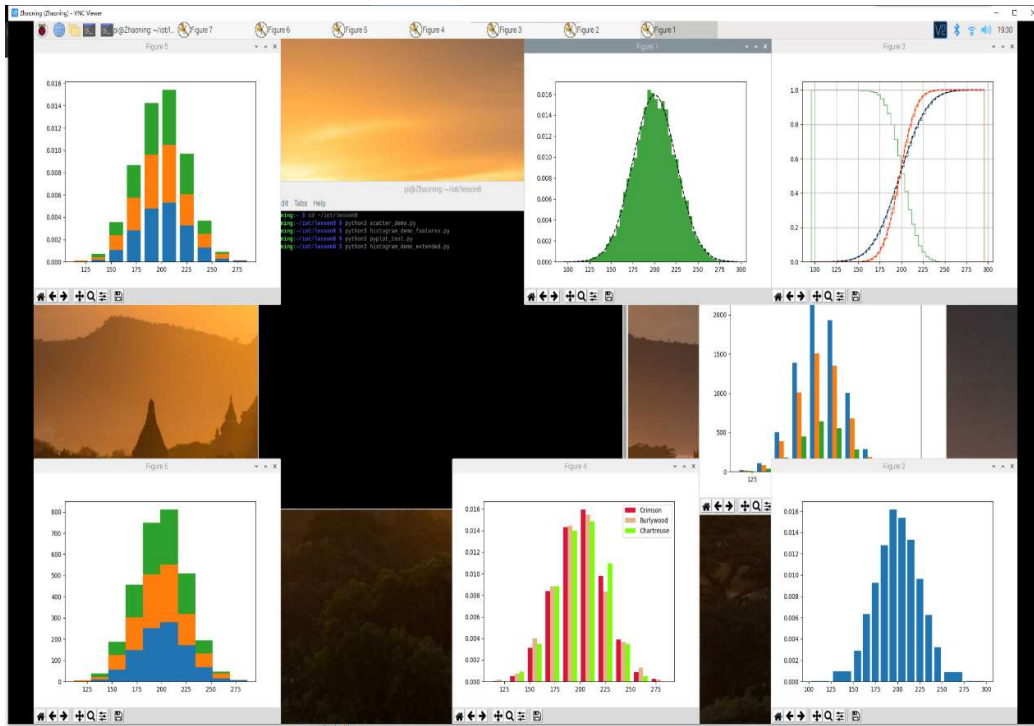
histogram_demo_features.py



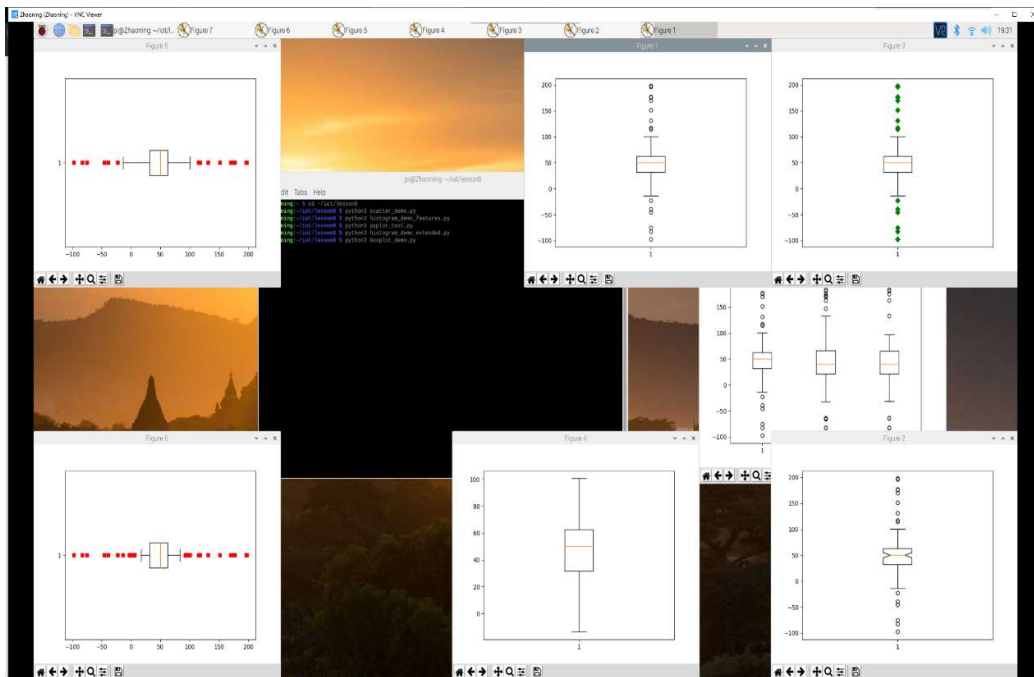
pyplot_text.py



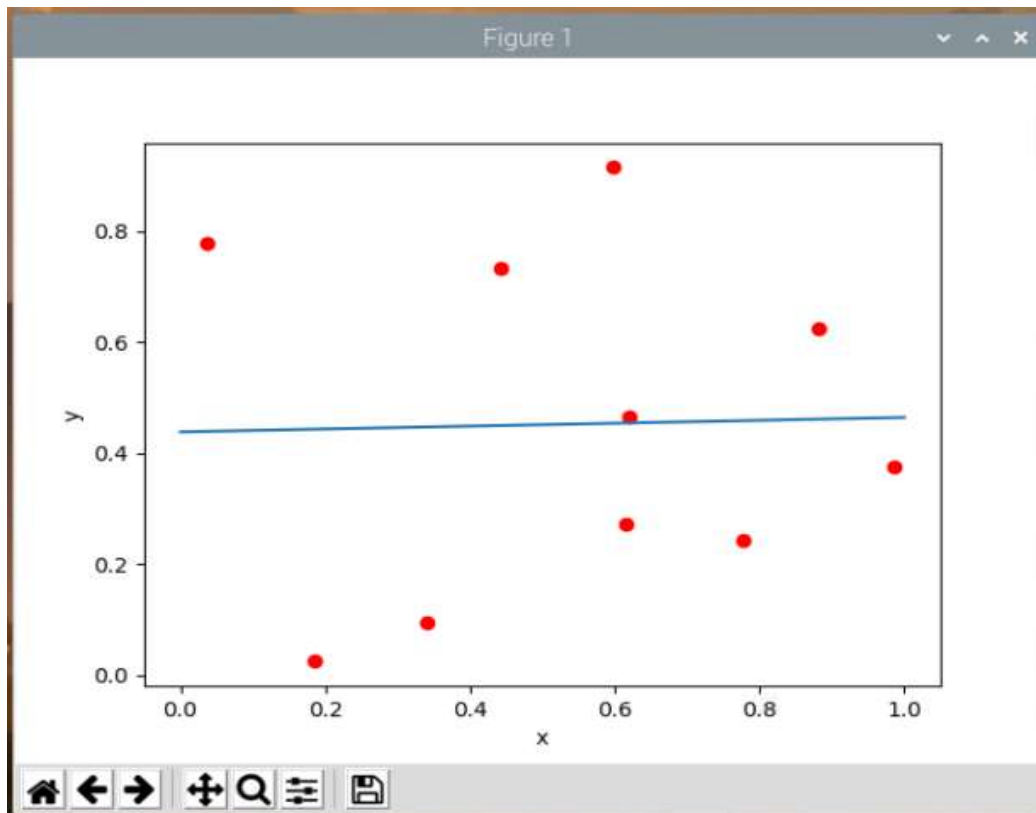
histogram_demo_extended.py



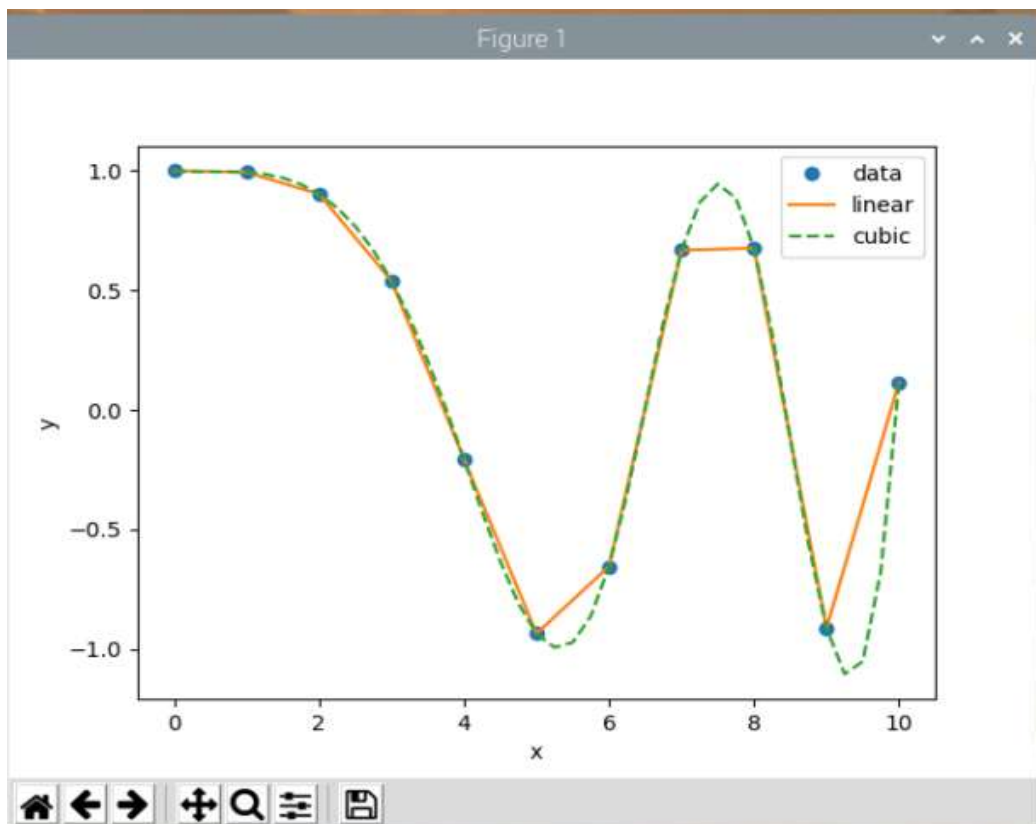
boxplot_demo.py



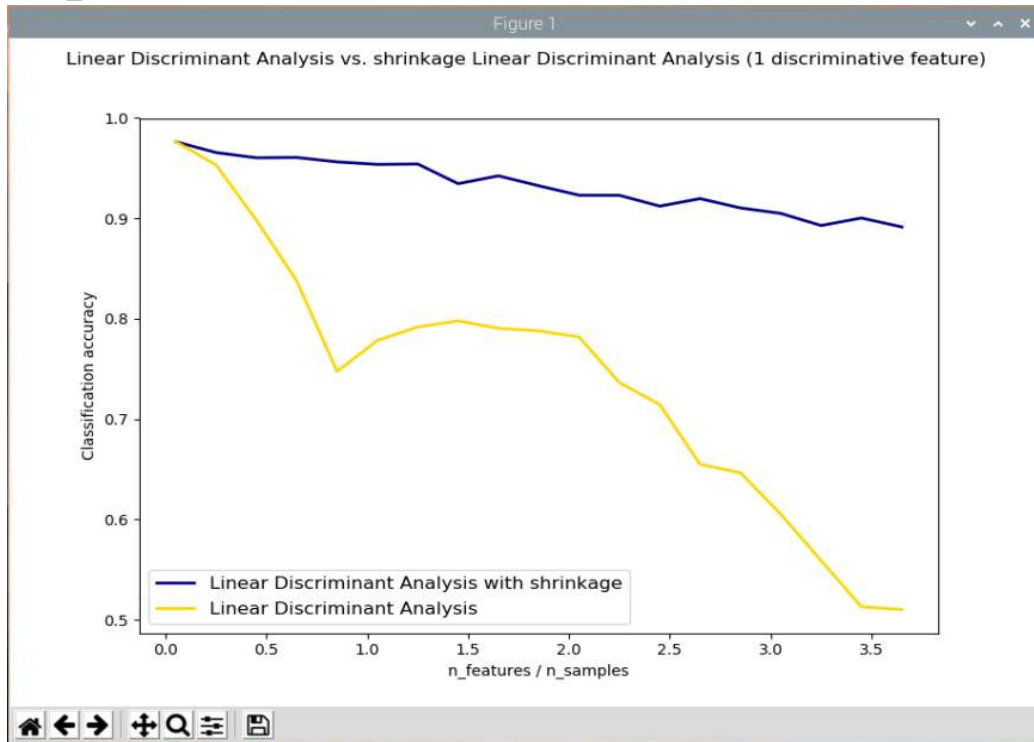
