金融科技

FinTech: Financial Technology

Tamkang University
淡江大學

Python Pandas財務大數據分析 (Finance Big Data Analytics with Pandas in Python)

1052FinTech07
MIS EMBA (M2263) (8595)
Fri, 12,13,14 (19:20-22:10) (D409)

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淡江大學 資訊管理學系
http://mail. tku.edu.tw/myday/

2017-04-28

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2017/02/17	Fintech 金融科技課程介紹 (Course Orientation for Fintech: Financial Technology)
2	2017/02/24	Fintech 金融科技的演進：貨幣與金融服務 (Evolution of Fintech: Money and Financial Services)
3	2017/03/03	Fintech 金融科技：金融服務科技創新 (Fintech: Technology Innovation in Financial Services)
4	2017/03/10	Fintech 金融科技與金融服務價值鏈 (Fintech and Financial Services Value Chain)
5	2017/03/17	Fintech 金融科技商業模式創新 (Fintech Business Models Innovation)
6	2017/03/24	Fintech 金融科技個案研究 I (Case Study on Fintech I)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2017/03/31	金融服務消費者心理與行為 (Consumer Psychology and Behavior on Financial Services)
8	2017/04/07	教學行政觀摩日 (Off-campus study)
9	2017/04/14	區塊鏈技術 (Blockchain Technology) [Invited Speaker: Dr. Raymund Lin, IBM (林俊叡 博士，IBM)]
10	2017/04/21	期中報告 (Midterm Project Report)
11	2017/04/28	Python Pandas財務大數據分析 (Finance Big Data Analytics with Pandas in Python)
12	2017/05/05	人工智慧與深度學習金融科技 (Artificial Intelligence and Deep Learning for Fintech)

課程大綱 (Syllabus)

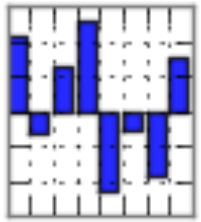
週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2017/05/12	Fintech 金融科技個案研究 II (Case Study on Fintech II)
14	2017/05/19	金融科技財富管理：機器人理財顧問 (Robo-Advisors for Wealth Management in Fintech)
15	2017/05/26	投資組合最佳化與程式交易 (Portfolio Optimization and Algorithmic Trading)
16	2017/06/02	金融科技智慧問答系統 (Intelligent Question Answering System for Fintech)
17	2017/06/09	期末報告 I (Final Project Presentation I)
18	2017/06/16	期末報告 II (Final Project Presentation II)

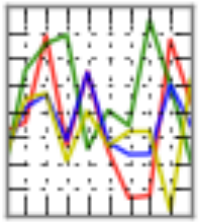
Finance Big Data Analytics with Pandas in Python

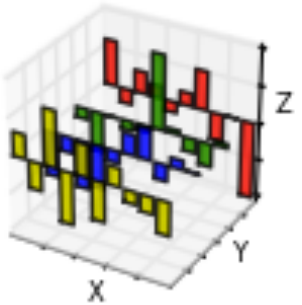
python™

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

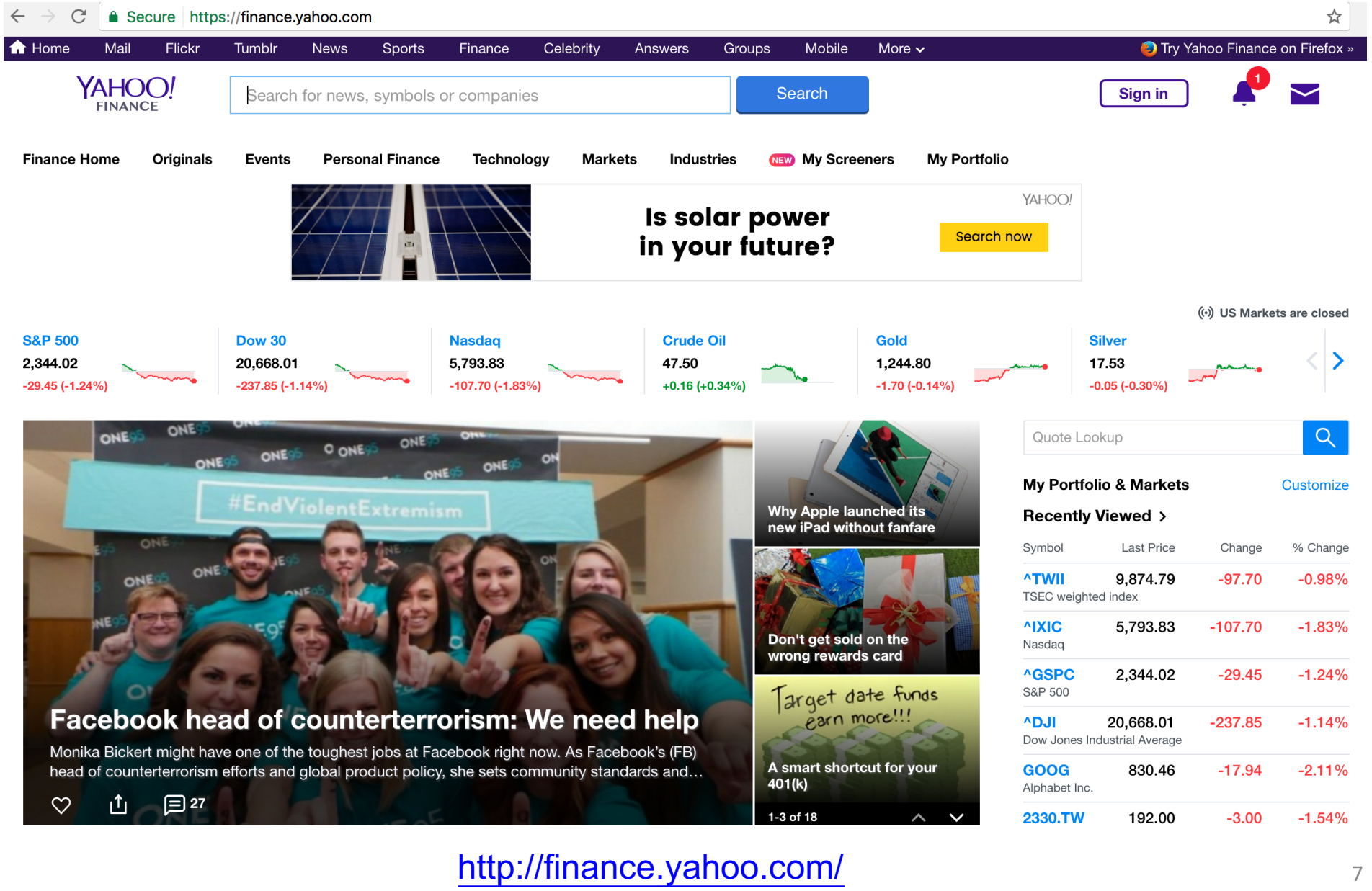






Source: https://www.python.org/community/logos/
http://pandas.pydata.org/

Yahoo Finance



http://finance.yahoo.com/

Apple Inc. (AAPL) -NasdaqGS

YAHOO! FINANCE

Search for news, symbols or companies | Search

Apple Inc. (AAPL)

NasdaqGS - NasdaqGS Delayed Price. Currency in USD

Add to watchlist

139.84 -1.62 (-1.15%)
At close: 4:00PM EDT

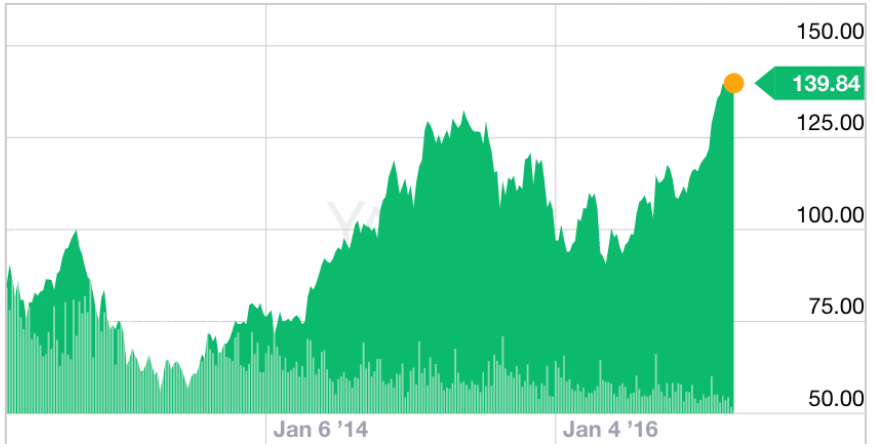
139.35 -0.49 (-0.35%)
After hours: 7:59PM EDT

Summary | Conversations | Statistics | Profile | Financials | Options | Holders | Historical Data | Analysts

Previous Close	141.46	Market Cap	733.68B
Open	142.11	Beta	1.45
Bid	139.31 x 100	PE Ratio (TTM)	16.79
Ask	139.40 x 1300	EPS (TTM)	8.33
Day's Range	139.73 - 142.80	Earnings Date	Apr 24, 2017 - Apr 28, 2017
52 Week Range	89.47 - 142.80	Dividend & Yield	2.28 (1.63%)
Volume	39,529,912	Ex-Dividend Date	N/A
Avg. Volume	26,889,183	1y Target Est	143.29

Trade prices are not sourced from all markets

1D 5D 1M 6M YTD 1Y 2Y **5Y** 10Y MAX | Interactive chart



http://finance.yahoo.com/quote/AAPL?p=AAPL

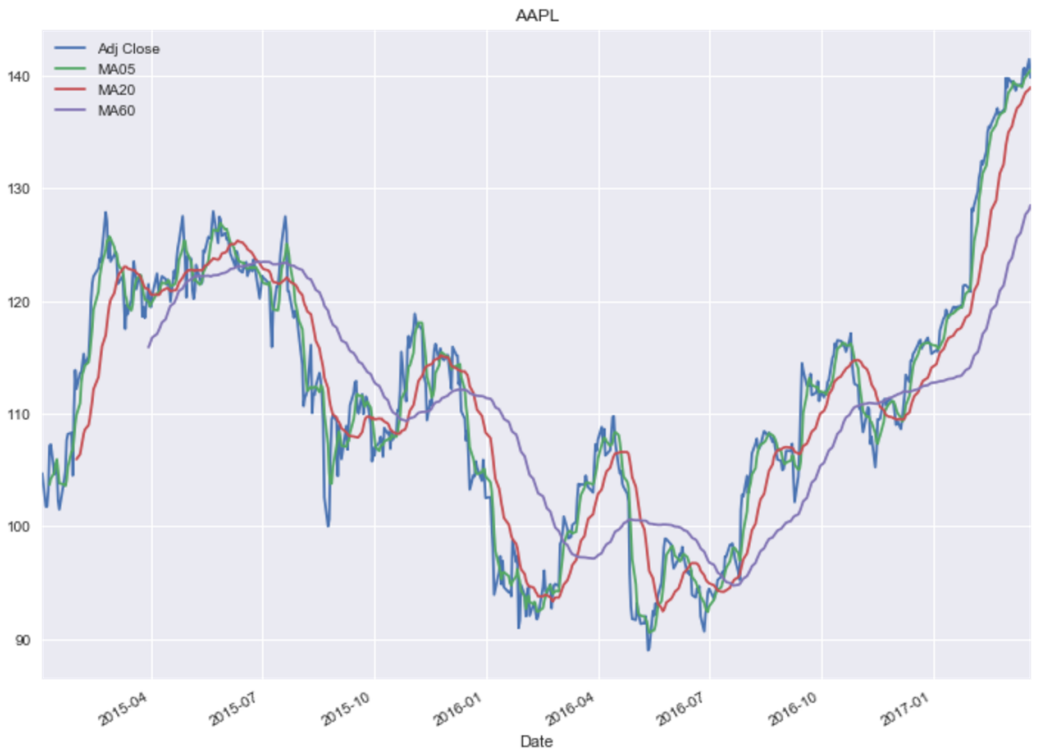
Yahoo Finance Charts: Apple Inc. (AAPL)

http://finance.yahoo.com/chart/AAPL

Python Pandas for Finance

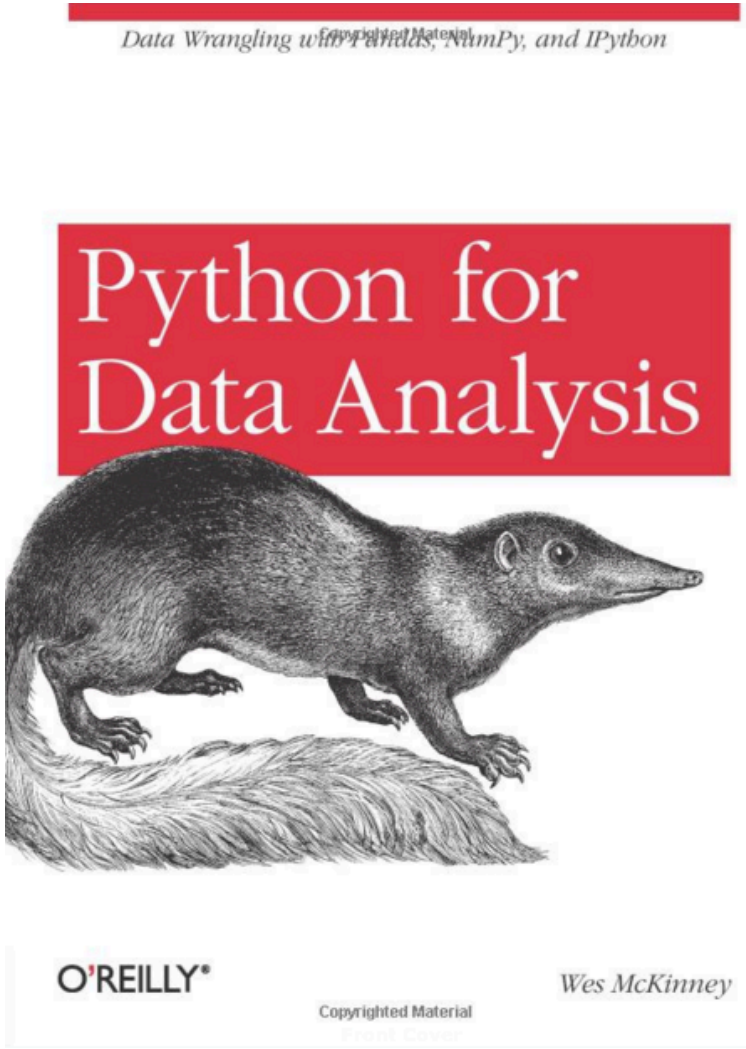
```
# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean() #5 days
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days

df2 = pd.DataFrame({'Adj Close': df['Adj Close'],'MA05': df['MA05'],'MA20': df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True, title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
```



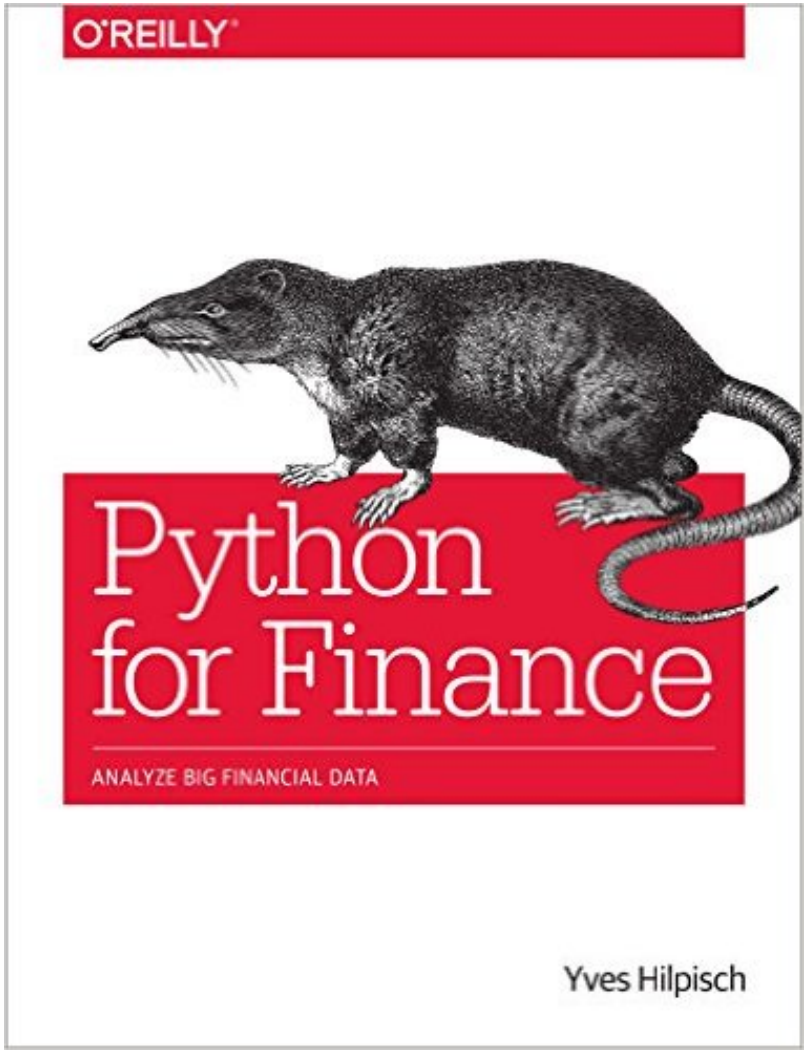
Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Wes McKinney (2012), Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media



Source: http://www.amazon.com/Python-Data-Analysis-Wrangling-IPython/dp/1449319793/

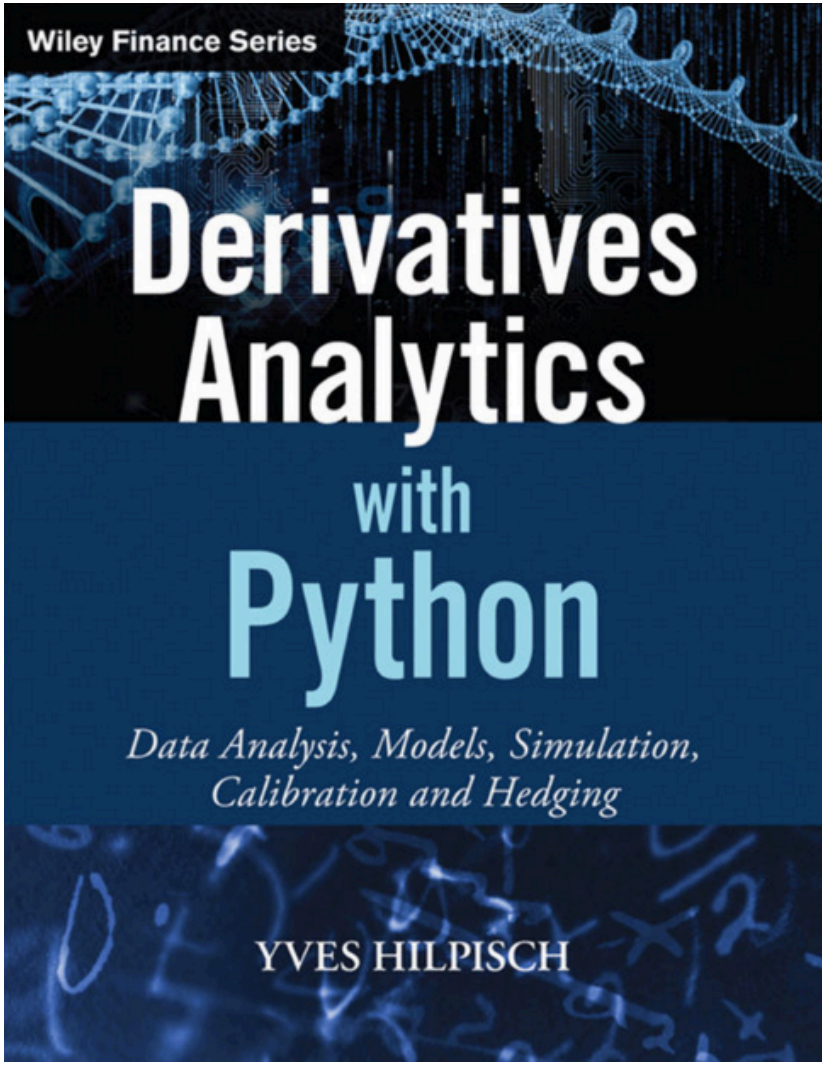
Yves Hilpisch, Python for Finance: Analyze Big Financial Data, O'Reilly, 2014



Source: http://www.amazon.com/Python-Finance-Analyze-Financial-Data/dp/1491945281

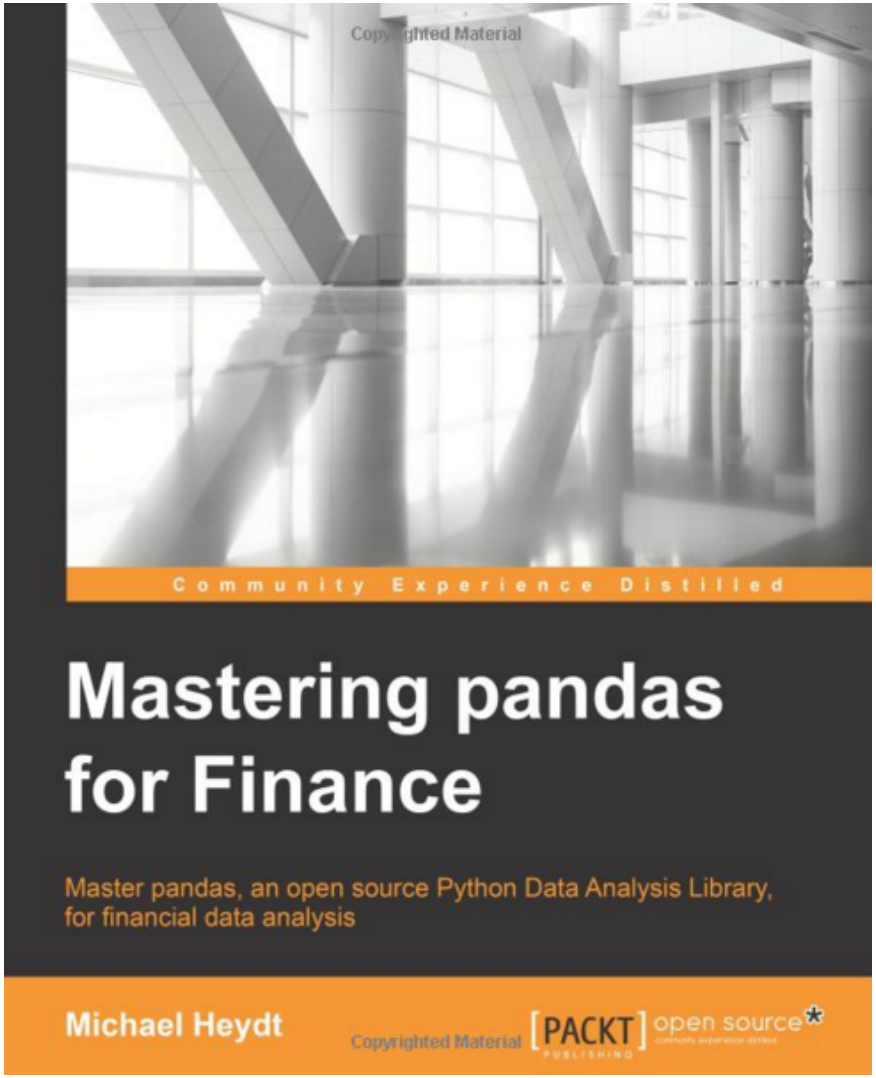
Yves Hilpisch (2015), Derivatives Analytics with Python:

