Stochastic Processes:
Data Analysis and Computer Simulation

Python programming for beginners

1. Using Python, iPython, and Jupyter notebook

1.1. Install anaconda

Instractions

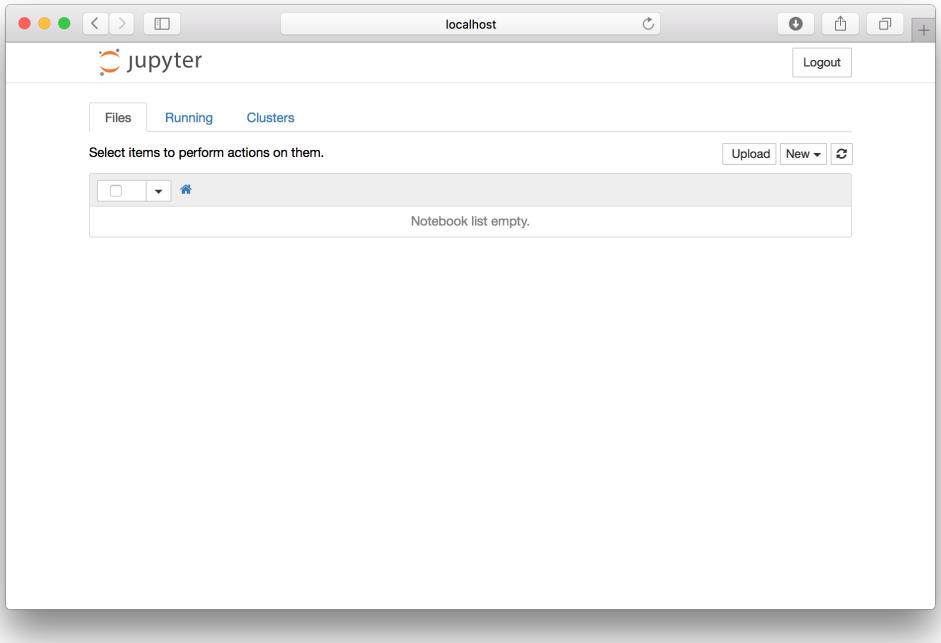
- Download the Python 3.* Anaconda package appropriate for your platform (Windows/Mac/Linux) from the official website (https://www.continuum.io/downloads (https://www.continuum.io/downloads)).
- Install anaconda by executing the installer program (see details at https://docs.continuum.io/anaconda/install (https://docs.continuum.io/anaconda/install)).
- You can update to the latest version of Anaconda by executing the following commands from the command line (optional).

```
conda update conda
conda update anaconda
```