linreg.py



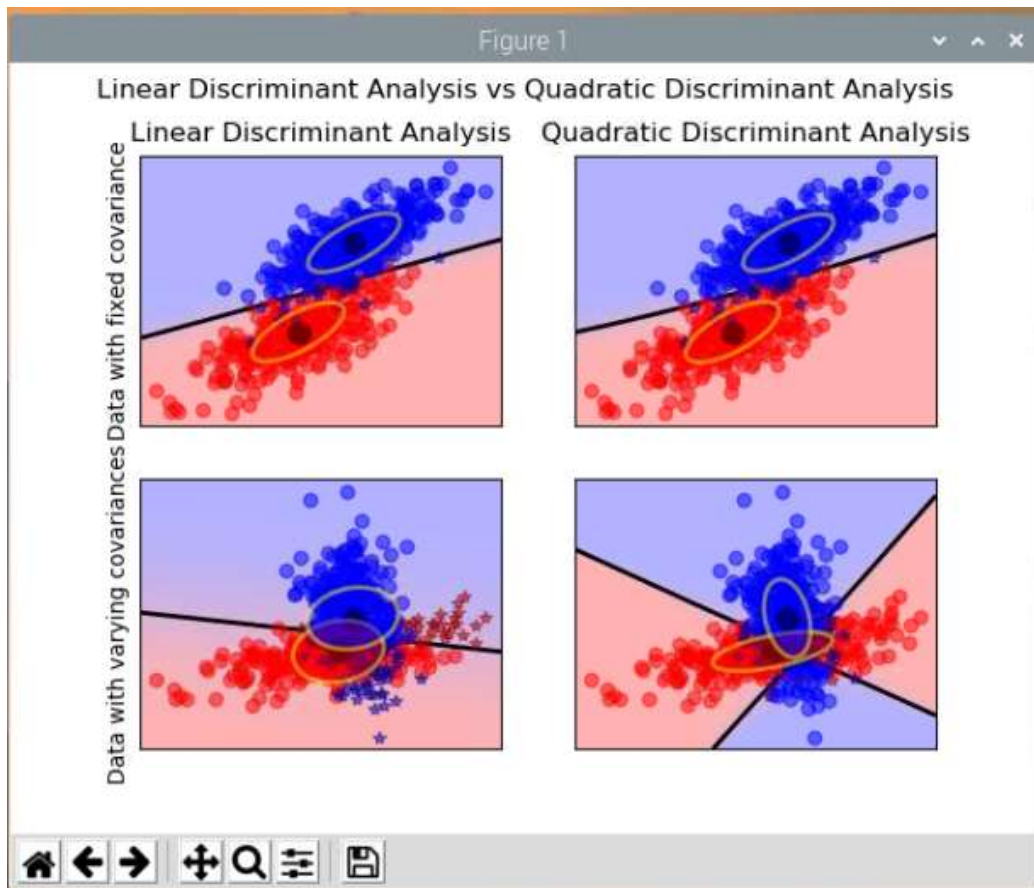
interpolation.py



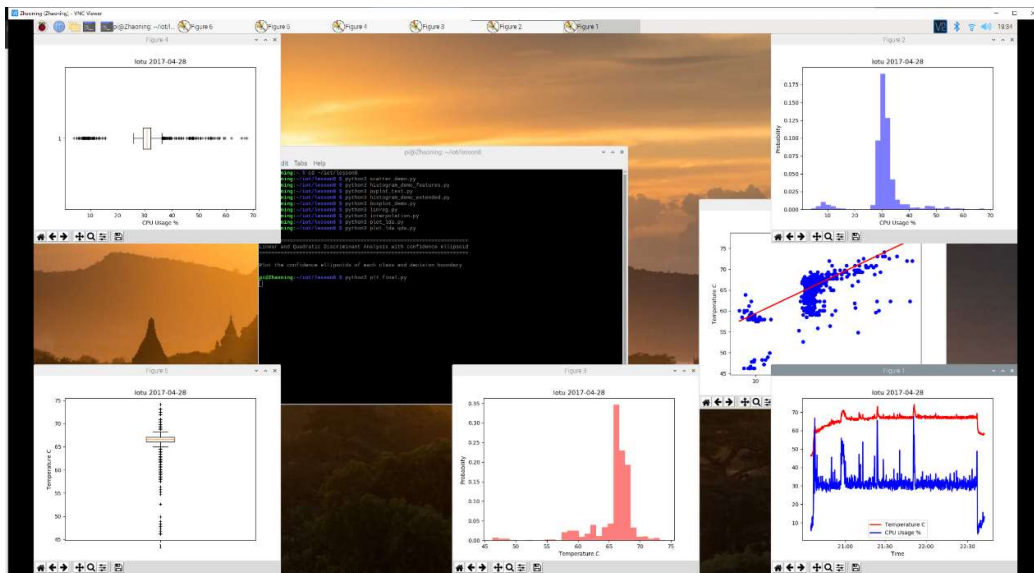
plot_lda.py



plot_lda_qda.py

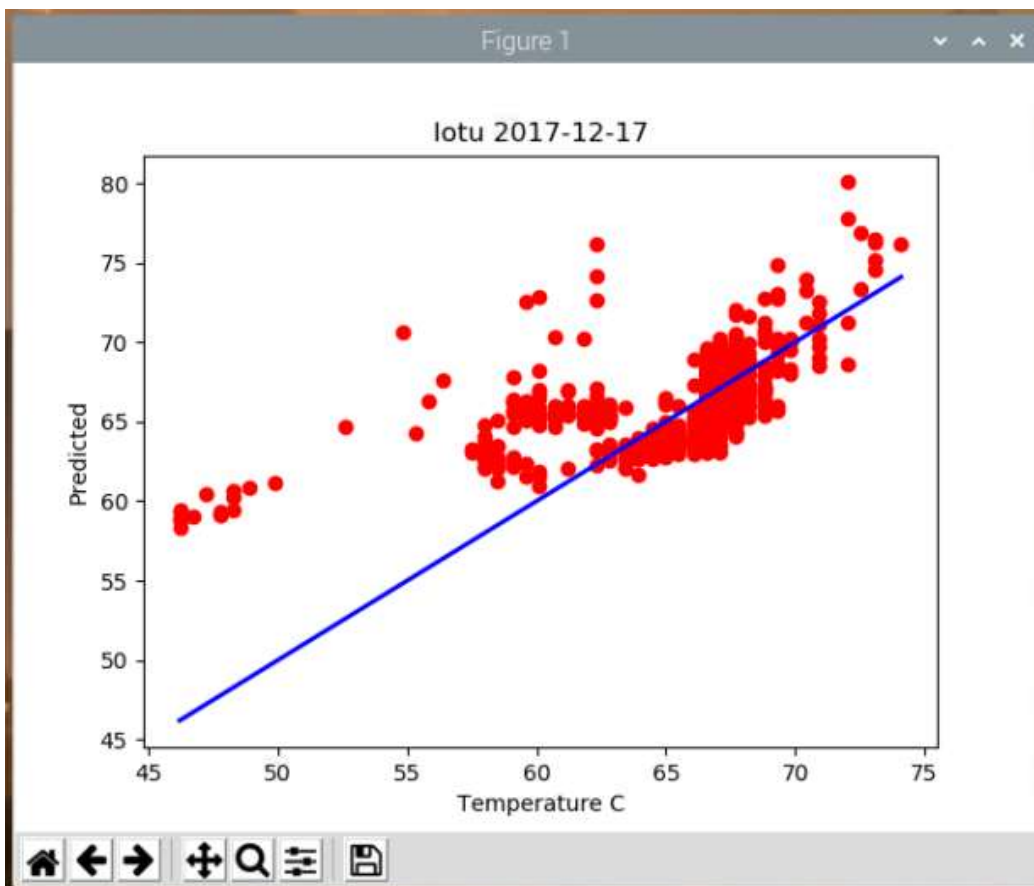


plt_final.py

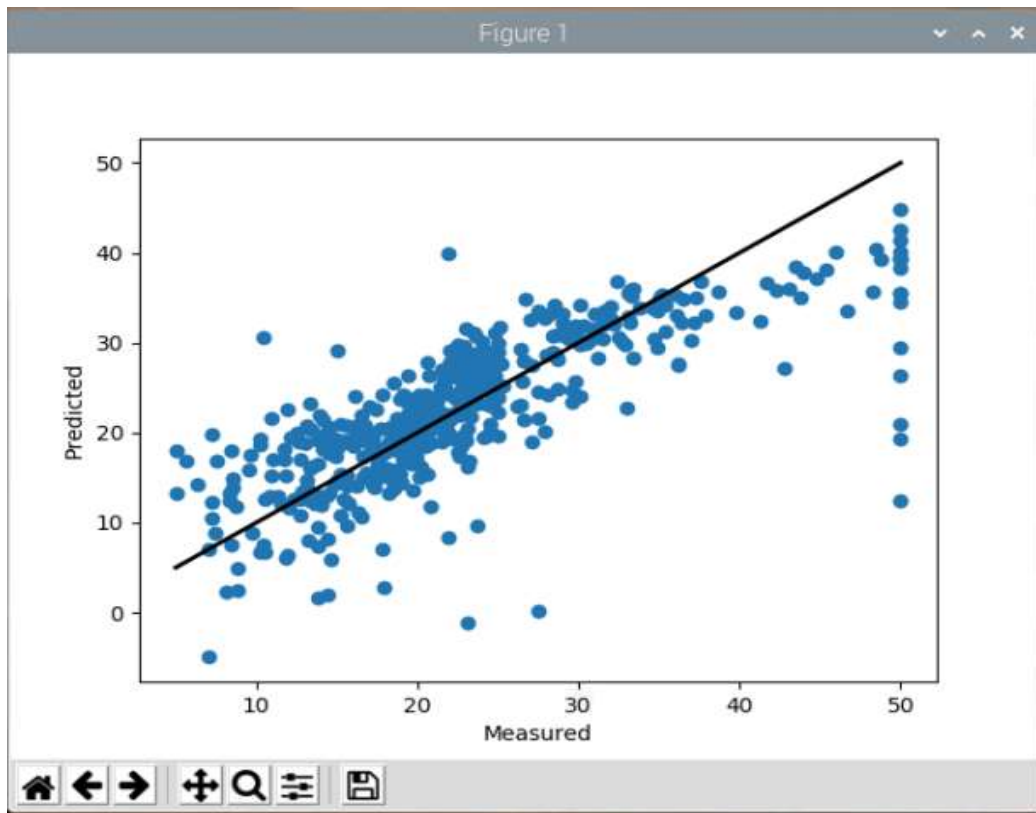


Cross-validation