Data Analysis, Models, Simulation, Calibration and Hedging, Wiley



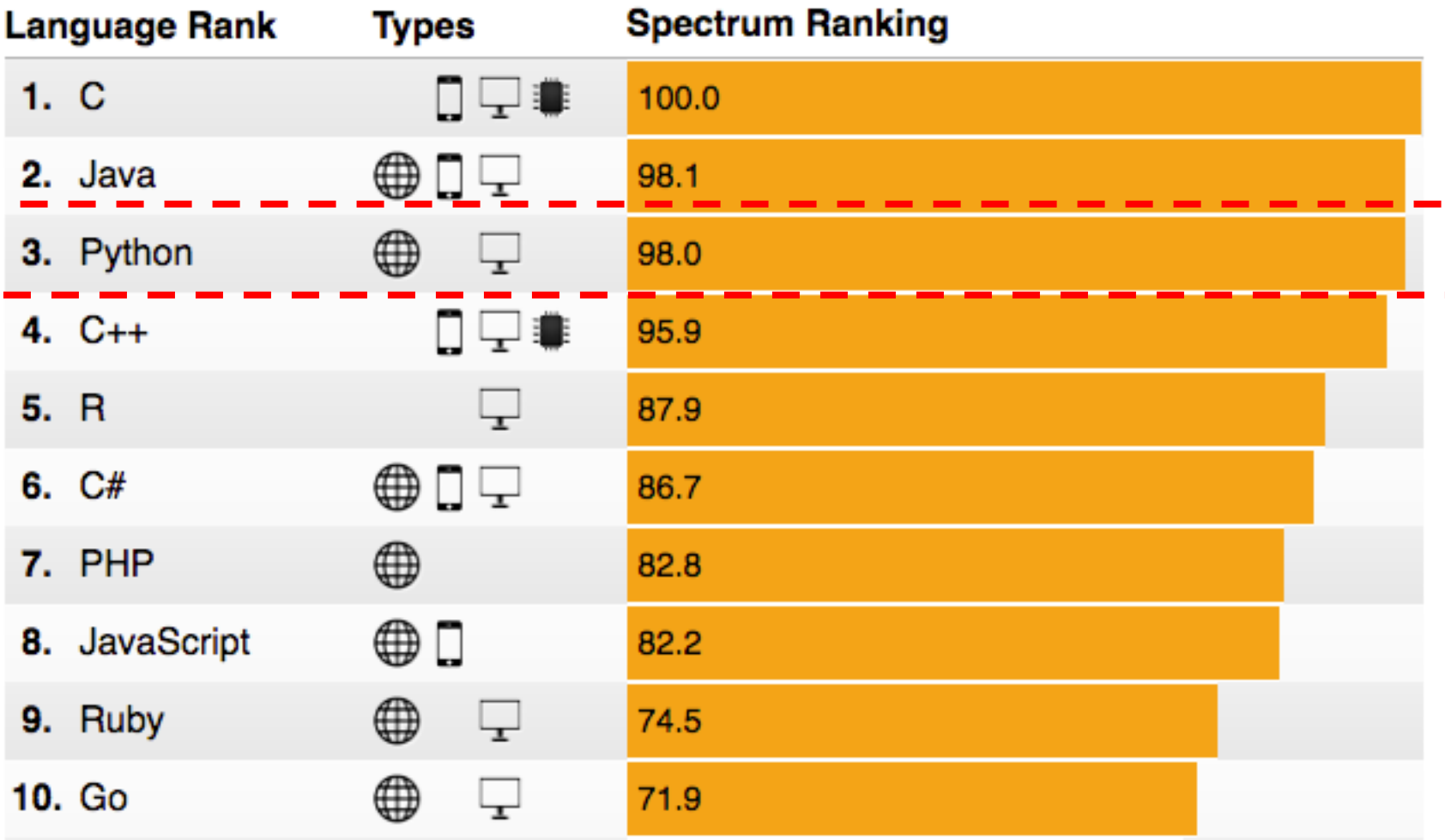
Source: http://www.amazon.com/Derivatives-Analytics-Python-Simulation-Calibration/dp/1119037999/

Michael Heydt ,
Mastering Pandas for Finance,
Packt Publishing, 2015



Source: http://www.amazon.com/Mastering-Pandas-Finance-Michael-Heydt/dp/1783985100

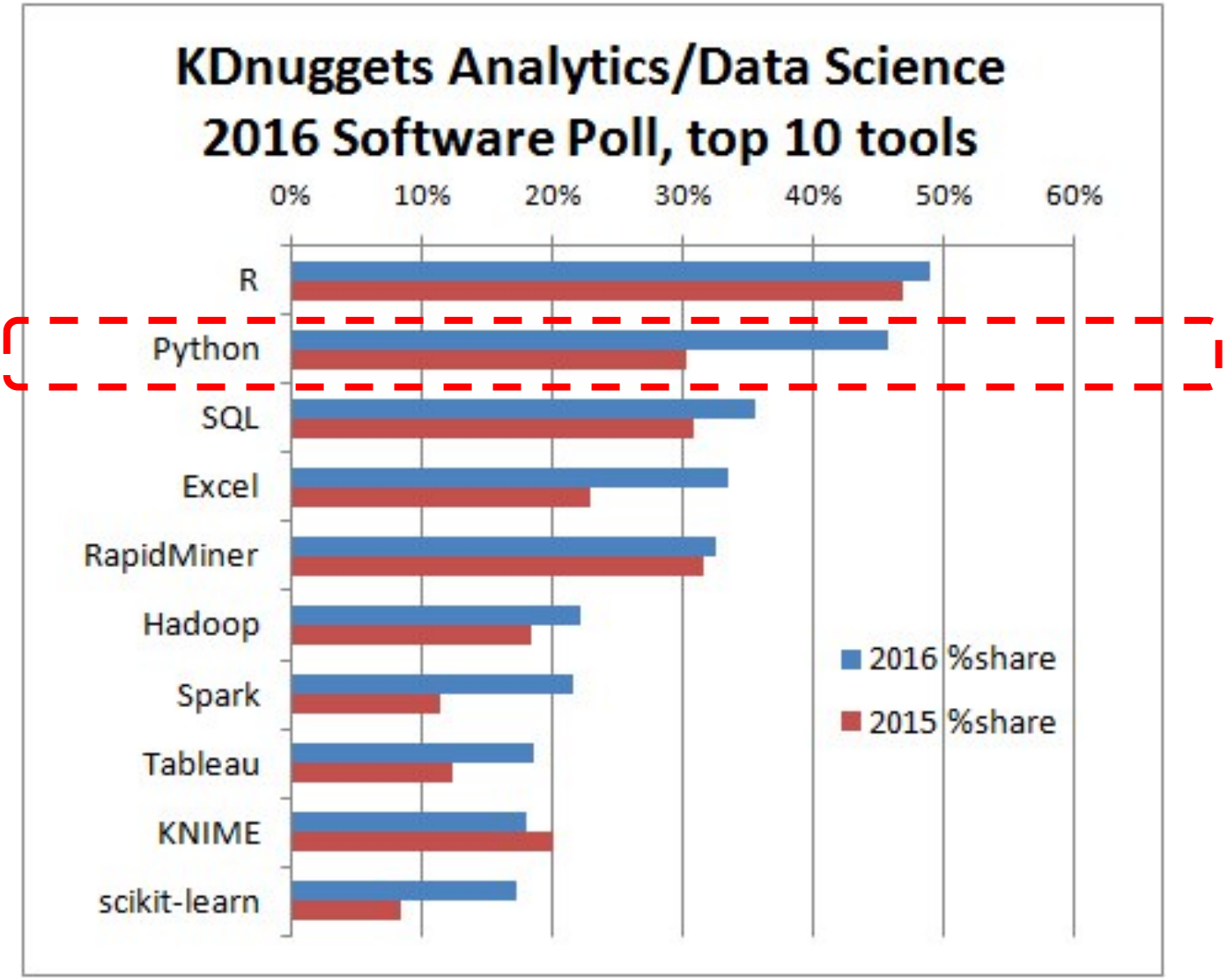
Python for Big Data Analytics



Language Rank	Types	Spectrum Ranking
1. C		100.0
2. Java		98.1
3. Python		98.0
4. C++		95.9
5. R		87.9
6. C#		86.7
7. PHP		82.8
8. JavaScript		82.2
9. Ruby		74.5
10. Go		71.9

Source: http://spectrum.ieee.org/computing/software/the-2016-top-programming-languages

Python: Analytics and Data Science Software



Source: http://www.kdnuggets.com/2016/06/r-python-top-analytics-data-mining-data-science-software.html

Anaconda

ANACONDA
Powered by Continuum Analytics

Log In Get Support Search Contact

PRODUCTS COMMUNITY CONSULTING TRAINING ABOUT RESOURCES

ACCELERATE

Time-to-Value

CONNECT

Data, Analytics & Compute

EMPOWER

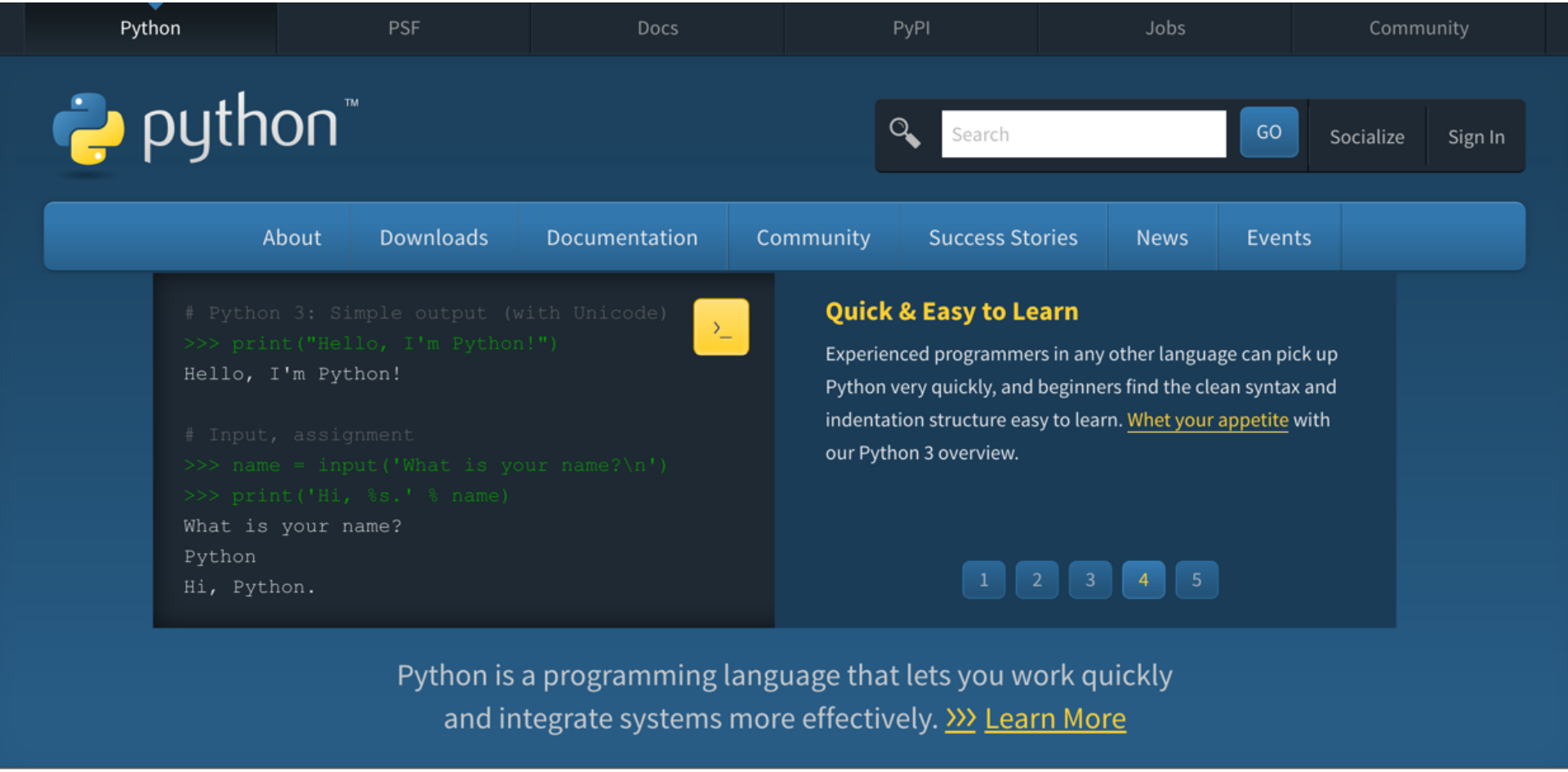
Data Science Teams

https://www.continuum.io/

Leading Open Data Science Platform Powered by Python

Source: https://www.continuum.io/

Python



https://www.python.org/

python™

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics.

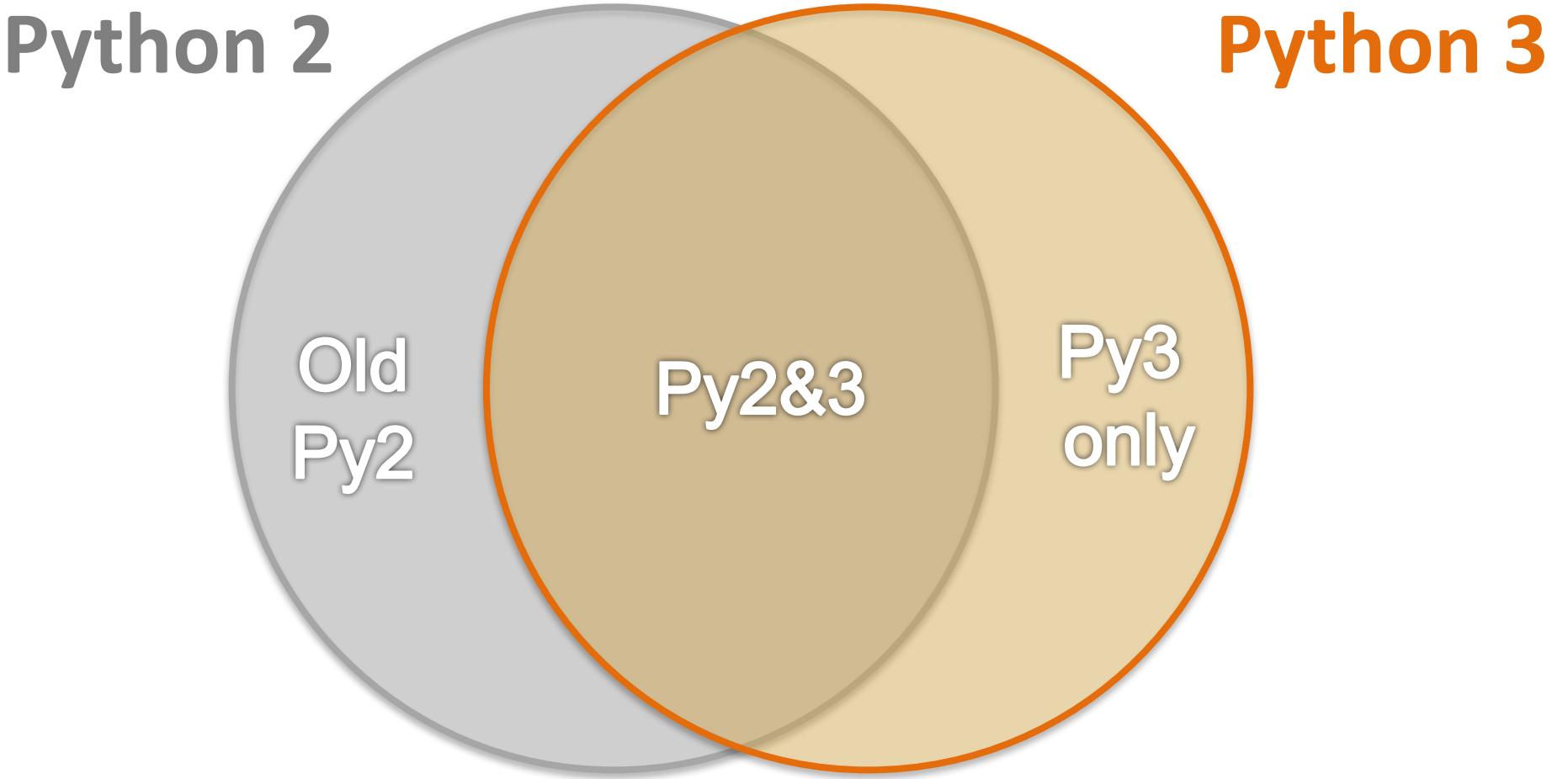
Source: https://www.python.org/doc/essays/blurb/

Python versions (py2 and py3)

- Python 0.9.0 released in 1991 (first release)
- Python 1.0 released in 1994
- Python 2.0 released in 2000
- Python 2.6 released in 2008
- **Python 2.7 released in 2010**
- **Python 3.0 released in 2008**
- Python 3.3 released in 2010
- Python 3.4 released in 2014
- **Python 3.5 released in 2015**
- **Python 3.6 released in 2016**

Source: Yves Hilpisch (2014), Python for Finance: Analyze Big Financial Data, O'Reilly

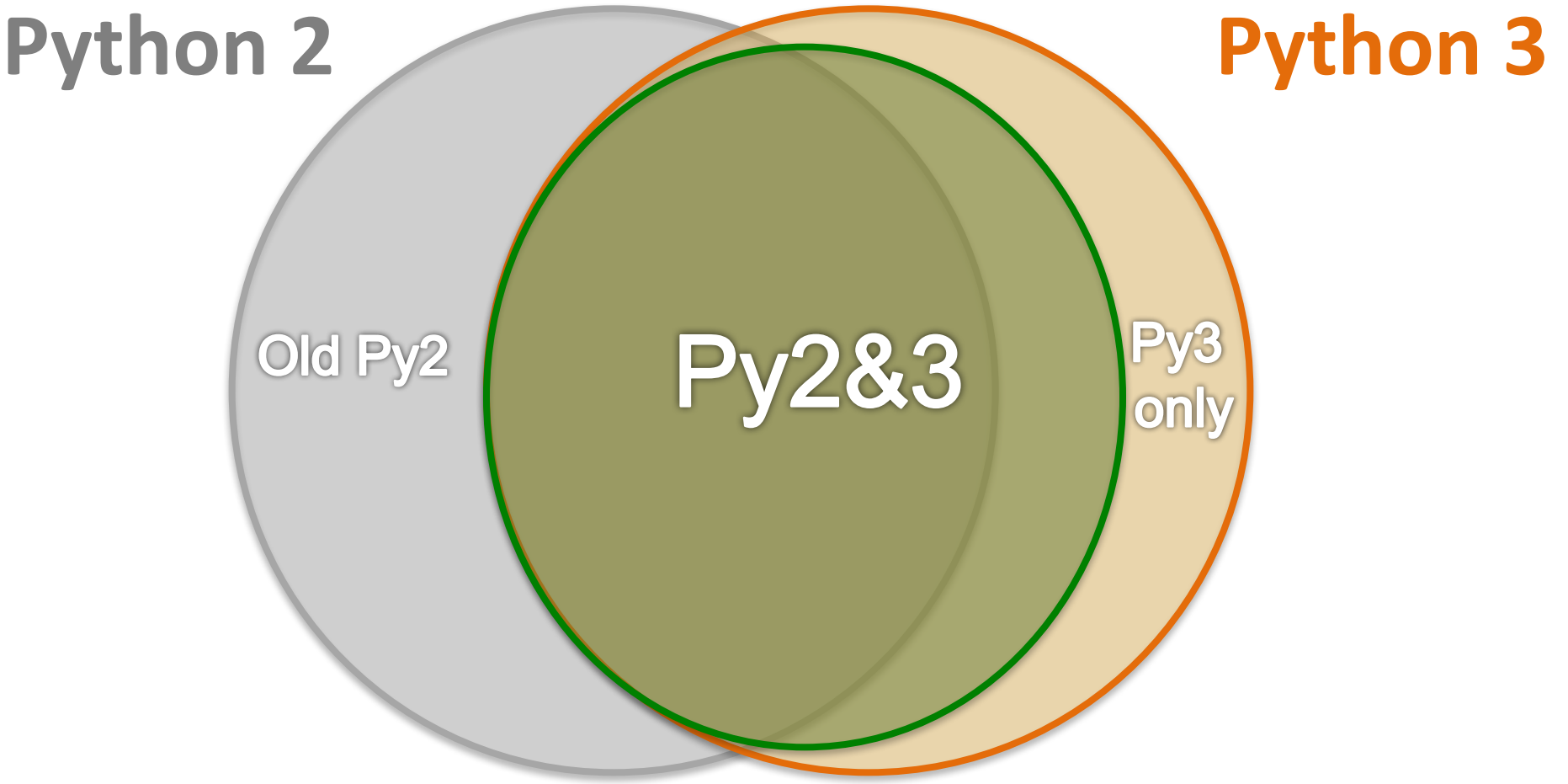
Python (Python 2.7 & Python 3.6) Standard Syntax



Source: PyCon Australia (2014), Writing Python 2/3 compatible code by Edward Schofield
https://www.youtube.com/watch?v=KOqk8j11aAI

`from __ future __ import ...`

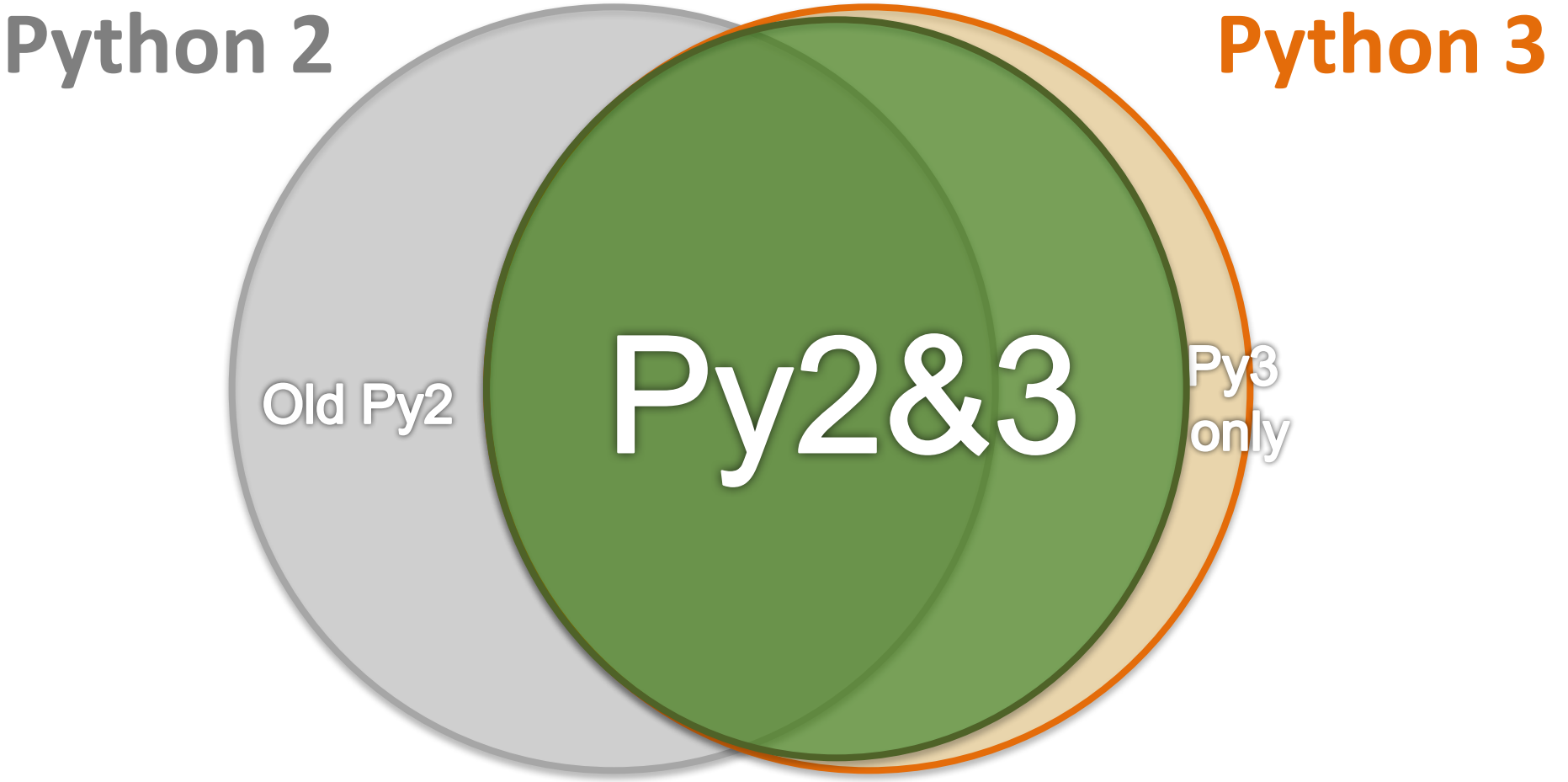
python™



Source: PyCon Australia (2014), Writing Python 2/3 compatible code by Edward Schofield
https://www.youtube.com/watch?v=KOqk8j11aAI