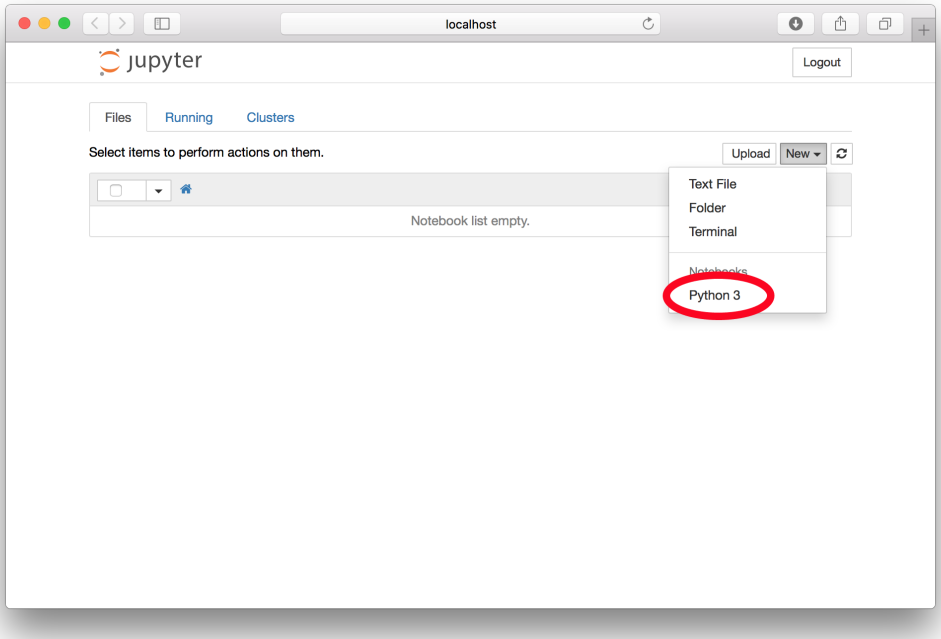
1.2. Launch jupyter notebook

Demonstration

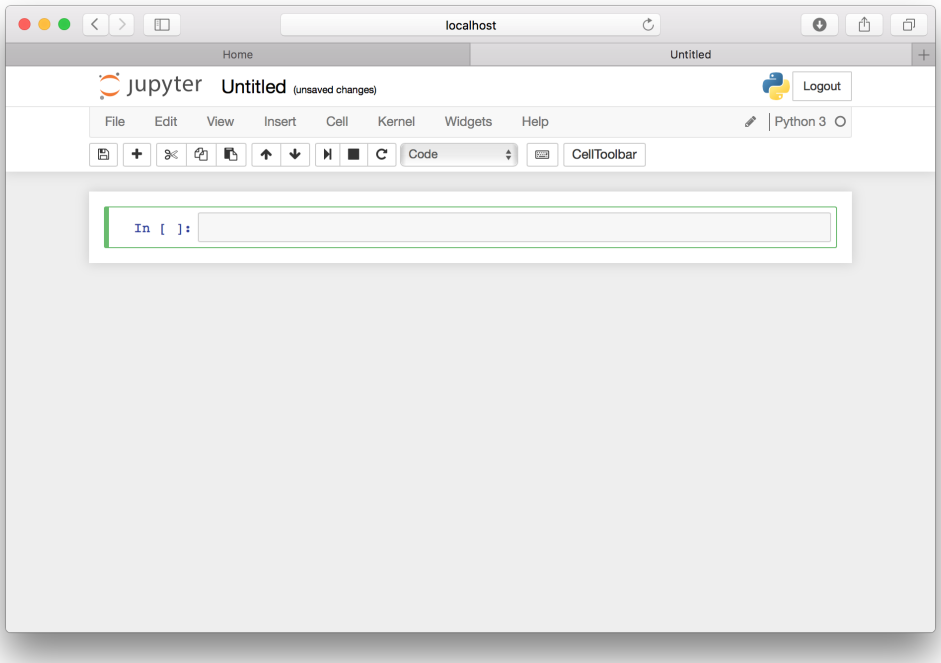
```
mkdir work
cd work
jupyter notebook
[I 18:10:21.427 NotebookApp] Serving notebooks from local directo
ry: /Users/ryoichi/work
[I 18:10:21.427 NotebookApp] 0 active kernels
...
```



Demo continued...



Demo continued...