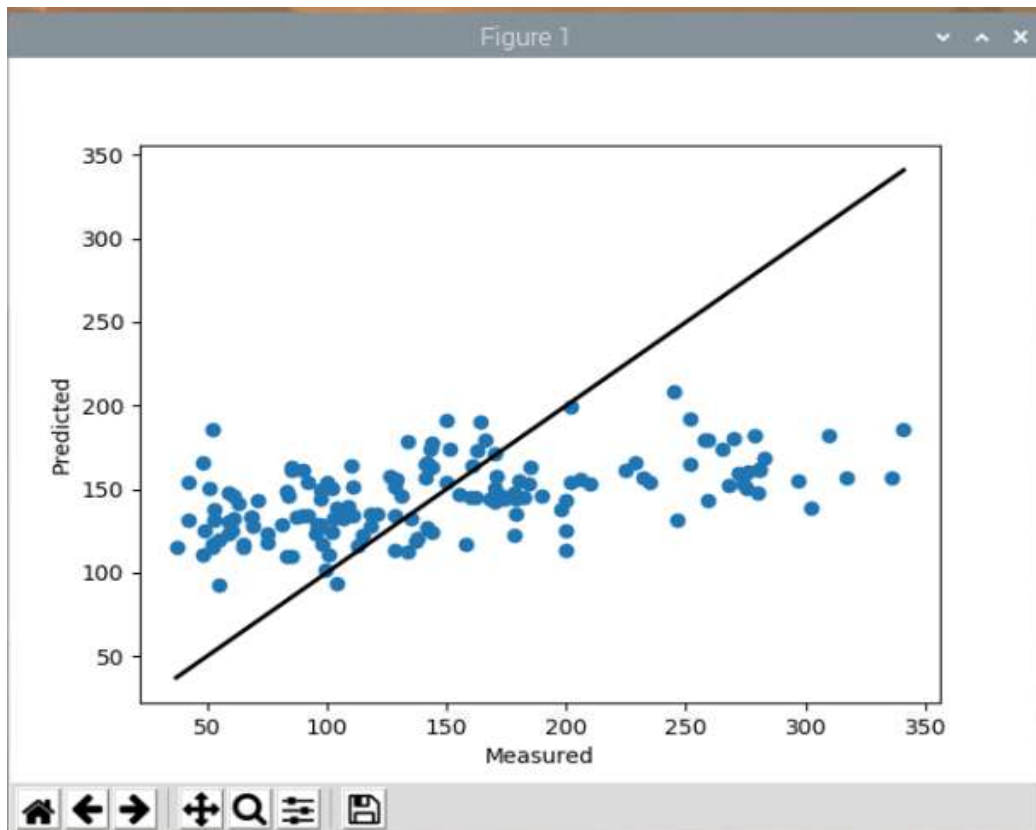
plt_cv2.py



plot_cv_predict.py



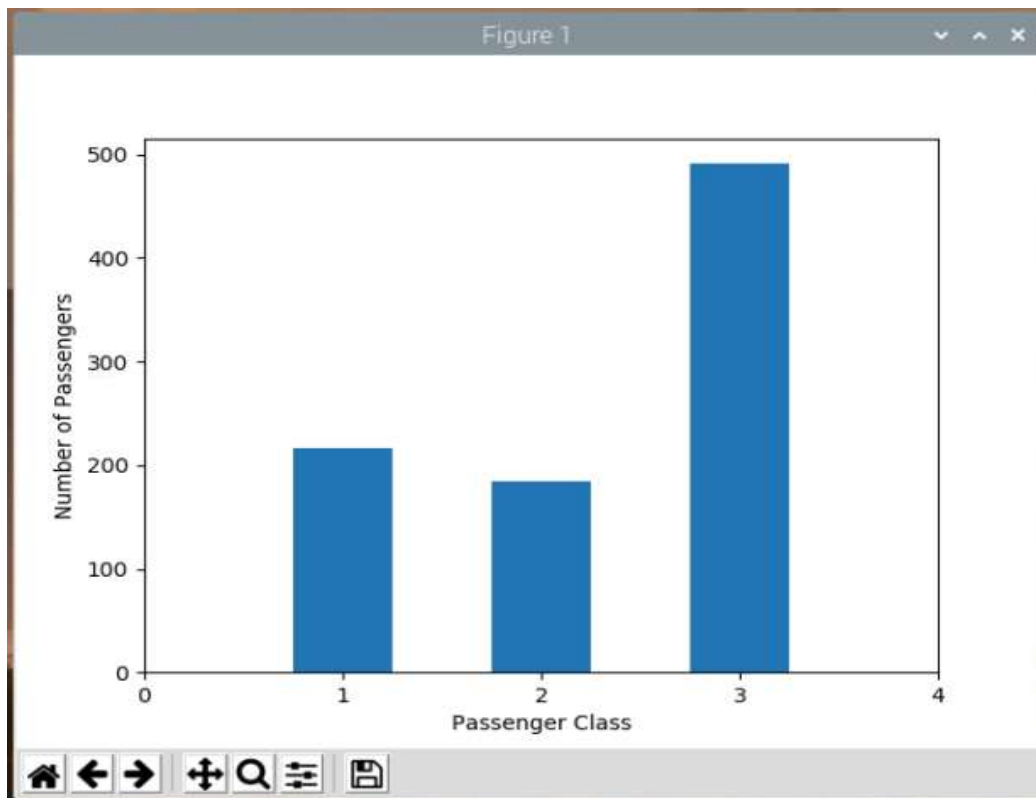
plot_cv_diabetes.py



Keras and TensorFlow

[illegible]

keras_first_network.py



Titanic example

```
pi@Zhaoning:~/iot/lesson8 $ python3 titanic_2.py
```

```
Survived:
```

```
Sex      Pclass
```

```
female  1      0.968085  
         2      0.921053  
         3      0.500000  
male    1      0.368852  
         2      0.157407  
         3      0.135447
```

```
Name: Survived, dtype: float64
```

```
Number of Missing Fare: 1
```

```
Indices of Missing Fare: 152
```

```
Survived:
```

```
Sex      Pclass  Fare_Bracket
```

```
female  1      2      0.833333  
         3      0.977273  
         2      1      0.914286  
         2      2      0.900000  
         3      3      1.000000  
         3      0      0.593750  
         1      1      0.581395  
         2      2      0.333333  
         3      3      0.125000  
male    1      0      0.000000  
         2      2      0.400000  
         3      3      0.383721  
         2      0      0.000000  
         1      1      0.158730  
         2      2      0.160000  
         3      3      0.214286  
         3      0      0.111538  
         1      1      0.236842  
         2      2      0.125000  
         3      3      0.240000
```

```
Name: Survived, dtype: float64
```

```
pi@Zhaoning:~/iot/lesson8 $
```