`from future.builtins import *`

python™



Source: PyCon Australia (2014), Writing Python 2/3 compatible code by Edward Schofield
https://www.youtube.com/watch?v=KOqk8j11aAI

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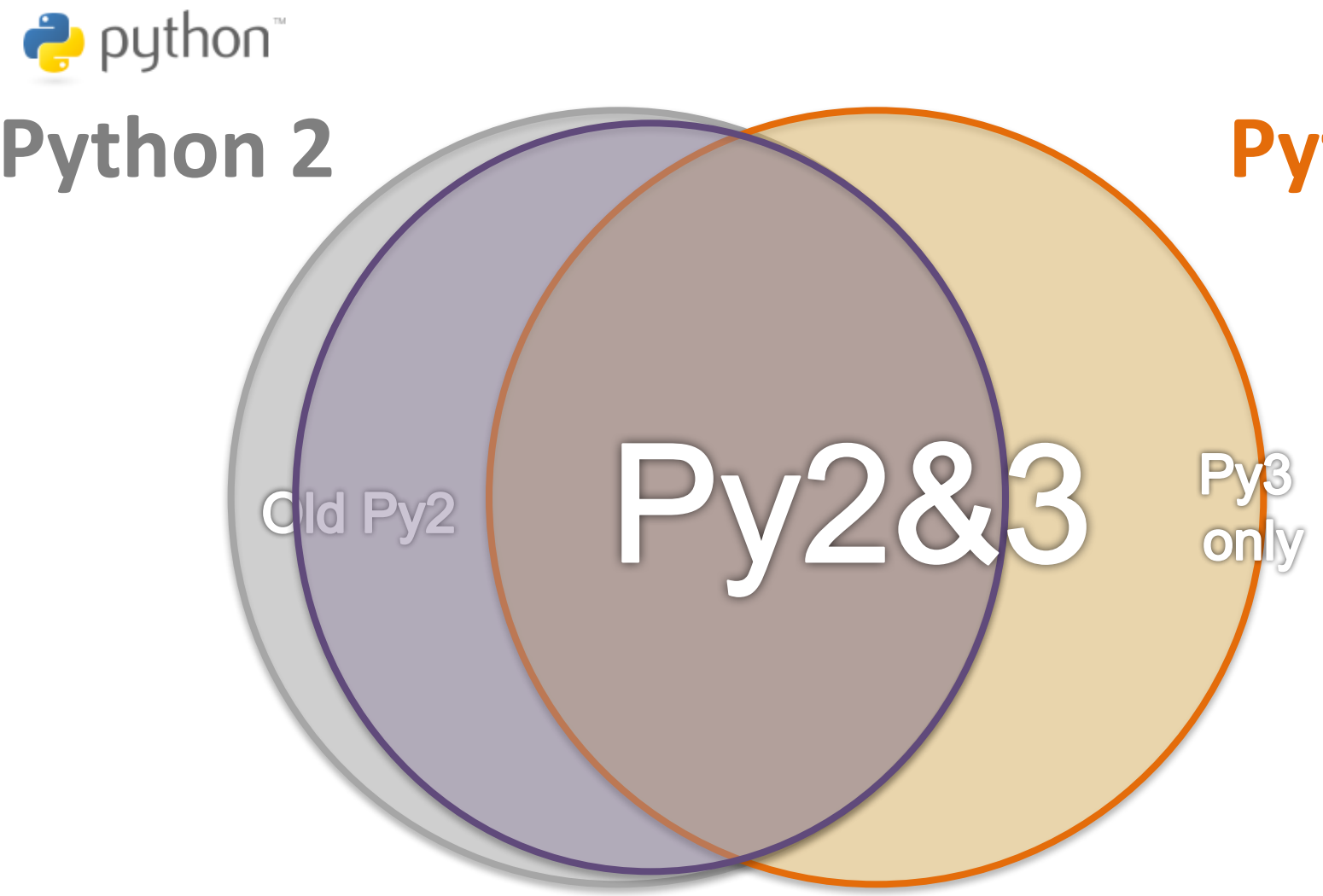
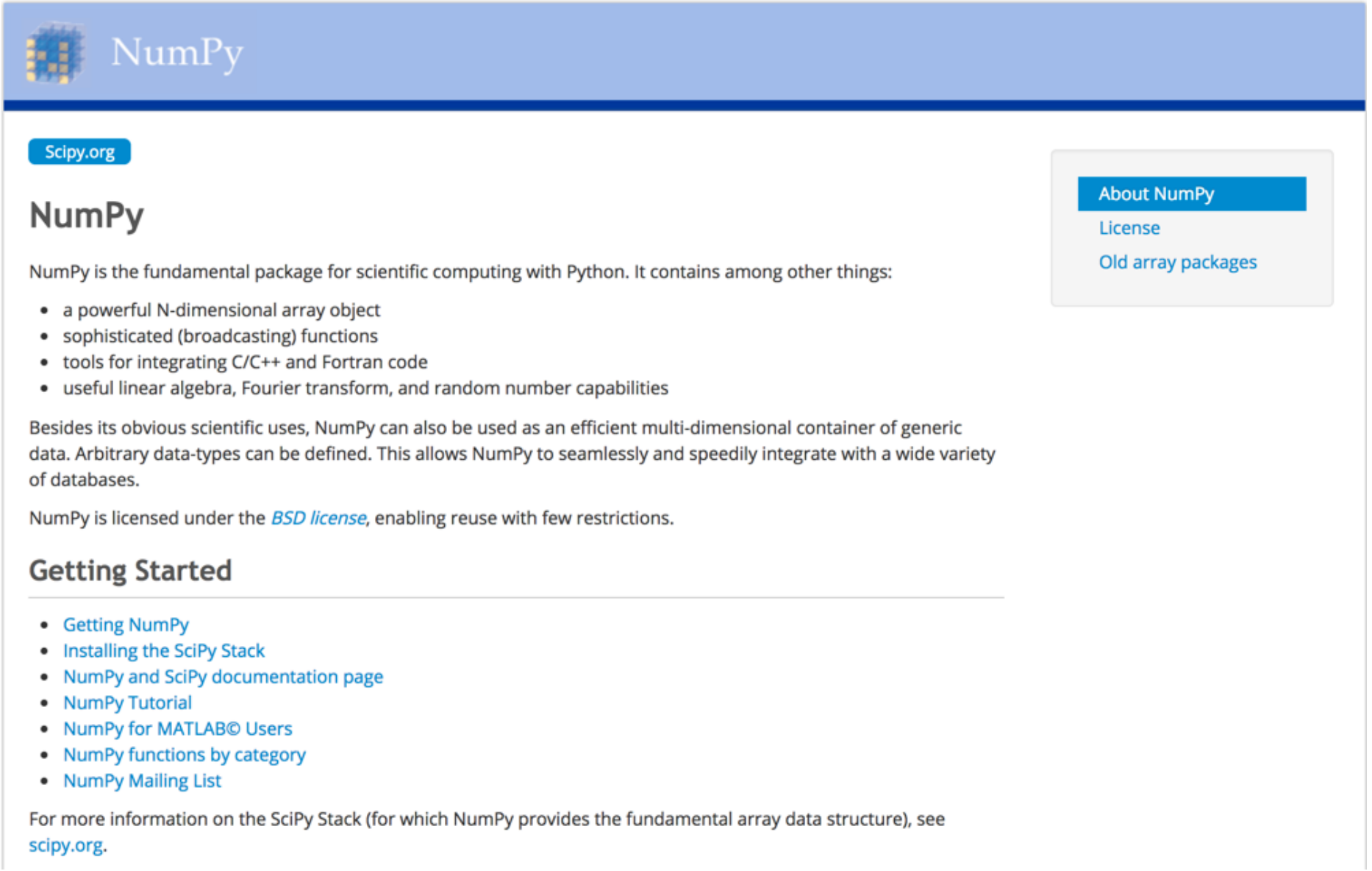


Source: PyCon Australia (2014), Writing Python 2/3 compatible code by Edward Schofield
https://www.youtube.com/watch?v=KOqk8j11aAI

NumPy



http://www.numpy.org/

NumPy

is the

fundamental package

for

scientific computing

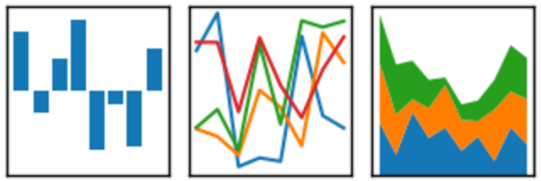
with Python.

Source: http://www.numpy.org/

pandas

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



Python Data Analysis Library

pandas is an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language.

pandas is a NUMFocus sponsored project. This will help ensure the success of development of *pandas* as a world-class open-source project.

A Fiscally Sponsored Project of
NUMFOCUS
OPEN CODE = BETTER SCIENCE

0.19.2 Final (December 24, 2016)

This is a minor bug-fix release in the 0.19.x series and includes some small regression fixes, bug fixes and performance improvements.

Highlights include:

- Compatibility with Python 3.6

VERSIONS

Release
0.19.2 - December 2016
download // docs // pdf

Development
0.20.0 - 2017
github // docs

Previous Releases
0.19.1 - download // docs // pdf
0.19.0 - download // docs // pdf
0.18.1 - download // docs // pdf
0.18.0 - download // docs // pdf
0.17.1 - download // docs // pdf
0.17.0 - download // docs // pdf
0.16.2 - download // docs // pdf
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0.15.2 - download // docs // pdf
0.15.1 - download // docs // pdf
0.15.0 - download // docs // pdf
0.14.1 - download // docs // pdf

http://pandas.pydata.org/

pandas

Python Data Analysis Library

providing high-performance, easy-to-use
data structures and data analysis tools
for the Python programming language.

Source: http://pandas.pydata.org/

pandas Ecosystem

- Statistics and Machine Learning
  - Statsmodels
  - sklearn-pandas
- Visualization
  - Bokeh
  - yhat/ggplot
  - Seaborn
  - Vincent
  - IPython Vega
  - Plotly
  - Pandas-Qt
- IDE
  - IPython
  - quantopian/qgrid
  - Spyder
- API
  - pandas-datareader
  - quandl/Python
  - pydatastream
  - pandaSDMX
  - fredapi
- Domain Specific
  - Geopandas
  - xarray
- Out-of-core
  - Dask
  - Blaze
  - Odo

Source: http://pandas.pydata.org/pandas-docs/stable/index.html

pandas: powerful Python data analysis toolkit

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- MultiIndex / Advanced Indexing
- Computational tools
- Working with missing data
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- Merge, join, and concatenate
- Reshaping and Pivot Tables
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- Categorical Data
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- pandas Ecosystem
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- Comparison with SQL
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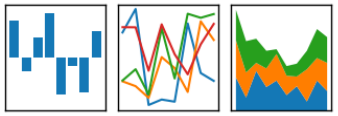
pandas: powerful Python data analysis toolkit

PDF Version

Zipped HTML

pandas

$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$



Date: Dec 24, 2016 **Version**: 0.19.2

Binary Installers: http://pypi.python.org/pypi/pandas

Source Repository: http://github.com/pydata/pandas

Issues & Ideas: https://github.com/pydata/pandas/issues

Q&A Support: http://stackoverflow.com/questions/tagged/pandas

Developer Mailing List: http://groups.google.com/group/pydata

pandas is a Python package providing fast, flexible, and expressive data structures designed to make working with "relational" or "labeled" data both easy and intuitive. It aims to be the fundamental high-level building block for doing practical, **real world** data analysis in Python. Additionally, it has the broader goal of becoming **the most powerful and flexible open source data analysis / manipulation tool available in any language**. It is already well on its way toward this goal.

pandas is well suited for many different kinds of data:

- Tabular data with heterogeneously-typed columns, as in an SQL table or Excel spreadsheet
- Ordered and unordered (not necessarily fixed-frequency) time series data.
- Arbitrary matrix data (homogeneously typed or heterogeneous) with row and column labels
- Any other form of observational / statistical data sets. The data actually need not be labeled at all to be placed into a pandas data structure

The two primary data structures of pandas, `Series` (1-dimensional) and `DataFrame` (2-dimensional), handle the vast majority of typical use cases in finance, statistics, social science, and many areas of engineering. For R users, `DataFrame` provides everything that R's `data.frame` provides and much more. pandas is built on top of NumPy and is

http://pandas.pydata.org/pandas-docs/stable/

pandas:
powerful Python data analysis toolkit

- Tabular data with heterogeneously-typed columns, as in an SQL table or Excel spreadsheet
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Source: http://pandas.pydata.org/pandas-docs/stable/

Series
DataFrame

- Primary data structures of pandas
  - Series (1-dimensional)
  - DataFrame (2-dimensional)
- Handle the vast majority of typical use cases in finance, statistics, social science, and many areas of engineering.

Source: http://pandas.pydata.org/pandas-docs/stable/

pandas DataFrame

- DataFrame provides everything that R's data.frame provides and much more.
- pandas is built on top of NumPy and is intended to integrate well within a scientific computing environment with many other 3rd party libraries.

pandas
Comparison with SAS

pandas	SAS
DataFrame	data set
column	variable
row	observation
groupby	BY-group
NaN	.

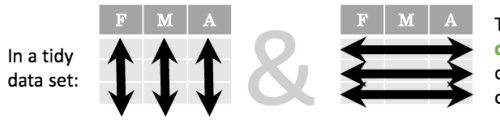
Source: http://pandas.pydata.org/pandas-docs/stable/comparison_with_sas.html

Python Pandas Cheat Sheet

Data Wrangling with pandas Cheat Sheet

http://pandas.pydata.org

Tidy Data – A foundation for wrangling in pandas



Each **variable** is saved in its own **column**

Each **observation** is saved in its own **row**

Tidy data complements pandas's **vectorized operations**. pandas will automatically preserve observations as you manipulate variables. No other format works as intuitively with pandas.

M * A

Syntax – Creating DataFrames

	a	b	c
1	4	7	10
2	5	8	11
3	6	9	12

```
df = pd.DataFrame(
        {"a" : [4 ,5, 6],
         "b" : [7, 8, 9],
         "c" : [10, 11, 12]},
       index = [1, 2, 3])
```

Specify values for each column.

```
df = pd.DataFrame(
    [[4, 7, 10],
     [5, 8, 11],
     [6, 9, 12]],
    index=[1, 2, 3],
    columns=['a', 'b', 'c'])
```

Specify values for each row.

		a	b	c
n	v			
d	1	4	7	10
	2	5	8	11
e	2	6	9	12

```
df = pd.DataFrame(
        {"a" : [4 ,5, 6],
         "b" : [7, 8, 9],
         "c" : [10, 11, 12]},
index = pd.MultiIndex.from_tuples(
        [('d',1),('d',2),('e',2)],
          names=['n','v']))
```

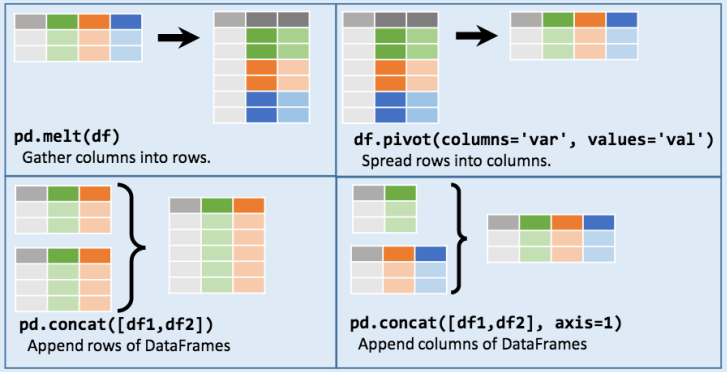
Create DataFrame with a MultiIndex

Method Chaining

Most pandas methods return a DataFrame so that another pandas method can be applied to the result. This improves readability of code.

```
df = (pd.melt(df)
        .rename(columns={
                'variable' : 'var',
                'value' : 'val'})
        .query('val >= 200')
    )
```

Reshaping Data – Change the layout of a data set



pd.melt(df)
Gather columns into rows.

df.pivot(columns='var', values='val')
Spread rows into columns.

pd.concat([df1,df2])
Append rows of DataFrames

pd.concat([df1,df2], axis=1)
Append columns of DataFrames

df=df.sort_values('mpg')
Order rows by values of a column (low to high).

df=df.sort_values('mpg',ascending=False)
Order rows by values of a column (high to low).

df=df.rename(columns = {'y':'year'})
Rename the columns of a DataFrame

df=df.sort_index()
Sort the index of a DataFrame

df=df.reset_index()
Reset index of DataFrame to row numbers, moving index to columns.

df=df.drop(['Length','Height'], axis=1)
Drop columns from DataFrame

Subset Observations (Rows)

df[df.Length > 7]
Extract rows that meet logical criteria.

df.drop_duplicates()
Remove duplicate rows (only considers columns).

df.head(n)
Select first n rows.

df.tail(n)
Select last n rows.

df.sample(frac=0.5)
Randomly select fraction of rows.

df.sample(n=10)
Randomly select n rows.

df.iloc[10:20]
Select rows by position.

df.nlargest(n, 'value')
Select and order top n entries.

df.nsmallest(n, 'value')
Select and order bottom n entries.

Subset Variables (Columns)

df[['width','length','species']]
Select multiple columns with specific names.

df['width'] *or* **df.width**
Select single column with specific name.

df.filter(regex='*regex*')
Select columns whose name matches regular expression *regex*.

regex (Regular Expressions) Examples

`'\.'`	Matches strings containing a period '.'
`'Length$'`	Matches strings ending with word 'Length'
`'^Sepal'`	Matches strings beginning with the word 'Sepal'
`'^x[1-5]$'`	Matches strings beginning with 'x' and ending with 1,2,3,4,5
`''^(?!Species$).*'`	Matches strings except the string 'Species'

df.loc[:,'x2':'x4']
Select all columns between x2 and x4 (inclusive).

df.iloc[:,[1,2,5]]
Select columns in positions 1, 2 and 5 (first column is 0).

df.loc[df['a'] > 10, ['a','c']]
Select rows meeting logical condition, and only the specific columns .

Logic in Python (and pandas)

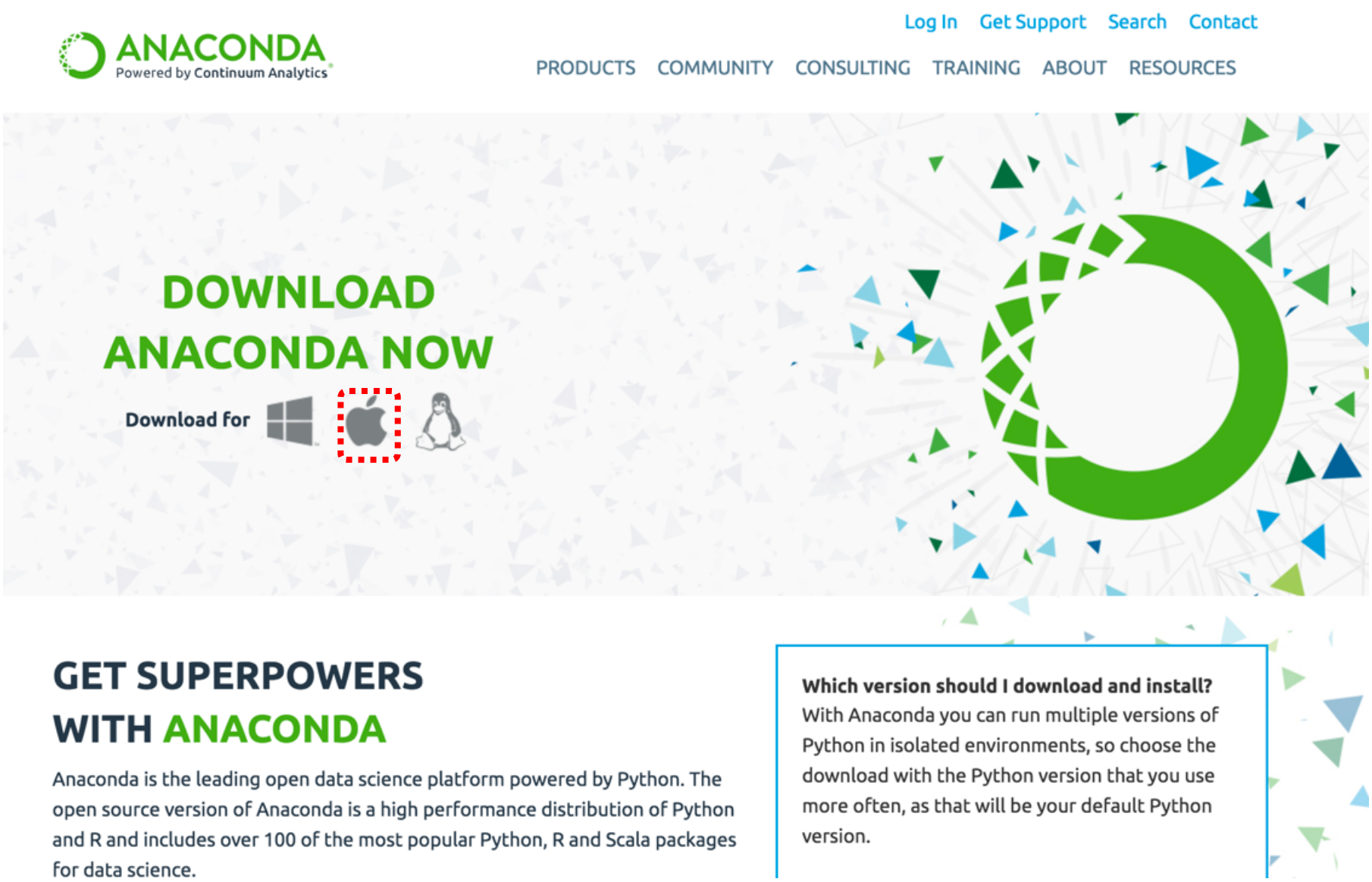
<	Less than	!=	Not equal to
>	Greater than	`df.column.isin(`*values*`)`	Group membership
==	Equals	`pd.isnull(`*obj*`)`	Is NaN
<=	Less than or equals	`pd.notnull(`*obj*`)`	Is not NaN
>=	Greater than or equals	`&,|,~,^,df.any(),df.all()`	Logical and, or, not, xor, any, all

http://pandas.pydata.org/ This cheat sheet inspired by Rstudio Data Wrangling Cheatsheet (https://www.rstudio.com/wp-content/uploads/2015/02/data-wrangling-cheatsheet.pdf) Written by Irv Lustig, Princeton Consultants

Source: https://github.com/pandas-dev/pandas/blob/master/doc/cheatsheet/Pandas_Cheat_Sheet.pdf