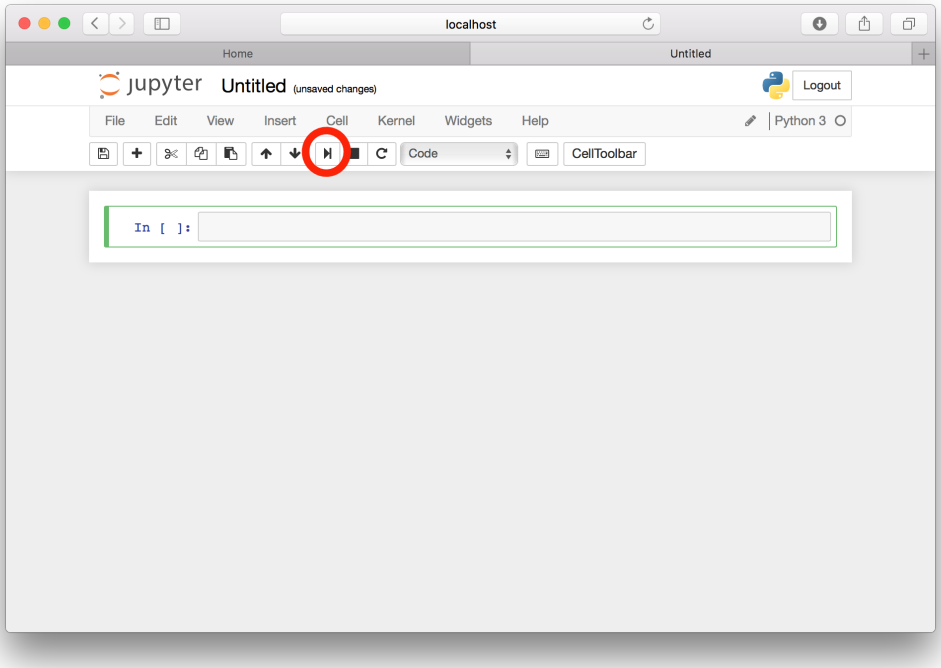
1.3. Check Python version

Demonstration

- Type the following commands, and perform one of the followings or click the icon circled in red in the figure.
  1. press "Control-Return"
  2. choose "Cell" menu -> "Insert Cell below".

```
In [2]: import sys
        sys.version
```

```
Out[2]: '3.5.2 |Anaconda 4.3.0 (x86_64)| (default, Jul  2 2016, 17:52:12) \n[GC
```



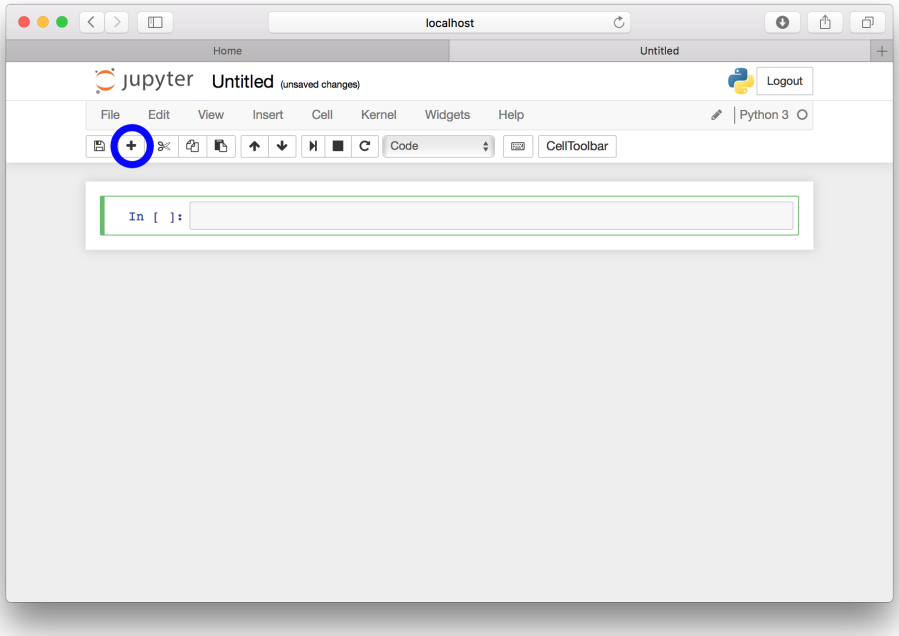
1.4. Use jupyter notebook to run Python in interactive mode: Code mode

Creat a new cell

Instructions

- Perform one of the following operations to create a new cell.

  1. press "Shift-Return"
  2. choose "Insert" -> "Insert Cell below" from the menubar.
  3. click "+" icon circled in blue in the figure.



The simplest calculation

A code example

In [2]:
```
1+1
```

Out[2]: 2

Mathematical functions

A code example

In [2]:
```
import numpy as np
thrad=0.5
theta=thrad*np.pi
sinth=np.sin(theta)
costh=np.cos(theta)
print('theta =',thrad,'* pi')
print('sin(theta) =',sinth)
print('cos(theta) =',costh)
```

```
theta = 0.5 * pi
sin(theta) = 1.0
cos(theta) = 6.12323399574e-17
```