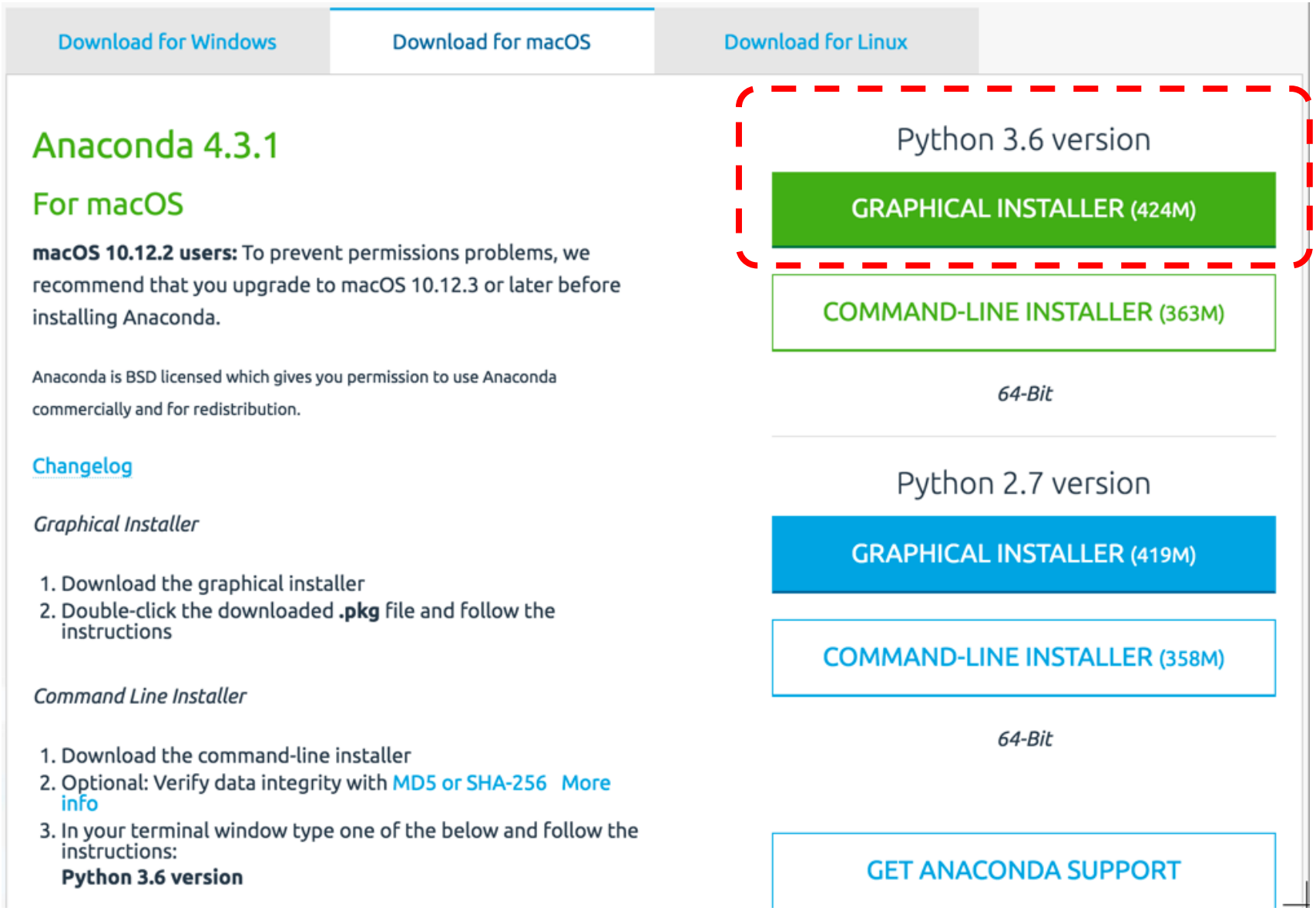
Python

Download Anaconda



https://www.continuum.io/downloads

Download Anaconda Python 3.6



https://www.continuum.io/downloads

OS X Anaconda Python 3.6 Installation

Command Line Installer

Download the command-line installer

In your terminal window type one of the below and follow the instructions:

Python 3.6 version

```
bash Anaconda3-4.3.1-MacOSX-x86_64.sh
```

Python 2.7 version

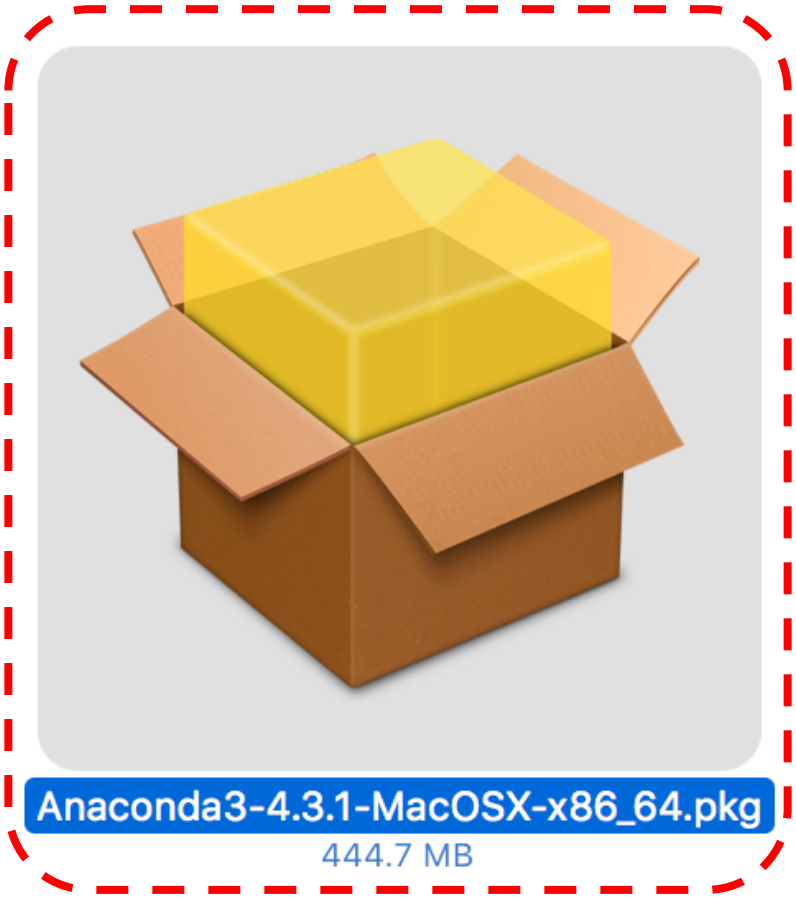
```
bash Anaconda2-4.3.1-MacOSX-x86_64.sh
```

https://www.continuum.io/downloads

OS X Anaconda 3 - 4.3.1

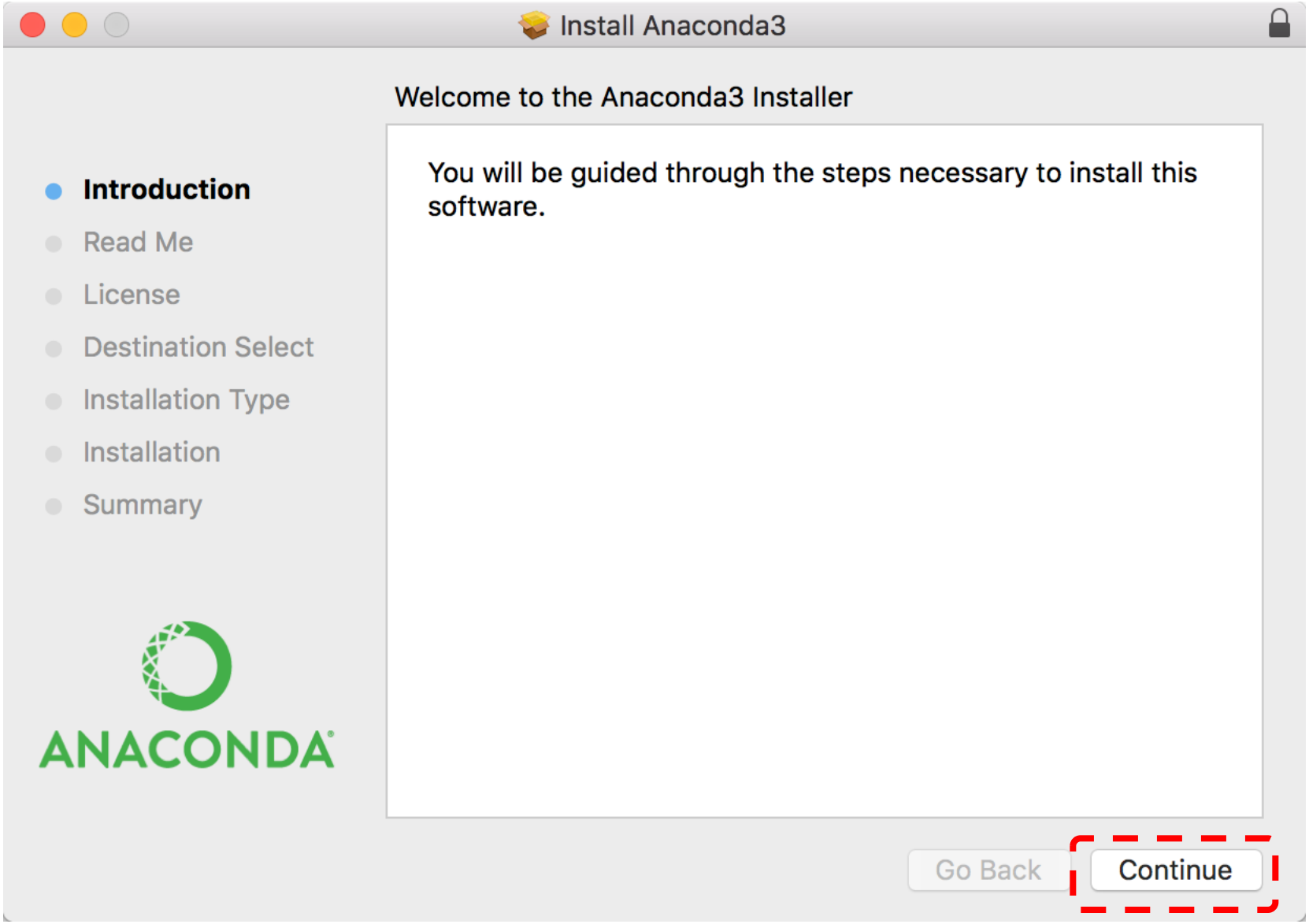
Python 3.6 Installation

Anaconda3-4.3.1-MacOSX-x86_64.pkg

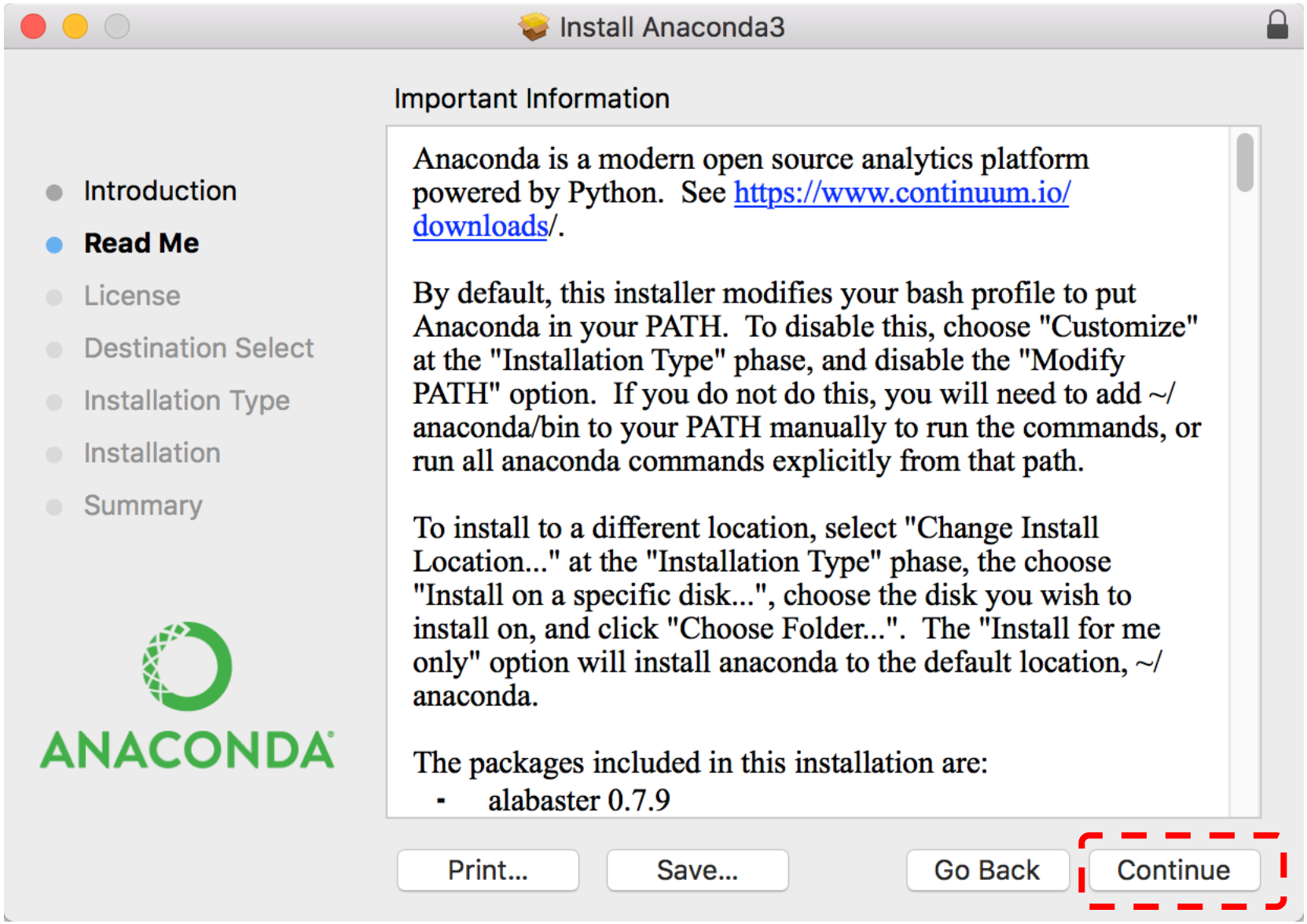


Installer package

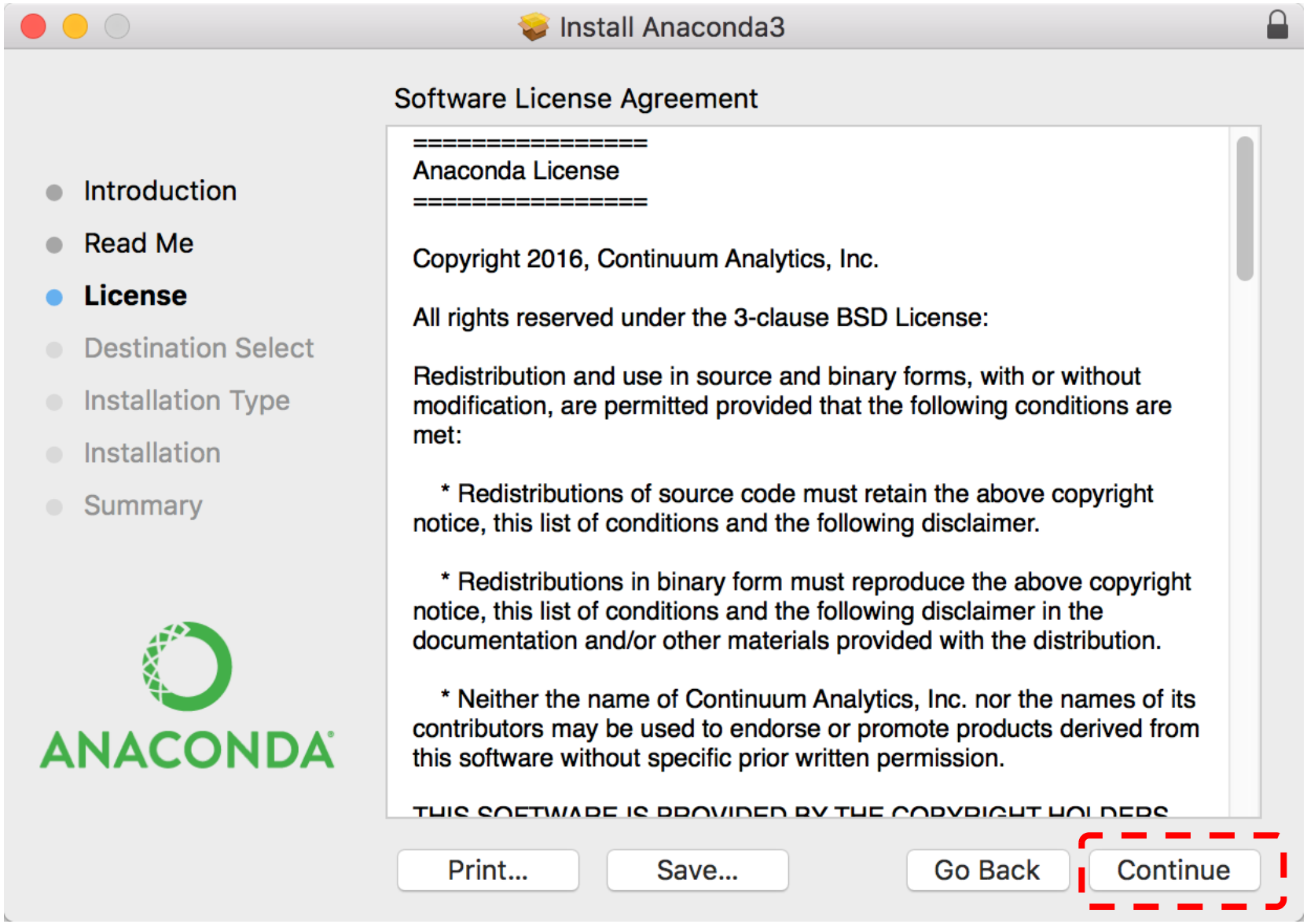
Install Anaconda 3



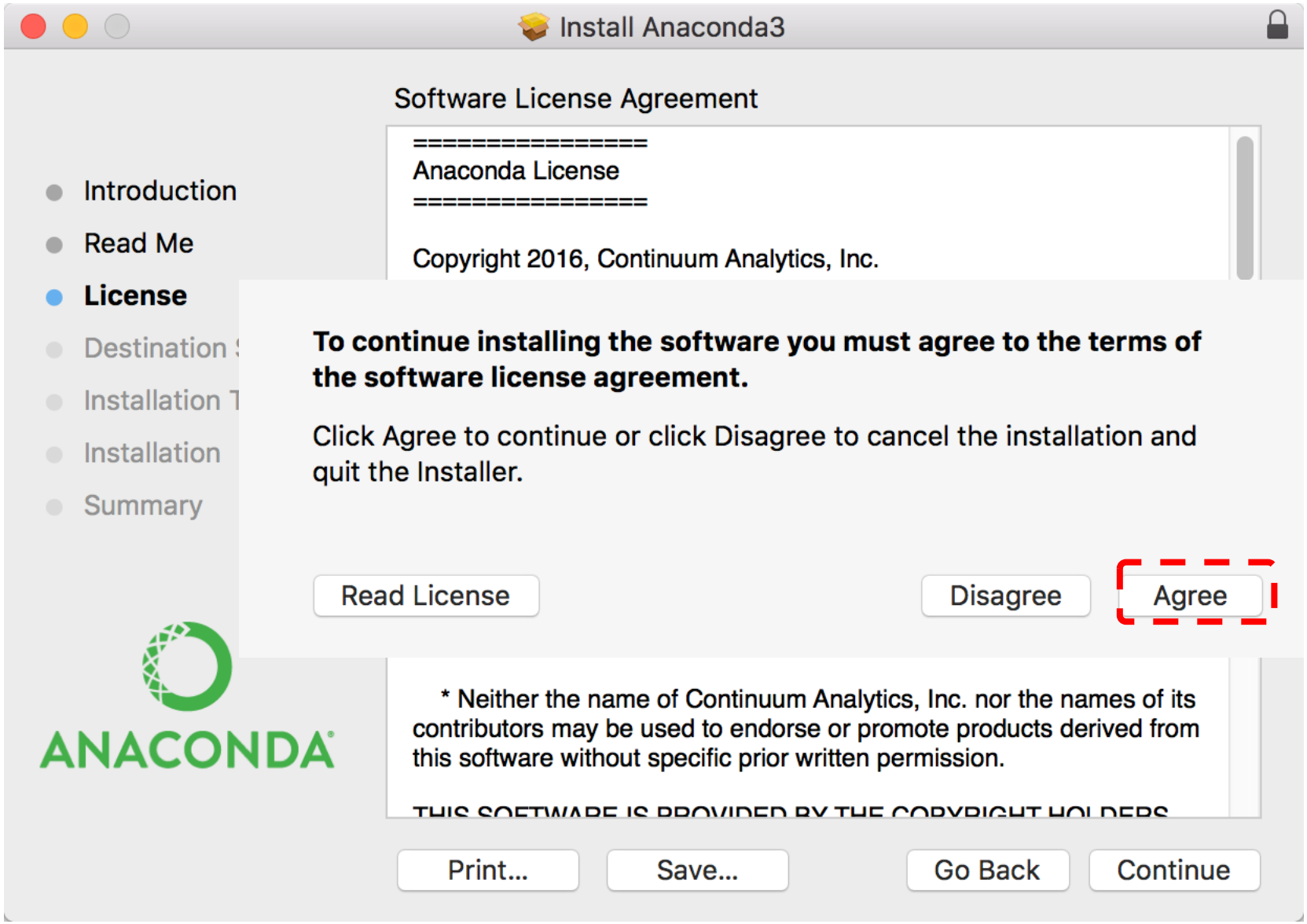
Install Anaconda 3



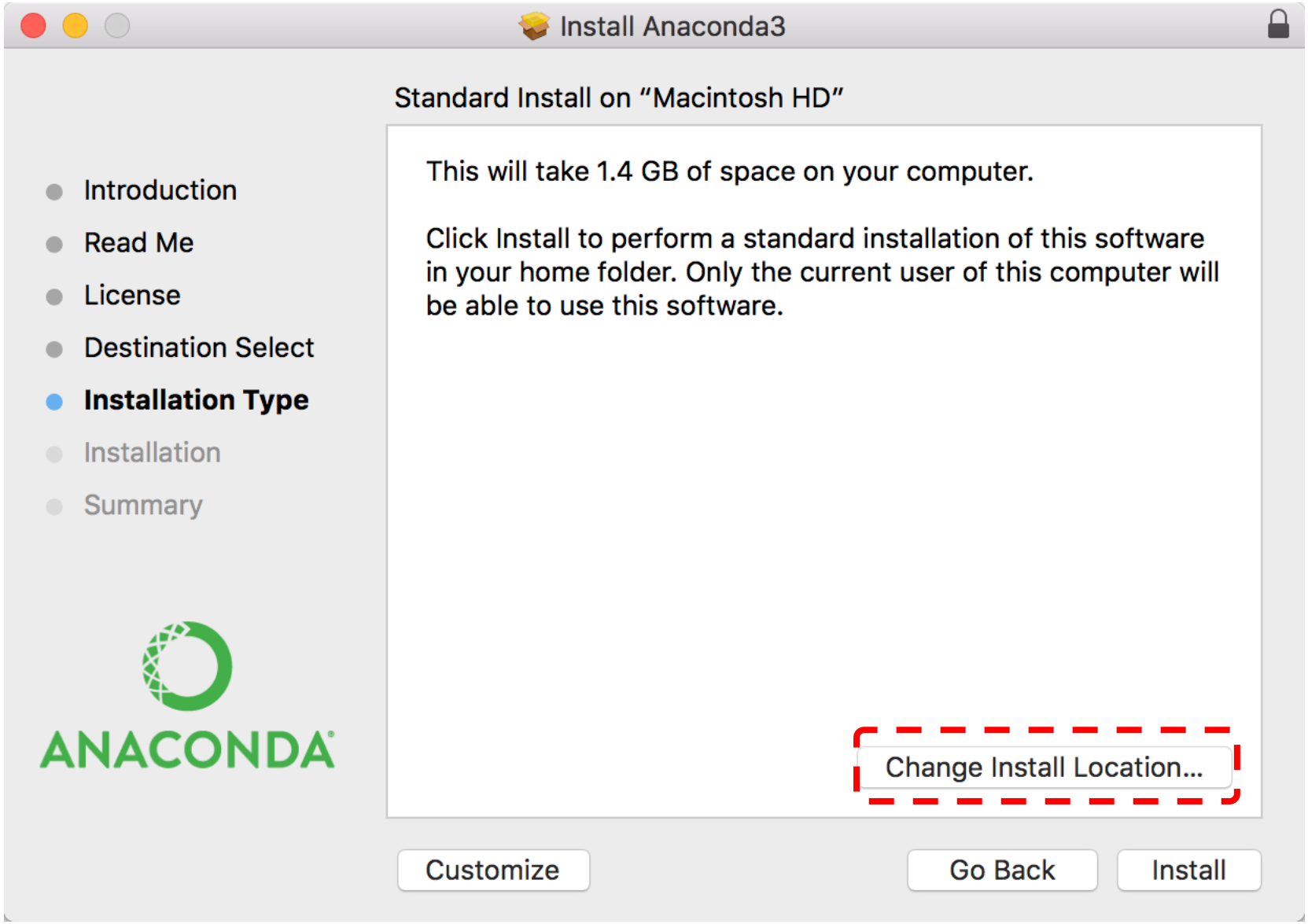
Install Anaconda 3



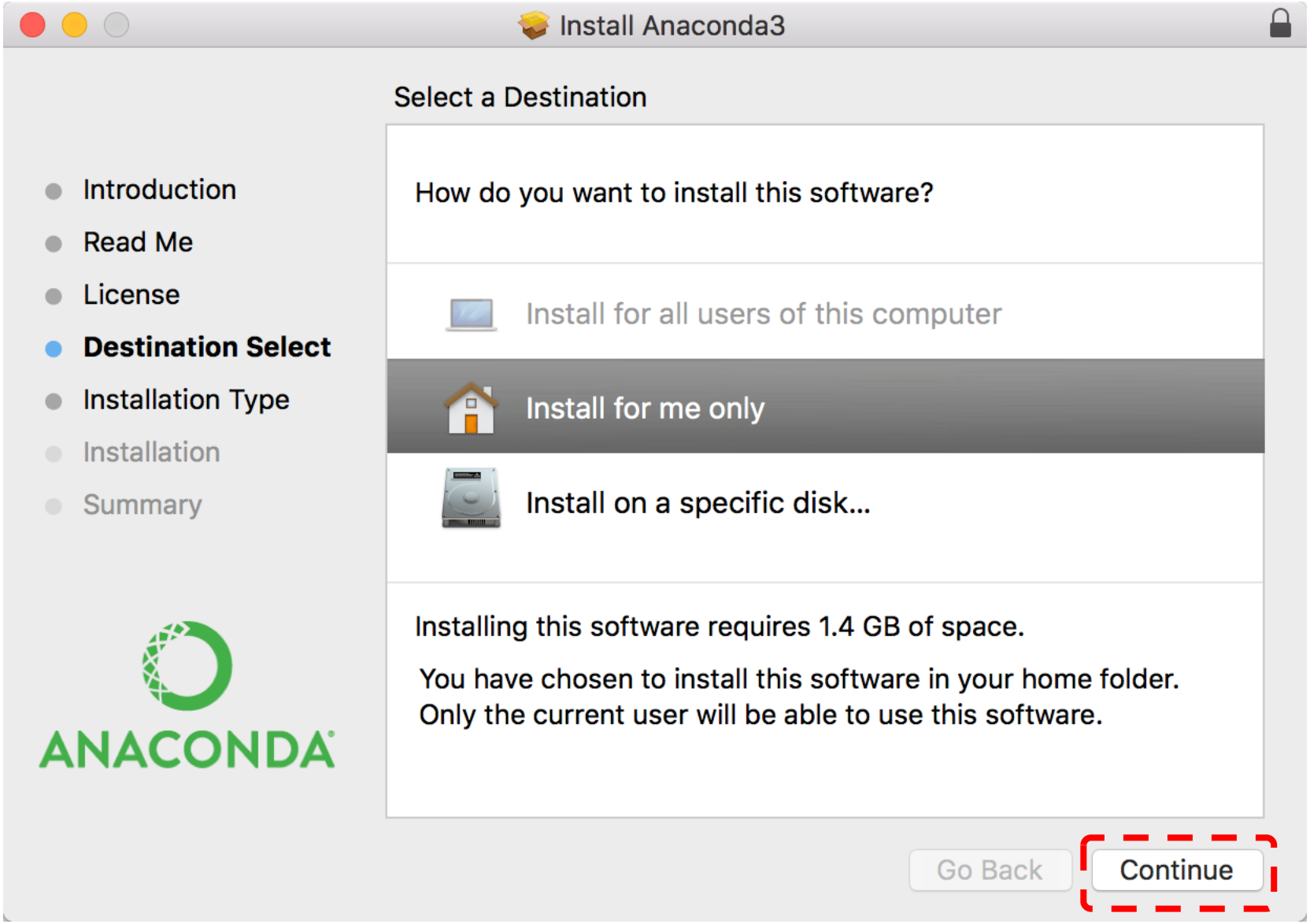
Install Anaconda 3



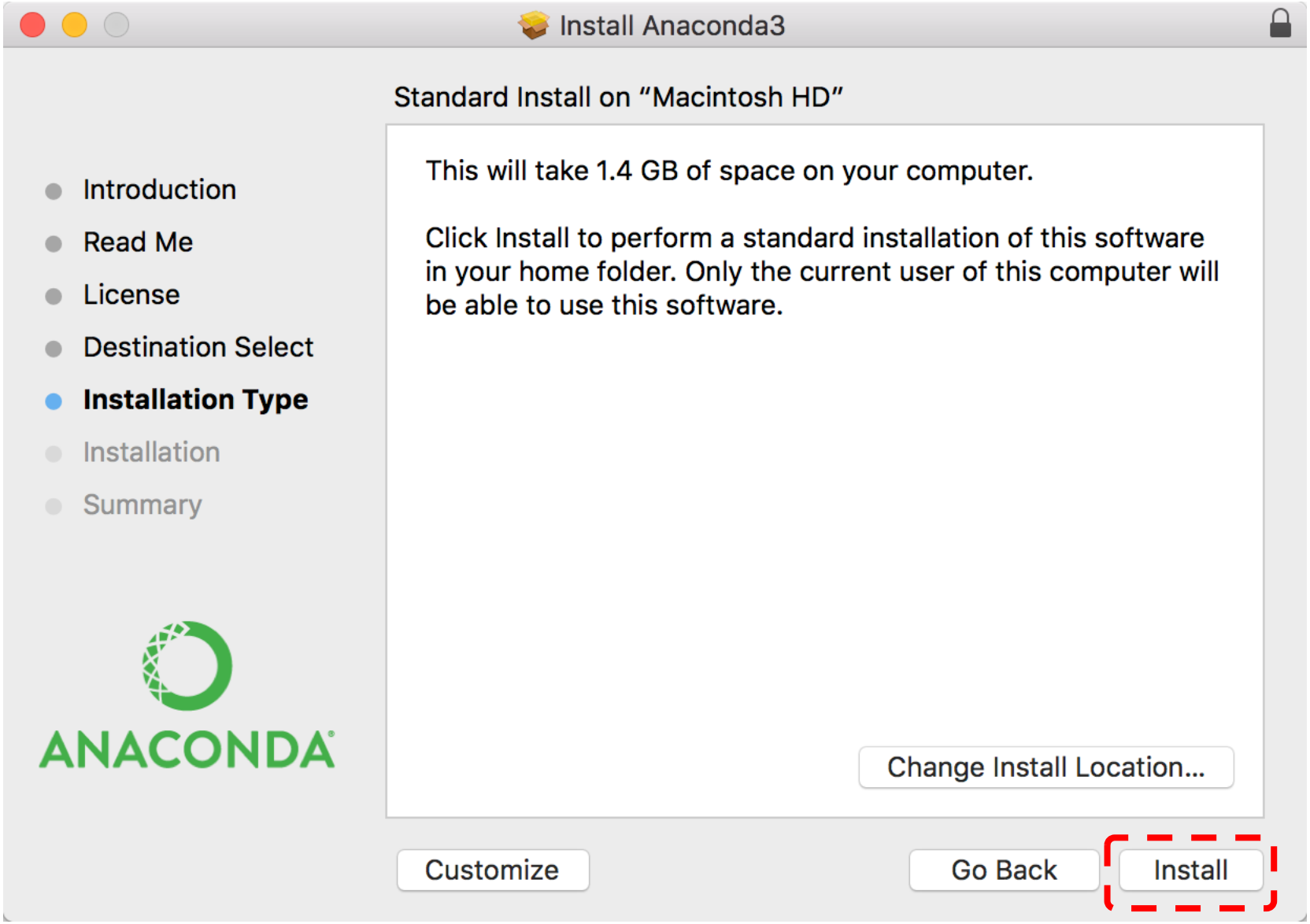
Install Anaconda 3



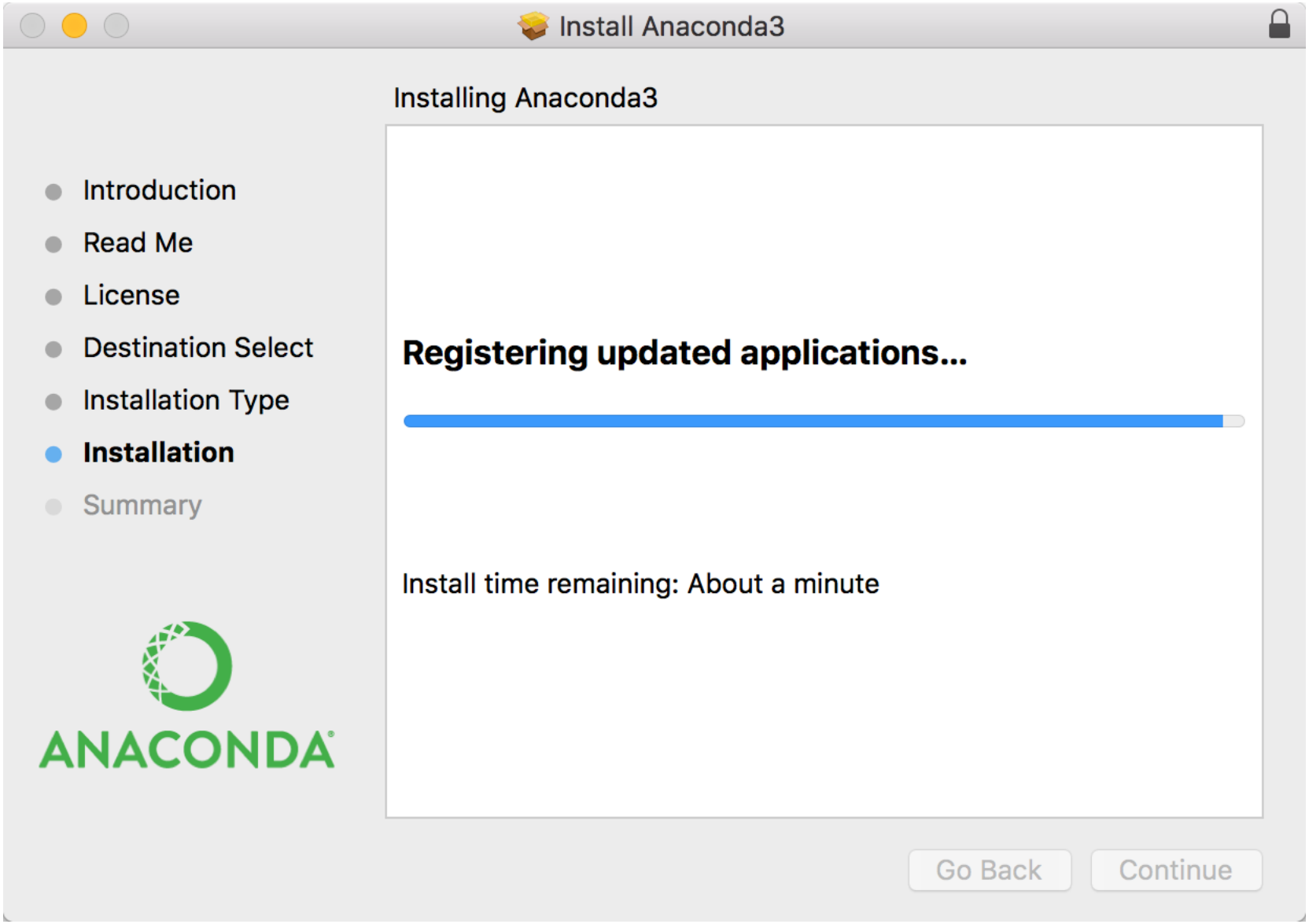
Install Anaconda 3



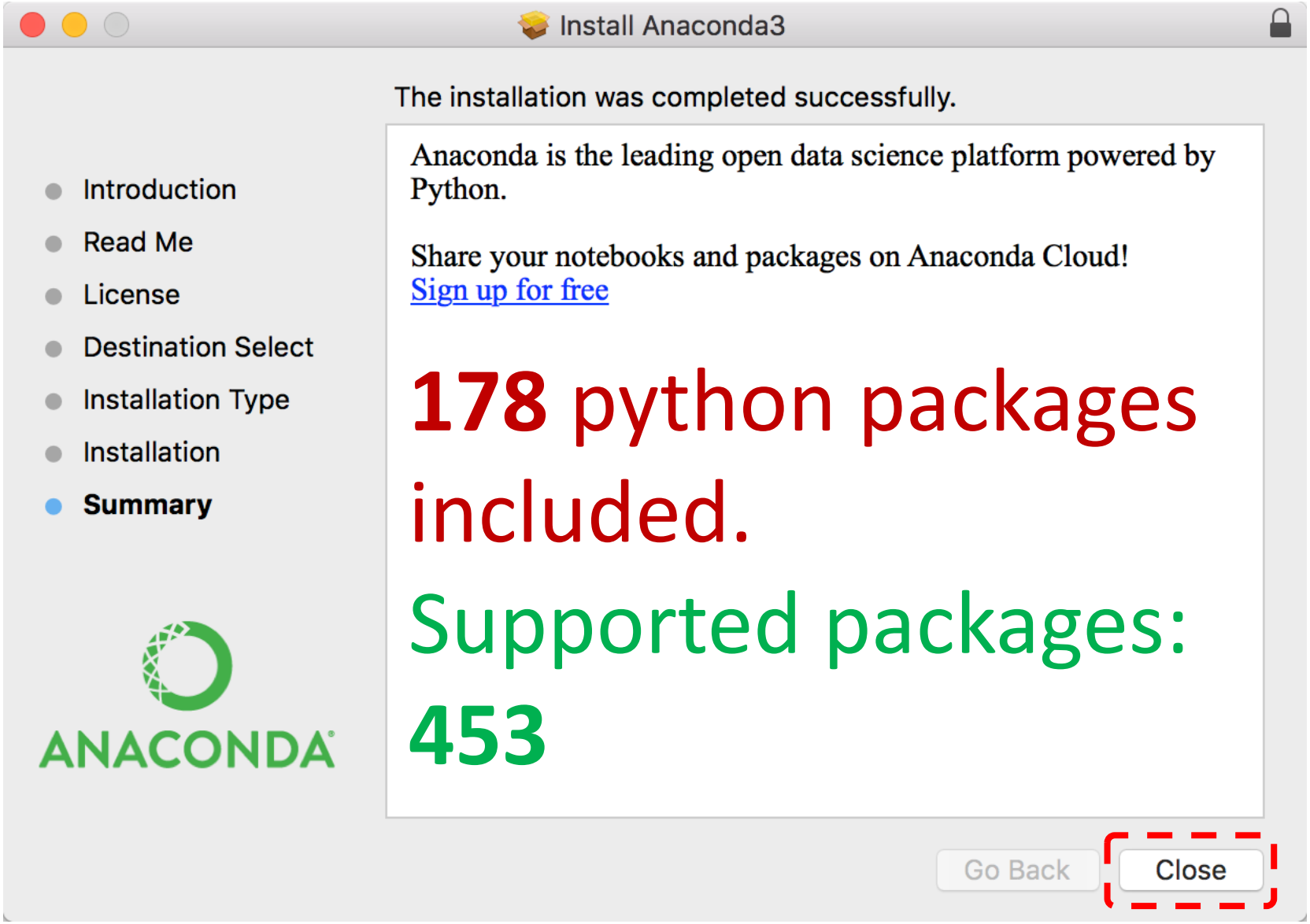
Install Anaconda 3



Install Anaconda 3



Install Anaconda 3



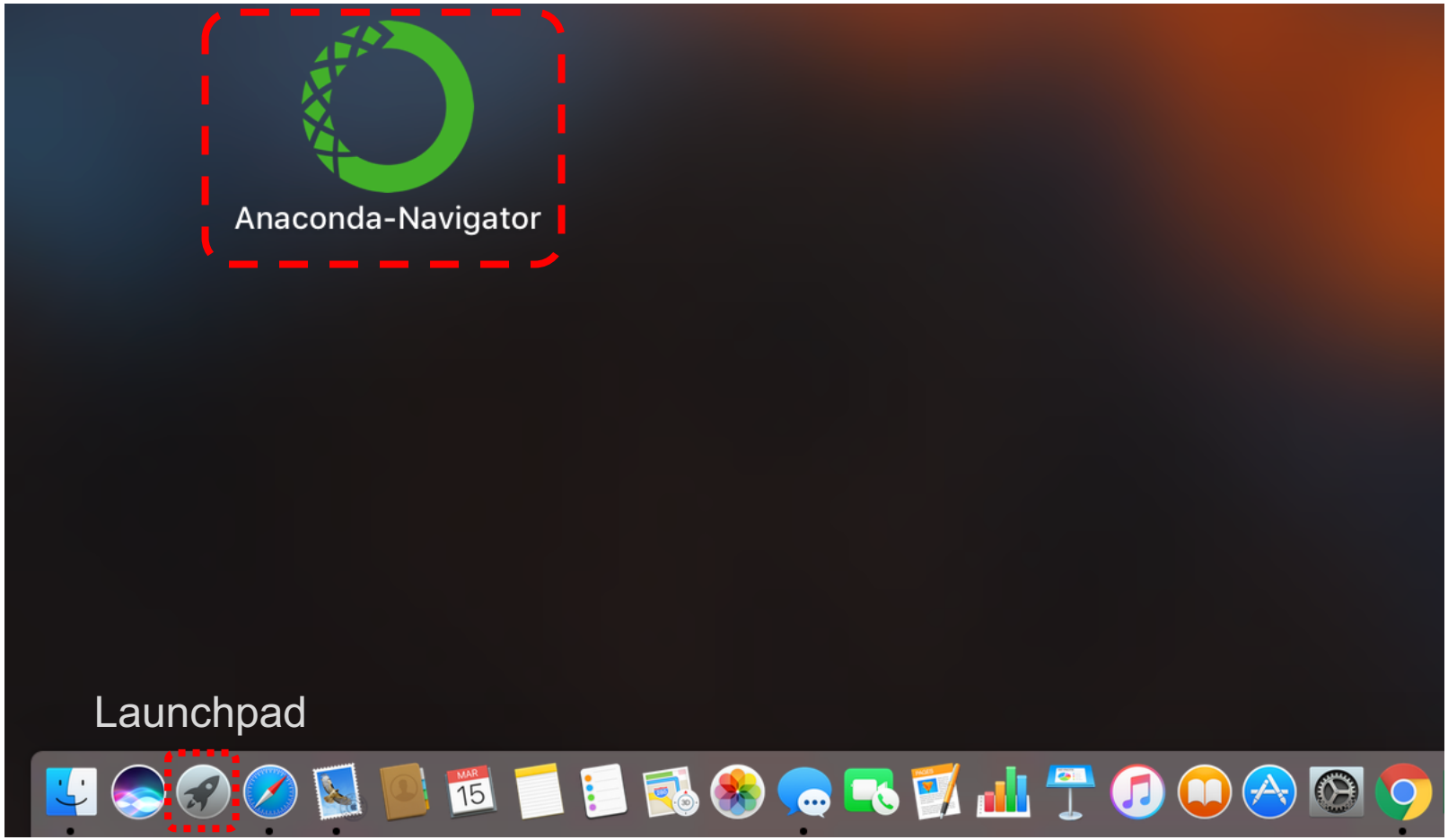
Source: https://docs.continuum.io/anaconda/pkg-docs