1.5. Use jupyter notebook to write documents: Markdown mode

Change cell mode

Instructions

- Select the cell and change cell type to Markdown mode by one of the following operations.
  1. press "ESC" to enter command mode and then press "m"
  2. choose "Cell" -> "Cell Type" -> "Markdown" from the menu

Write text

A code example

- Type (or copy and paste) the following code example in the selected cell and run it.

```
# Title level 1
## Title level 2
### Title level 3

- Item 1
- Item 2


1. Enumerate 1
2. Enumerate 2
```

Title level 1

Title level 2

Title level 3

- Item 1
- Item 2

1. Enumerate 1
2. Enumerate 2

Mathematical Typesetting

A code example

- Type (or copy and paste) the following code example in the selected cell and run it.

```
$$
\frac{d\mathbf{R}(t)}{dt}=\mathbf{V}(t) \tag{1}
$$
$$
m\frac{d\mathbf{V}(t)}{dt}=-\zeta\mathbf{V}(t)-k\mathbf{R}(t) \tag{2}
$$
```

$$\frac{d\mathbf{R}(t)}{dt} = \mathbf{V}(t) \tag{1}$$

$$m\frac{d\mathbf{V}(t)}{dt} = -\zeta\mathbf{V}(t) - k\mathbf{R}(t) \tag{2}$$

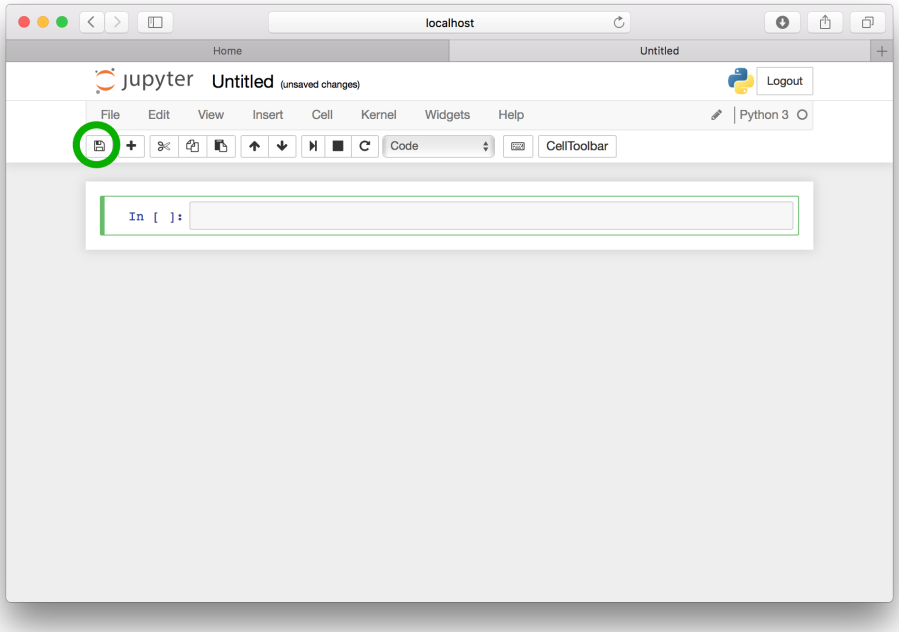
1.6. Save jupyter notebook

Save to file

1. Select "File" menu -> "Save and Checkpoint".
2. click the "save" icon circled in green in the figure shown below.

Change file name

- Select "File" menu -> "Rename" -> Enter a new notebook name -> "OK"



1.7. Terminate jupyter notebook

Server

1. Press "Control-C" ("Control" and "c" keys together) in command line.
2. Select "File" menu -> "Close and Halt".

Browser

- If the jupyter notebook server is not terminated, you can resume the notebook by re-opening the same local URL (by default, http://localhost:8888 (http://localhost:8888)).

References

- Local URL for Jupyter notebook, by default, http://localhost:8888 (http://localhost:8888)
- The numpy website, http://www.numpy.org/ (http://www.numpy.org/)
- Mastering Markdown, https://guides.github.com/features/mastering-markdown/ (https://guides.github.com/features/mastering-markdown/)
- The LaTeX project, https://www.latex-project.org/ (https://www.latex-project.org/)