Install Anaconda 3

No.	Package	Version	Build
1	_license	1.1	
2	alabaster	0.7.9	
3	anaconda	4.3.1	
4	anaconda-client	1.6.0	
5	anaconda-navigator	1.5.0	
6	anaconda-project	0.4.1	
7	appnope	0.1.0	
8	appscript	1.0.1	
9	astroid	1.4.9	
10	astropy	1.3	
11	babel	2.3.4	
12	backports	1.0	
13	beautifulsoup4	4.5.3	
14	bitarray	0.8.1	
15	blaze	0.10.1	
16	bokeh	0.12.4	
17	boto	2.45.0	
18	bottleneck	1.2.0	
19	cffi	1.9.1	
20	chardet	2.3.0	
21	chest	0.2.3	
22	click	6.7	
23	cloudpickle	0.2.2	
24	clyent	1.2.2	
25	colorama	0.3.7	
26	conda	4.3.14	
27	conda-env	2.6.0	
28	configobj	5.0.6	
29	contextlib2	0.5.4	
30	cryptography	1.7.1	
31	curl	7.52.1	
32	cycler	0.10.0	
33	cython	0.25.2	
34	cytoolz	0.8.2	
35	dask	0.13.0	
36	datashape	0.5.4	
37	decorator	4.0.11	
38	dill	0.2.5	
39	docutils	0.13.1	
40	entrypoints	0.2.2	
41	et_xmlfile	1.0.1	
42	fastcache	1.0.2	
43	flask	0.12	
44	flask-cors	3.0.2	
45	freetype	2.5.5	
46	get_terminal_size	1.0.0	
47	gevent	1.2.1	
48	greenlet	0.4.11	
49	h5py	2.6.0	
50	hdf5	1.8.17	
51	heapdict	1.0.0	
52	icu	54.1	
53	idna	2.2	
54	imagesize	0.7.1	
55	ipykernel	4.5.2	
56	ipython	5.1.0	
57	ipython_genutils	0.1.0	
58	ipywidgets	5.2.2	
59	isort	4.2.5	
60	itsdangerous	0.24	
61	jbig	2.1	
62	jdcal	1.3	
63	jedi	0.9.0	
64	jinja2	2.9.4	
65	jpeg	9b	
66	jsonschema	2.5.1	
67	jupyter	1.0.0	
68	jupyter_client	4.4.0	
69	jupyter_console	5.0.0	
70	jupyter_core	4.2.1	
71	lazy-object-proxy	1.2.2	
72	libiconv	1.14	
73	libpng	1.6.27	
74	libtiff	4.0.6	
75	libxml2	2.9.4	
76	libxslt	1.1.29	
77	llvmlite	0.15.0	
78	locket	0.2.0	
79	lxml	3.7.2	
80	markupsafe	0.23	
81	matplotlib	2.0.0	
82	mistune	0.7.3	
83	mkl	2017.0.1	
84	mkl-service	1.1.2	
85	mpmath	0.19	
86	multipledispatch	0.4.9	
87	nbconvert	4.2.0	
88	nbformat	4.2.0	
89	networkx	1.11	
90	nltk	3.2.2	
91	nose	1.3.7	
92	notebook	4.3.1	
93	numba	0.30.1	
94	numexpr	2.6.1	
95	numpy	1.11.3	
96	numpydoc	0.6.0	
97	odo	0.5.0	
98	openpyxl	2.4.1	
99	openssl	1.0.2k	
100	pandas	0.19.2	
101	partd	0.3.7	
102	path.py	10.0	
103	pathlib2	2.2.0	
104	patsy	0.4.1	
105	pep8	1.7.0	
106	pexpect	4.2.1	
107	pickleshare	0.7.4	
108	pillow	4.0.0	
109	pip	9.0.1	
110	ply	3.9	
111	prompt_toolkit	1.0.9	
112	psutil	5.0.1	
113	ptyprocess	0.5.1	
114	py	1.4.32	
115	pyasn1	0.1.9	
116	pycosat	0.6.1	
117	pycparser	2.17	
118	pycrypto	2.6.1	
119	pycurl	7.43.0	
120	pyflakes	1.5.0	
121	pygments	2.1.3	
122	pylint	1.6.4	
123	pyopenssl	16.2.0	
124	pyparsing	2.1.4	
125	pyqt	5.6.0	
126	pytables	3.3.0	
127	pytest	3.0.5	
128	python	3.6.0	
129	python-dateutil	2.6.0	py36_0
130	python.app	1.2	py36_4
131	pytz	2016.10	py36_0
132	pyyaml	3.12	py36_0
133	pyzmq	16.0.2	py36_0
134	qt	5.6.2	0
135	qtawesome	0.4.3	py36_0
136	qtconsole	4.2.1	py36_1
137	qtpy	1.2.1	py36_0
138	readline	6.2	2
139	redis	3.2.0	0
140	redis-py	2.10.5	py36_0
141	requests	2.12.4	py36_0
142	rope	0.9.4	py36_1
143	ruamel_yaml	0.11.14	py36_1
144	scikit-image	0.12.3	np111py36_1
145	scikit-learn	0.18.1	np111py36_1
146	scipy	0.18.1	np111py36_1
147	seaborn	0.7.1	py36_0
148	setuptools	27.2.0	py36_0
149	simplegeneric	0.8.1	py36_1
150	singledispatch	3.4.0.3	py36_0
151	sip	4.18	py36_0
152	six	1.10.0	py36_0
153	snowballstemmer	1.2.1	py36_0
154	sockjs-tornado	1.0.3	py36_0
155	sphinx	1.5.1	py36_0
156	spyder	3.1.2	py36_0
157	sqlalchemy	1.1.5	py36_0
158	sqlite	3.13.0	0
159	statsmodels	0.6.1	np111py36_1
160	sympy	1.0	py36_0
161	terminado	0.6	py36_0
162	tk	8.5.18	0
163	toolz	0.8.2	py36_0
164	tornado	4.4.2	py36_0
165	traitlets	4.3.1	py36_0
166	unicodecsv	0.14.1	py36_0
167	wcwidth	0.1.7	py36_0
168	werkzeug	0.11.15	py36_0
169	wheel	0.29.0	py36_0
170	widgetsnbextension	1.2.6	py36_0
171	wrapt	1.10.8	py36_0
172	xlrd	1.0.0	py36_0
173	xlsxwriter	0.9.6	py36_0
174	xlwings	0.10.2	py36_0
175	xlwt	1.2.0	py36_0
176	xz	5.2.2	1
177	yaml	0.1.6	0
178	zlib	1.2.8	3

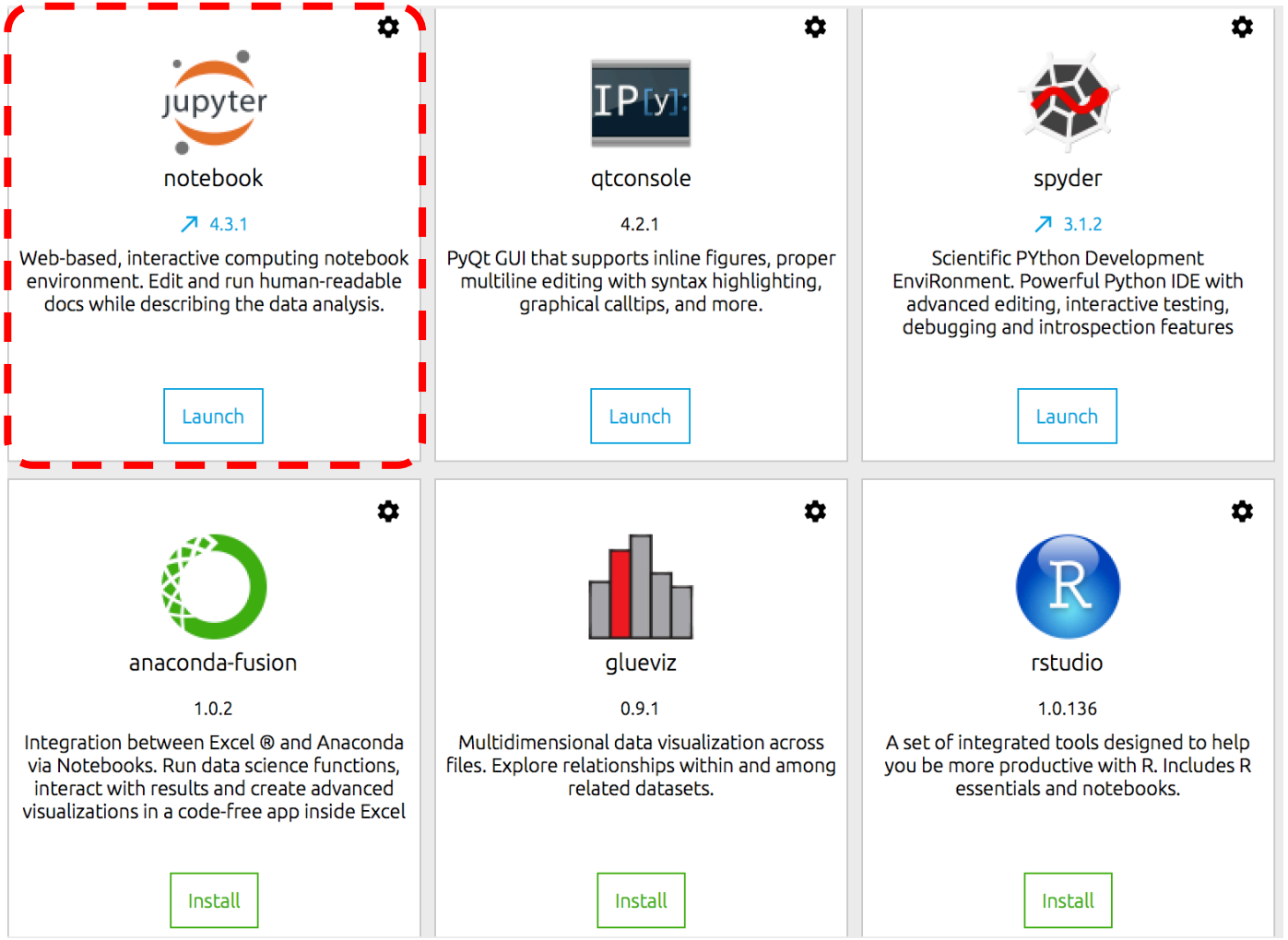
178 python packages included.

Anaconda-Navigator

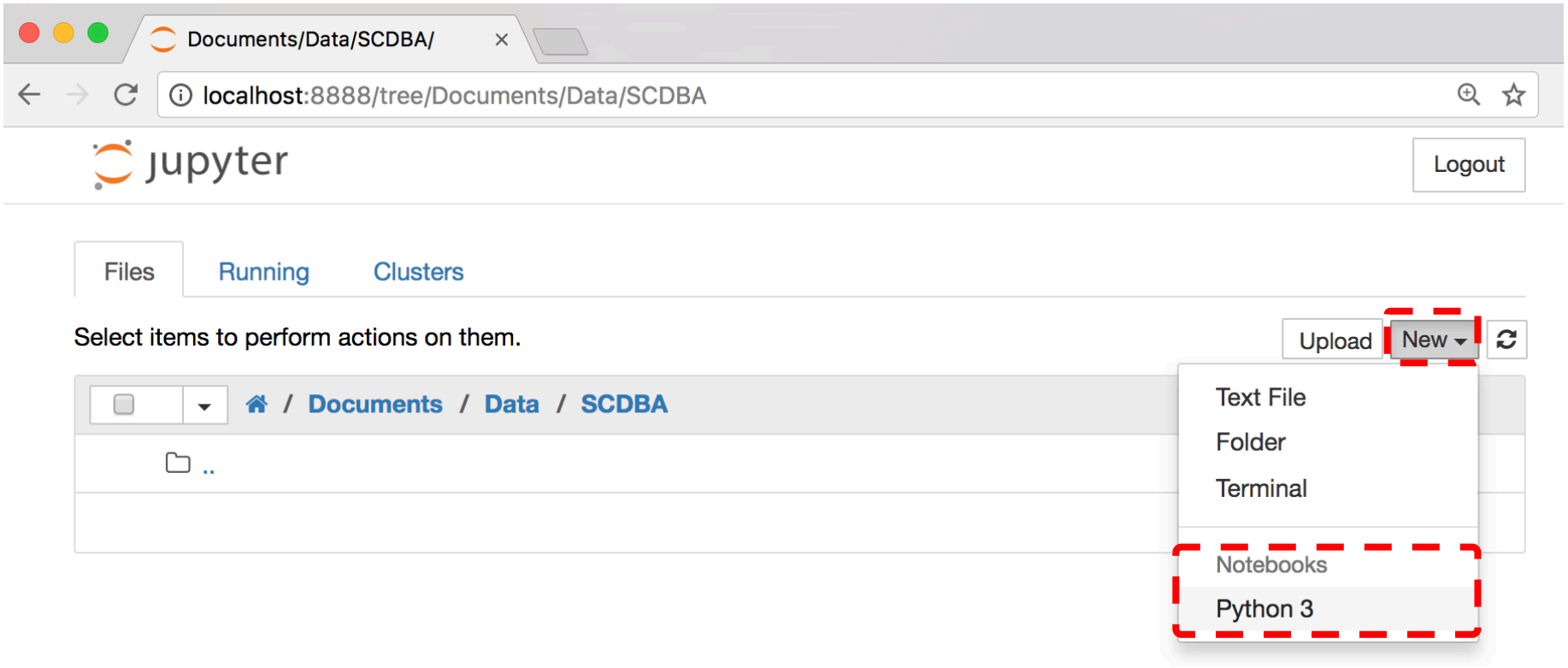


Anaconda-Navigator

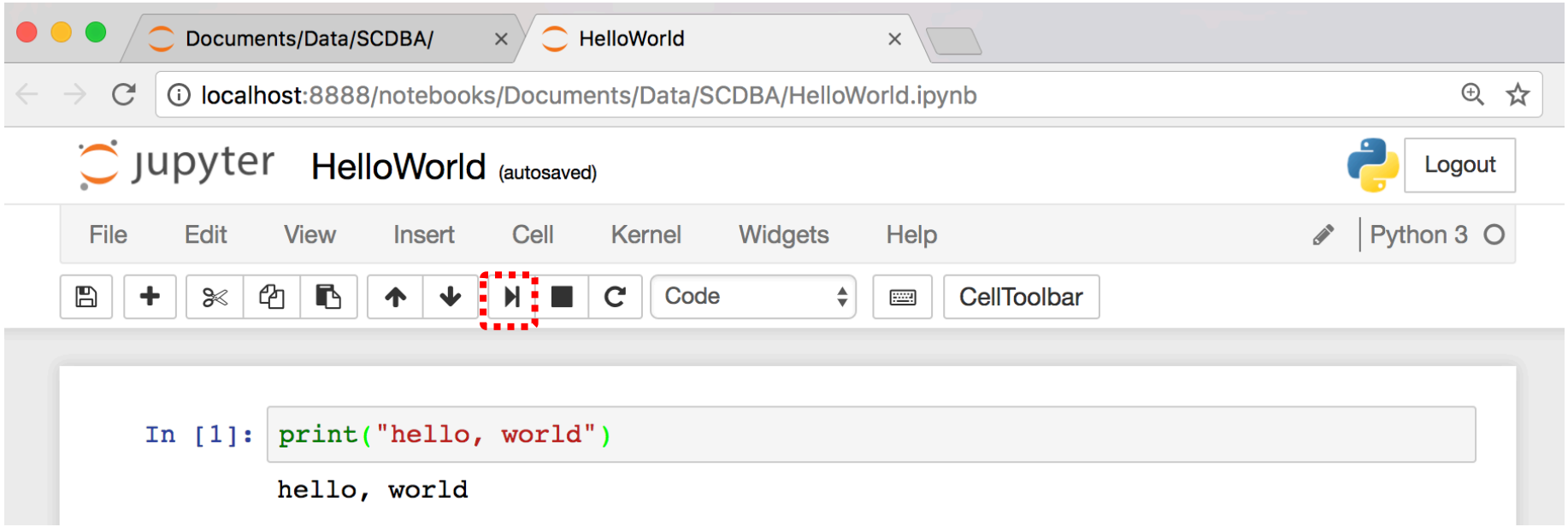
Jupyter Notebook



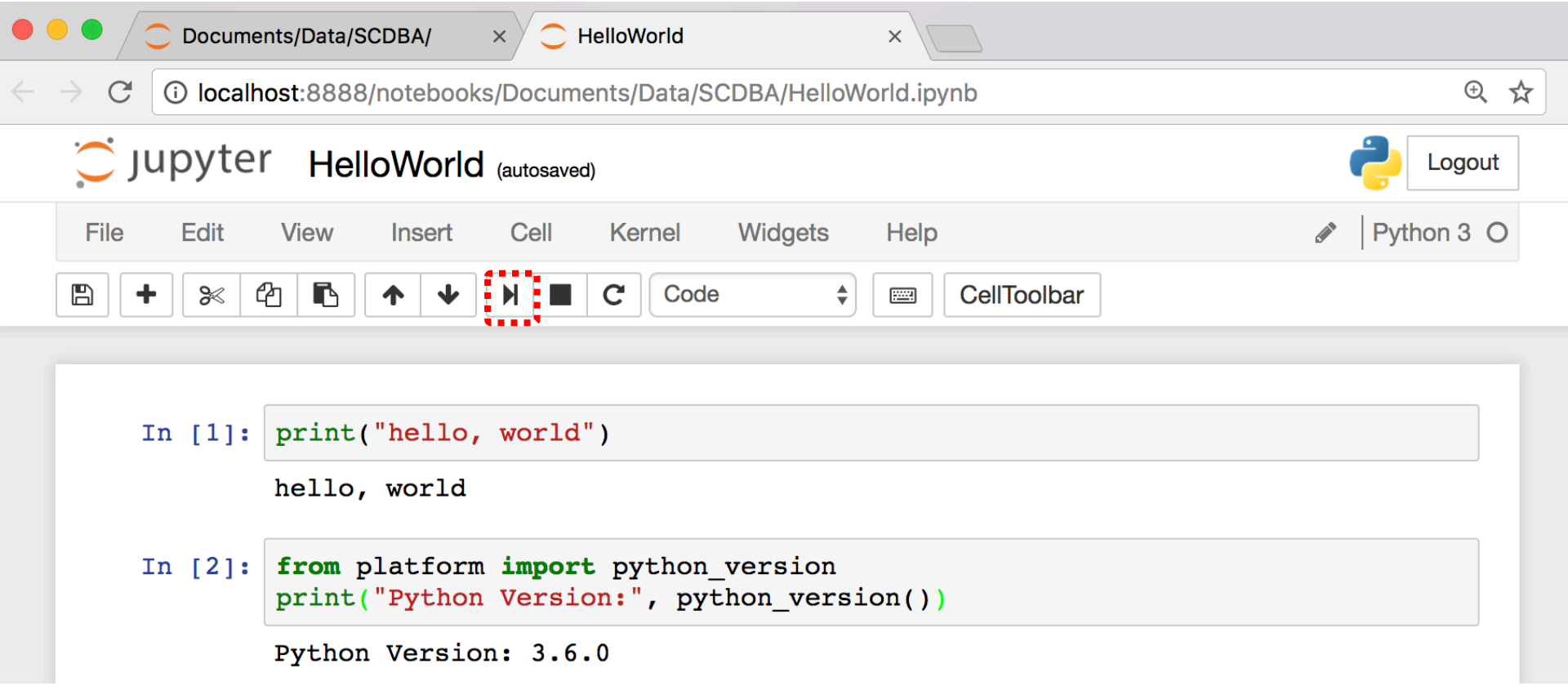
Jupyter Notebook
New Python 3



print("hello, world")



```
from platform import python_version
print("Python Version:", python_version())
```

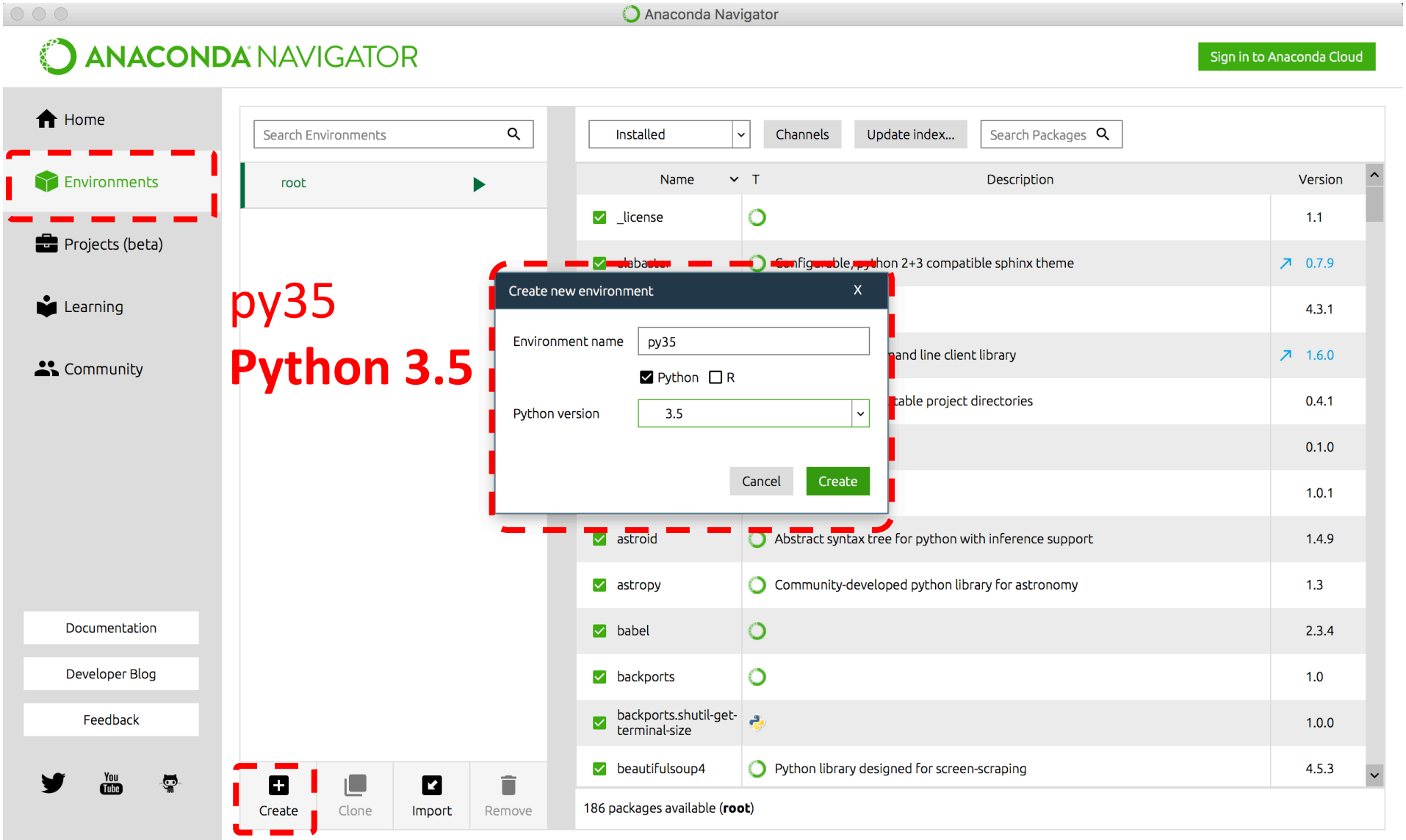


Create Python Environments with Anaconda

- Python 3.6
- Python 3.5
  - Python 3.5.3
  - Python 3.5.2
- Python 2.7

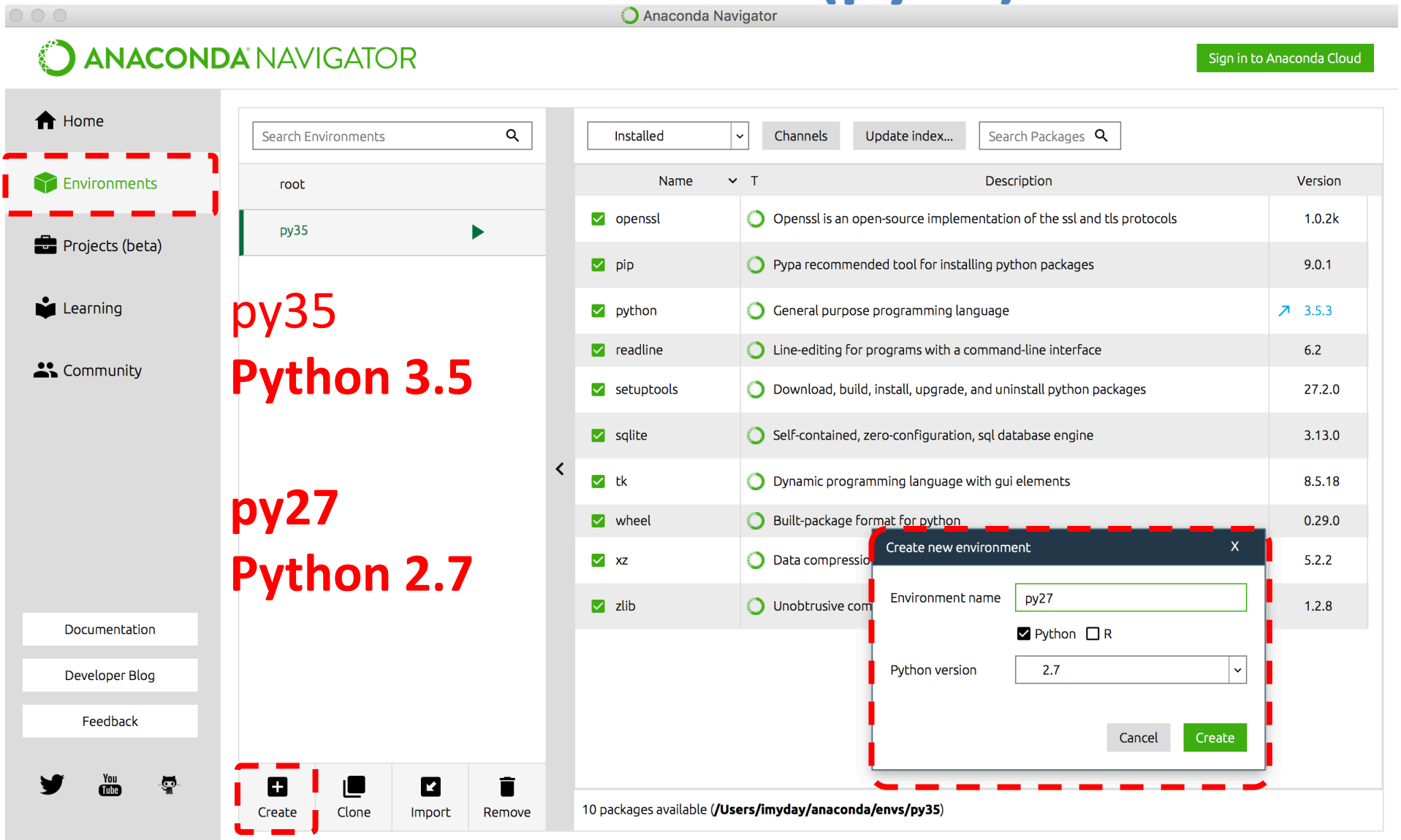
https://conda.io/docs/py2or3.html

Anaconda Create New Python 3.5 Environment (py35)



Source: http://conda.pydata.org/docs/py2or3.html

Anaconda Create New Python 2.7 Environment (py27)



Source: http://conda.pydata.org/docs/py2or3.html

Verify that conda is installed, check current conda version

- **`conda --version`**

- Update conda to the current version
  - **`conda update conda`**

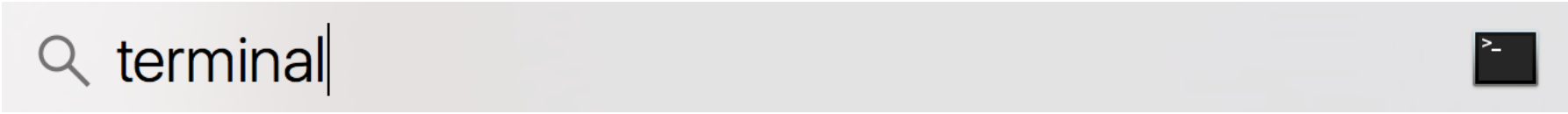
http://conda.pydata.org/docs/using/using.html#verify-that-conda-is-installed-check-current-conda-version

Check current conda version
Check current python version
Check conda environments

- `conda --version`
- `python --version`
- `conda info --envs`

http://conda.pydata.org/docs/using/using.html#verify-that-conda-is-installed-check-current-conda-version

Terminal




```
terminal
```

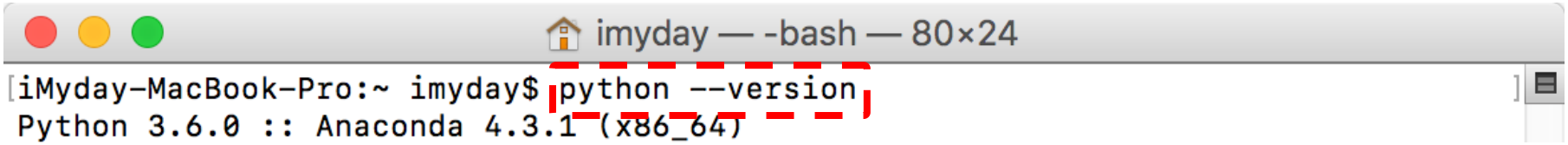
conda list

imyday — -bash — 80×24

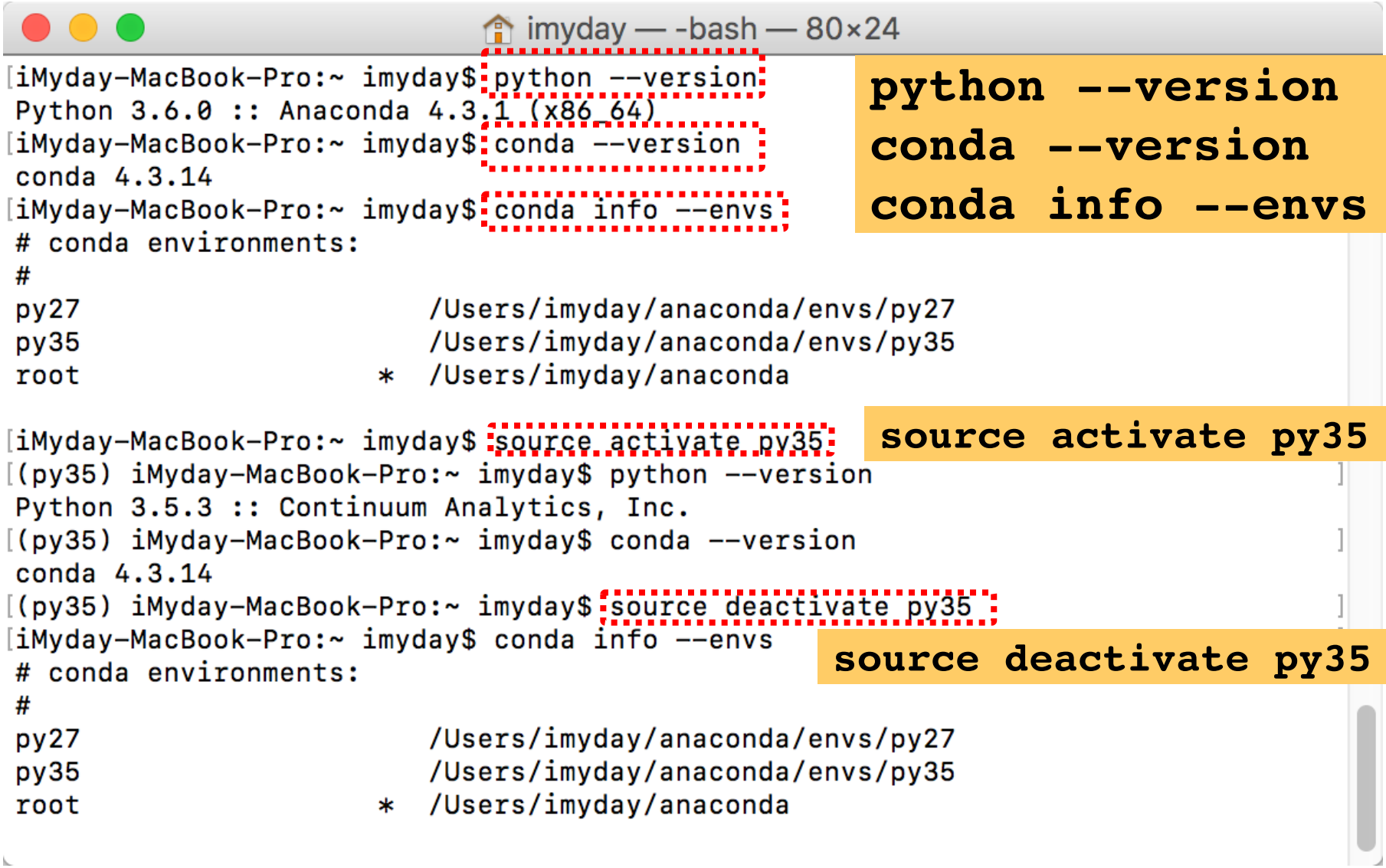
```
iMyday-MacBook-Pro:~ imyday$ conda list
# packages in environment at /Users/imyday/anaconda:
#
_license                  1.1                      py36_1
alabaster                 0.7.9                    py36_0
anaconda                  4.3.1                 np111py36_0
anaconda-client           1.6.0                    py36_0
anaconda-navigator        1.5.0                    py36_0
anaconda-project          0.4.1                    py36_0
appnope                   0.1.0                    py36_0
appscript                 1.0.1                    py36_0
astroid                   1.4.9                    py36_0
astropy                   1.3                   np111py36_0
babel                     2.3.4                    py36_0
backports                 1.0                      py36_0
beautifulsoup4            4.5.3                    py36_0
bitarray                  0.8.1                    py36_0
blaze                     0.10.1                   py36_0
bokeh                     0.12.4                   py36_0
boto                      2.45.0                   py36_0
bottleneck                1.2.0                 np111py36_0
cffi                      1.9.1                    py36_0
chardet                   2.3.0                    py36_0
chest                     0.2.3                    py36_0
```

http://conda.pydata.org/docs/using/using.html#verify-that-conda-is-installed-check-current-conda-version

python --version



conda --version

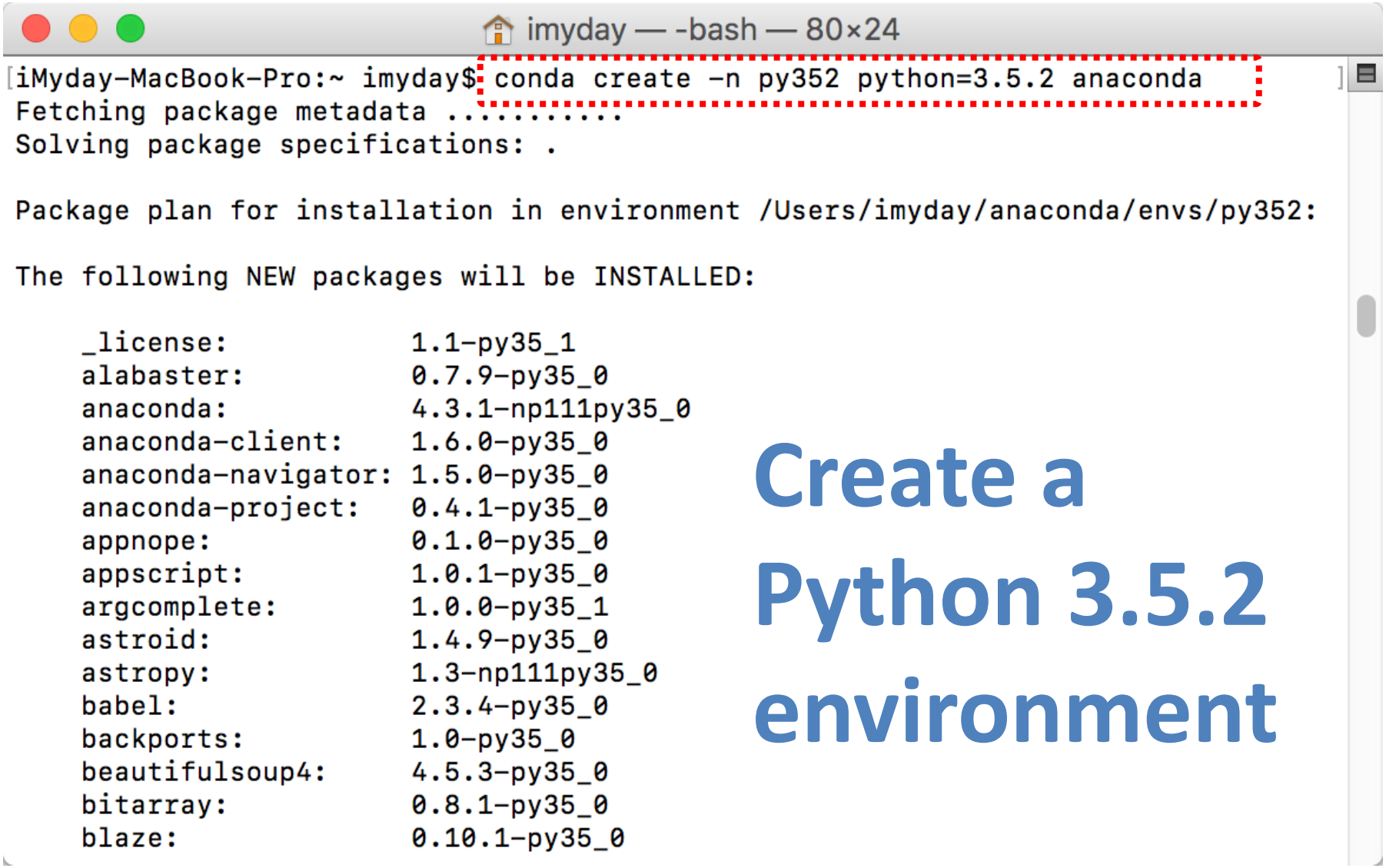


python --version
conda --version
conda info --envs

source activate py35

source deactivate py35

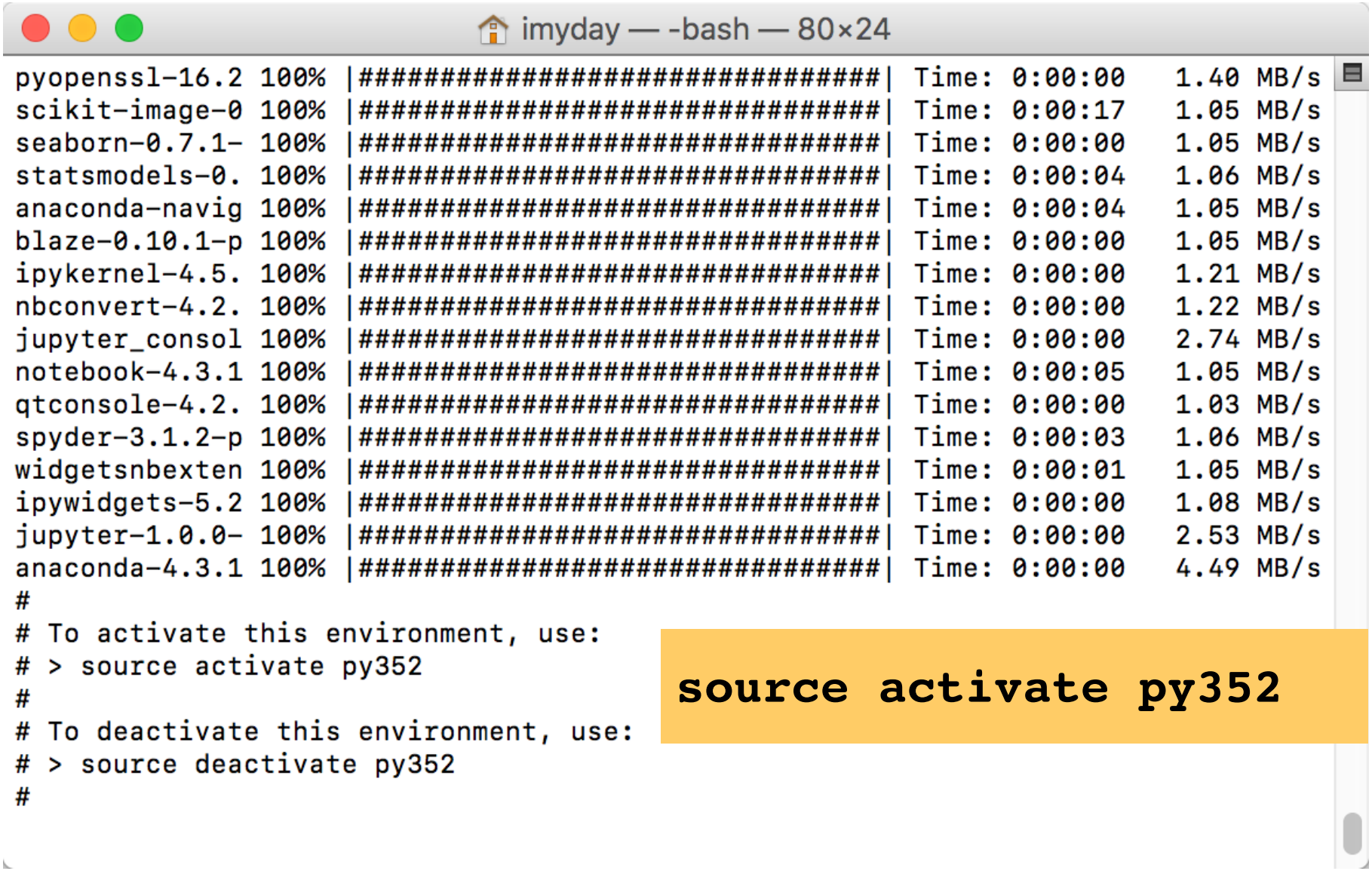
conda create -n py352 python=3.5.2 anaconda



Create a Python 3.5.2 environment

Source: http://conda.pydata.org/docs/py2or3.html

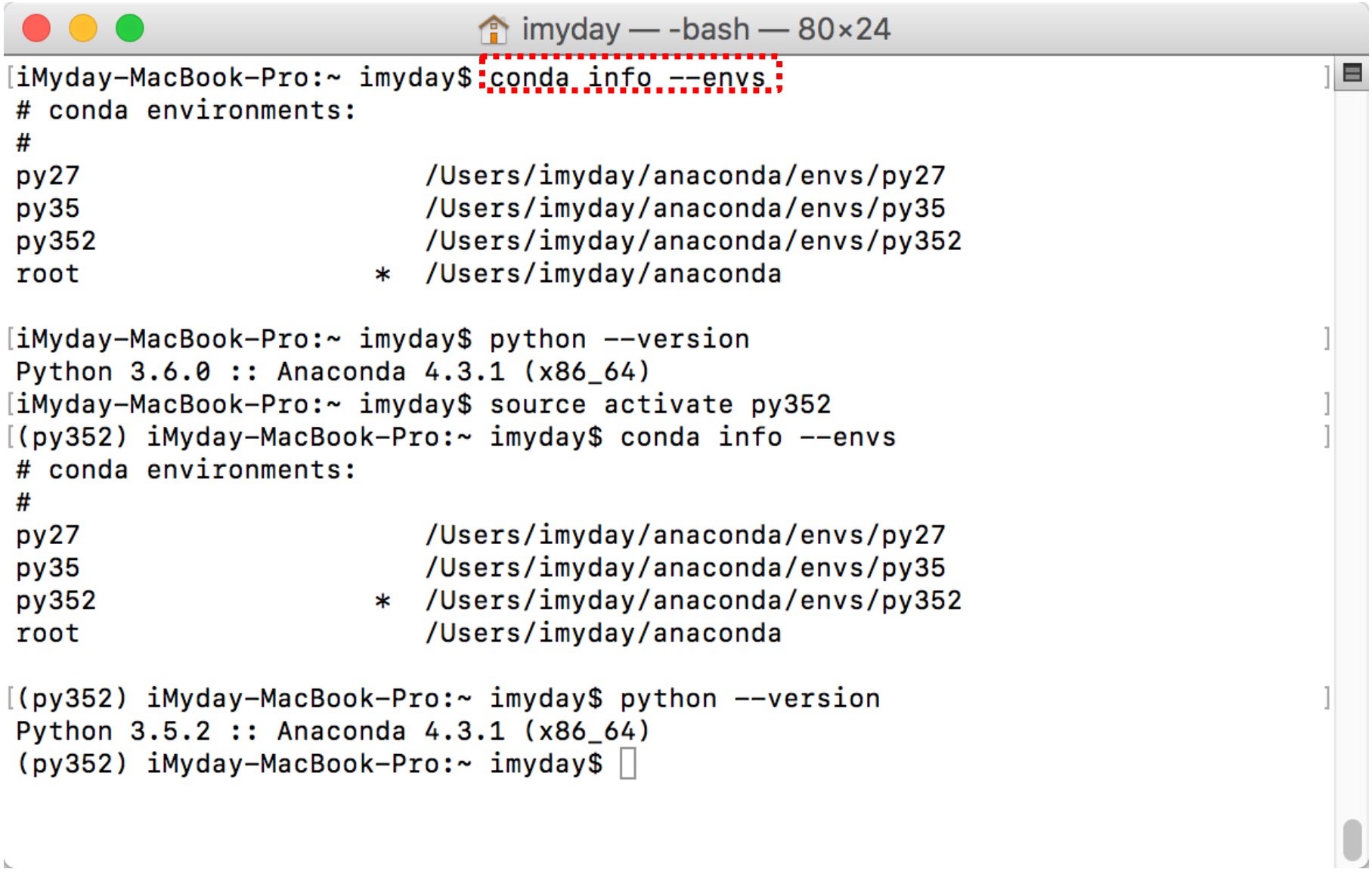
conda create -n py352 python=3.5.2 anaconda



source activate py352

Source: http://conda.pydata.org/docs/py2or3.html

conda info --envs



```
conda info --envs
source activate py27
python --version

conda install notebook ipykernel

jupyter notebook
```

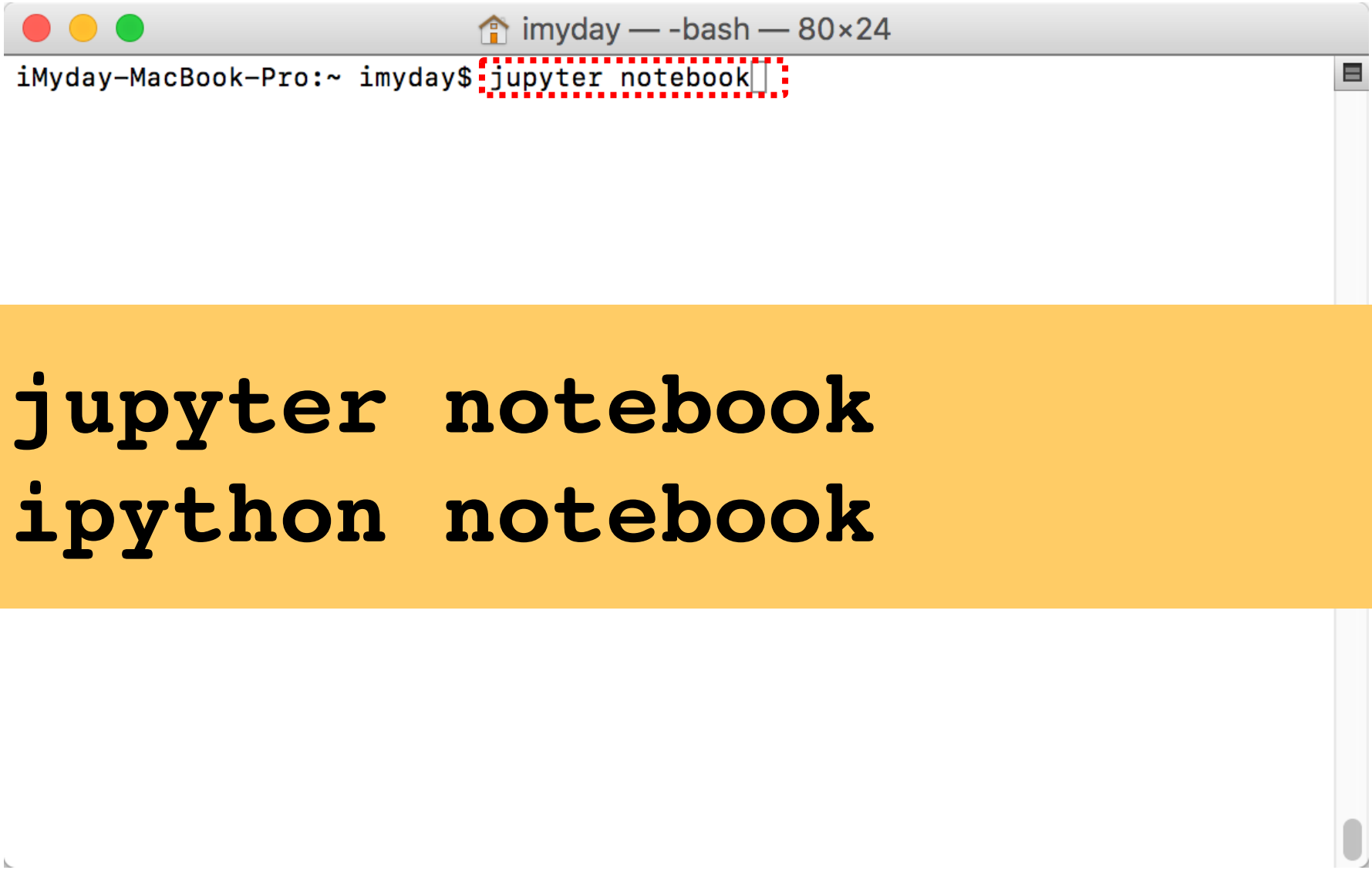
source activate py27
conda install notebook ipykernel

imyday — -bash — 80×24

```
iMyday-MacBook-Pro:~ imyday$ conda info --envs
# conda environments:
#
py27                     /Users/imyday/anaconda/envs/py27
py35                     /Users/imyday/anaconda/envs/py35
py352                    /Users/imyday/anaconda/envs/py352
root                  *  /Users/imyday/anaconda

iMyday-MacBook-Pro:~ imyday$ source activate py27
(py27) iMyday-MacBook-Pro:~ imyday$ python --version
Python 2.7.13 :: Continuum Analytics, Inc.
(py27) iMyday-MacBook-Pro:~ imyday$ conda install notebook ipykernel
Fetching package metadata ...........
Solving package specifications: .

Package plan for installation in environment /Users/imyday/anaconda/envs/py27:

The following NEW packages will be INSTALLED:

    appnope:             0.1.0-py27_0
    backports:           1.0-py27_0
    backports_abc:       0.5-py27_0
    bleach:              1.5.0-py27_0
    configparser:        3.5.0-py27_0
```

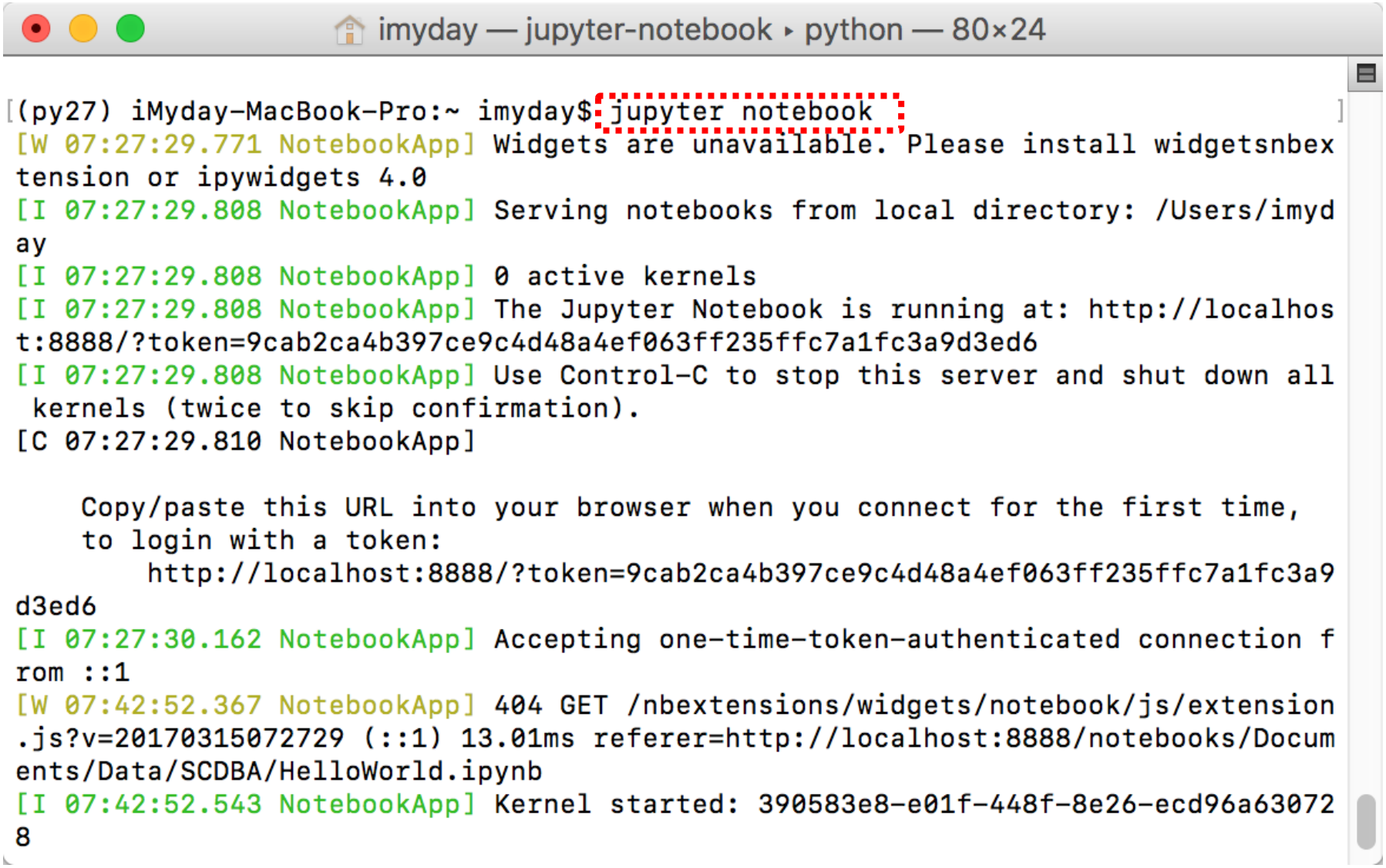
conda info --envs
source activate py27
python --version
conda install notebook ipykernel
jupyter notebook

jupyter notebook

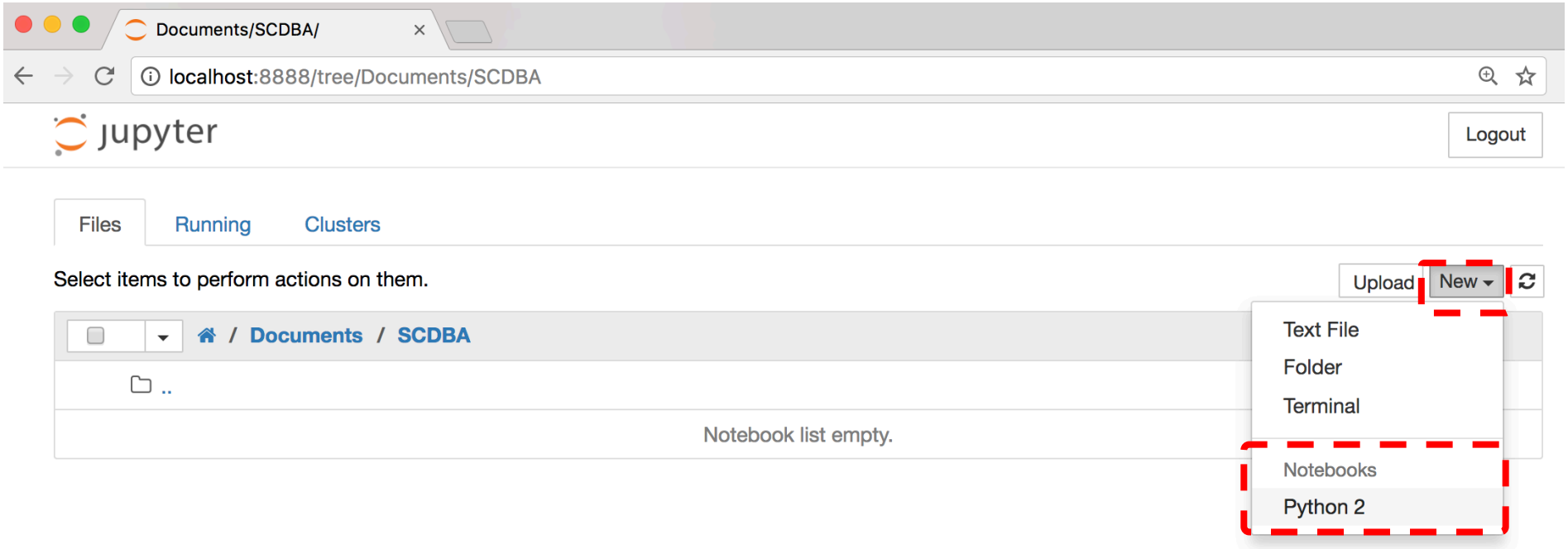


jupyter notebook
ipython notebook

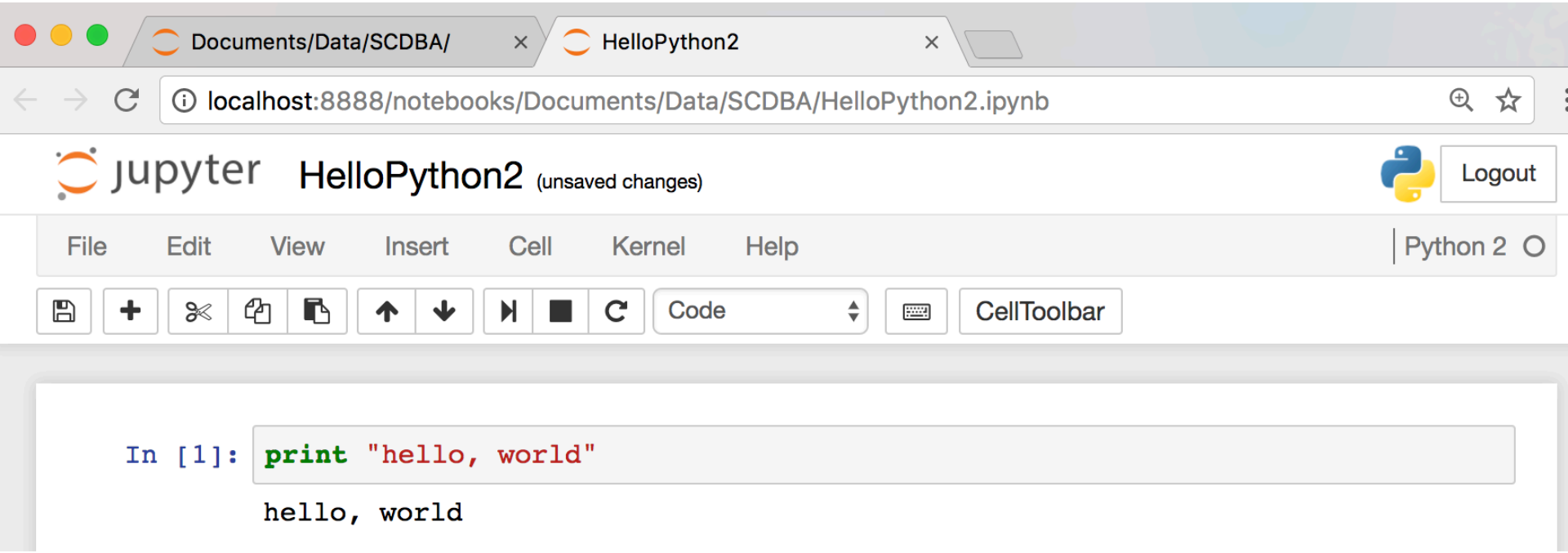
jupyter notebook



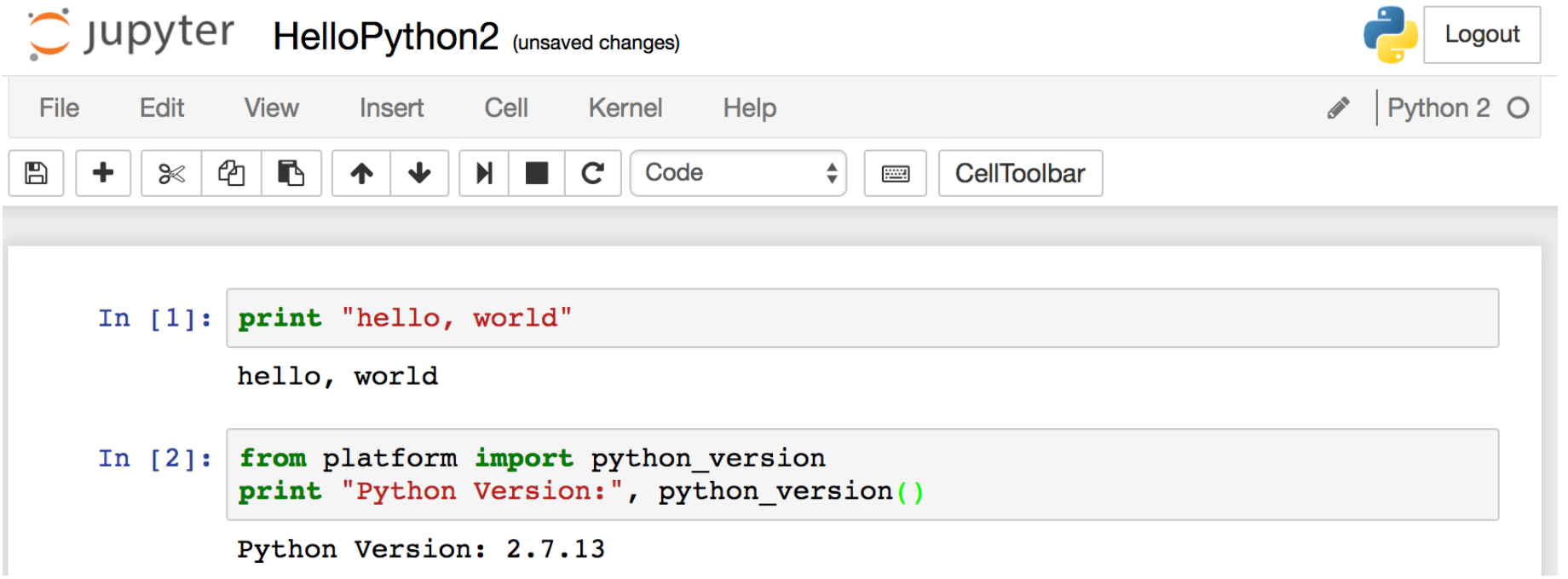
Jupyter Notebook
New Python 2



print “hello, world”

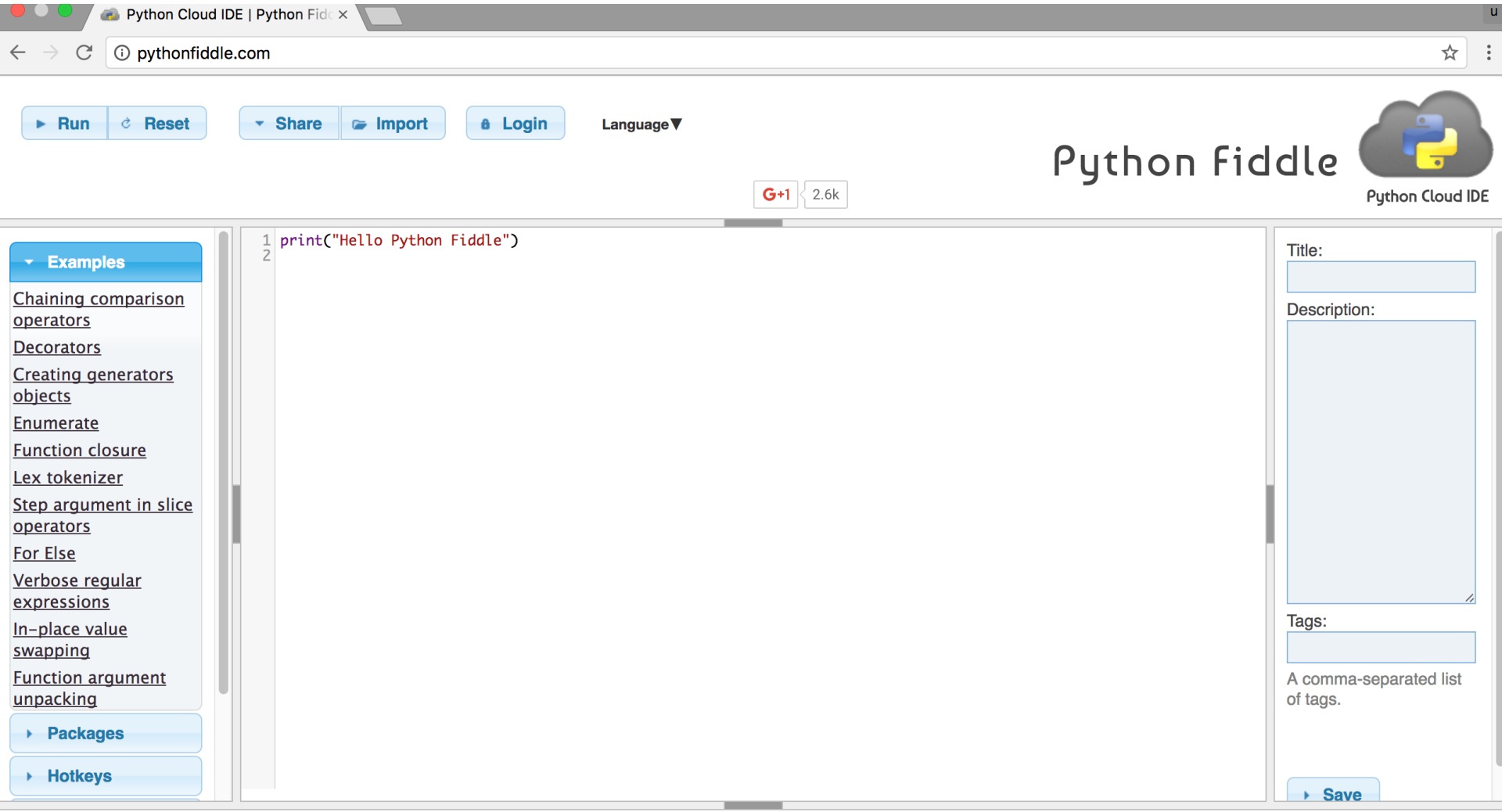


```
from platform import python_version
print "Python Version:", python_version()
```



Source: https://www.python.org/community/logos/

Python Fiddle



http://pythonfiddle.com/

Text input and output

```
print("Hello World")
```

```
print("Hello World\nThis is a message")
```

```
x = 3
print(x)
```

```
x = 2
y = 3
print(x, ' ', y)
```

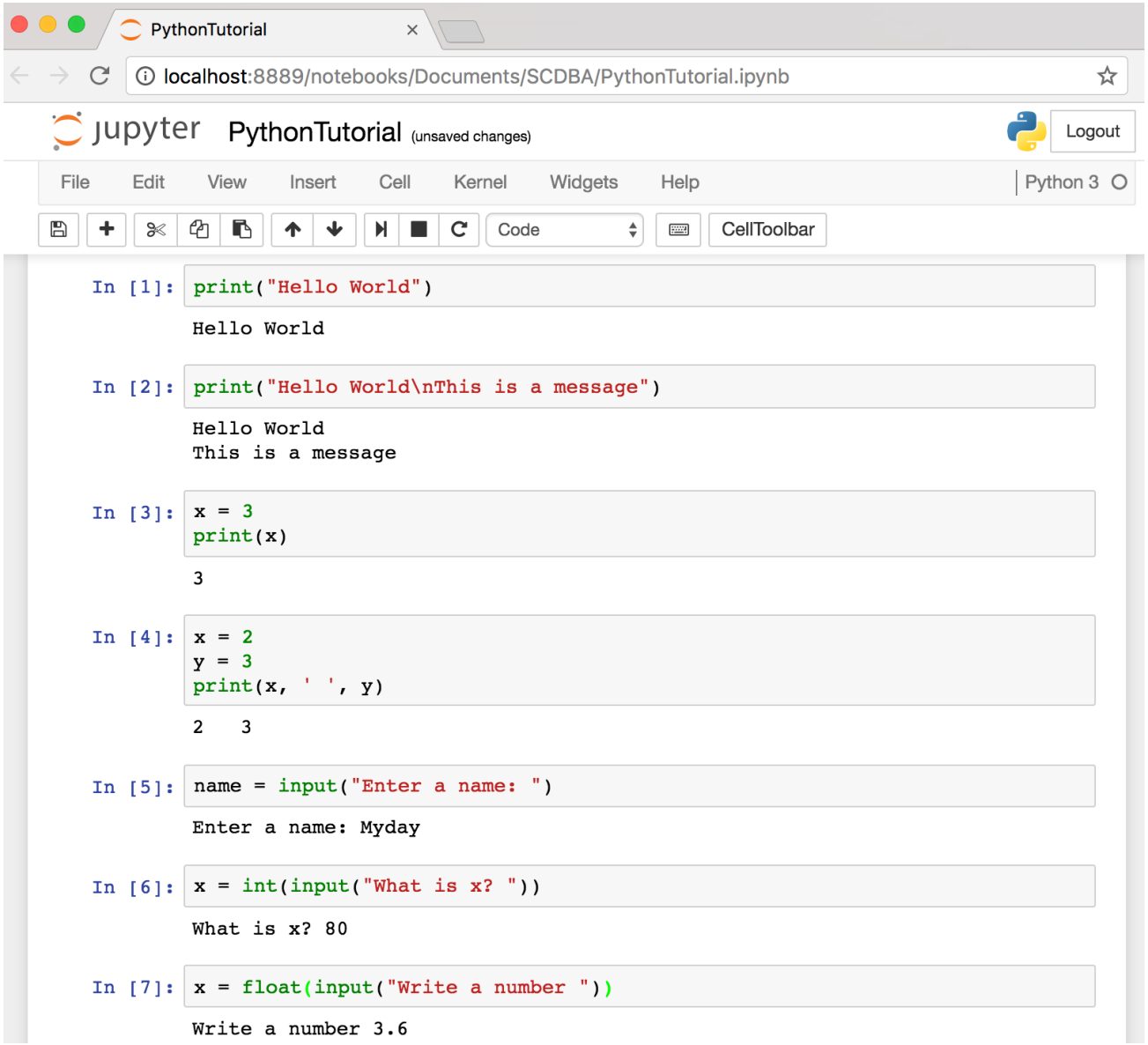
```
name = input("Enter a name: ")
```

```
x = int(input("What is x? "))
```

```
x = float(input("Write a number "))
```

Source: http://pythonprogramminglanguage.com/text-input-and-output/

Text input and output



Source: http://pythonprogramminglanguage.com/text-input-and-output/

python™

Variables

```
x = 2
price = 2.5
word = 'Hello'
```

```
word = 'Hello'
word = "Hello"
word = '''Hello'''
```

```
x = 2
x = x + 1
x = 5
```

Source: http://pythonprogramminglanguage.com/

Python Basic Operators

```
print('7 + 2 =', 7 + 2)
print('7 - 2 =', 7 - 2)
print('7 * 2 =', 7 * 2)
print('7 / 2 =', 7 / 2)
print('7 // 2 =', 7 // 2)
print('7 % 2 =', 7 % 2)
print('7 ** 2 =', 7 ** 2)
```

```
print('7 + 2 =', 7 + 2)
print('7 - 2 =', 7 - 2)
print('7 * 2 =', 7 * 2)
print('7 / 2 =', 7 / 2)
print('7 // 2 =', 7 // 2)
print('7 % 2 =', 7 % 2)
print('7 ** 2 =', 7 ** 2)
```

```
7 + 2 = 9
7 - 2 = 5
7 * 2 = 14
7 / 2 = 3.5
7 // 2 = 3
7 % 2 = 1
7 ** 2 = 49
```

BMI Calculator in Python

```
height_cm = float(input("Enter your height in cm: "))
weight_kg = float(input("Enter your weight in kg: "))

height_m = height_cm/100
BMI = (weight_kg/(height_m**2))

print("Your BMI is: " + str(round(BMI,1)))
```

Source: http://code.activestate.com/recipes/580615-bmi-code/

BMI Calculator in Python

jupyter PythonTutorial Last Checkpoint: a minute ago (unsaved changes) Logout

File Edit View Insert Cell Kernel Widgets Help Python 3

Code CellToolbar

In [1]:
```
height_cm = float(input("Enter your height in cm: "))
weight_kg = float(input("Enter your weight in kg: "))

height_m = height_cm/100
BMI = (weight_kg/(height_m**2))

print("Your BMI is: " + str(round(BMI,1)))
```

```
Enter your height in cm: 170
Enter your weight in kg: 60
Your BMI is: 20.8
```

In [ ]:

Source: http://code.activestate.com/recipes/580615-bmi-code/

If statements

> greater than
< smaller than
== equals
!= is not

```
score = 80
if score >=60 :
    print("Pass")
else:
    print("Fail")
```

```
Pass
```


```
score = 80
if score >=60 :
    print("Pass")
else:
    print("Fail")
```


Source: http://pythonprogramminglanguage.com/

For loops

```
for i in range(1,11):
    print(i)
```

```
1
2
3
4
5
6
7
8
9
10
```

Source: http://pythonprogramminglanguage.com/

For loops

```
for i in range(1,10):
    for j in range(1,10):
        print(i, ' * ' , j , ' = ', i*j)
```

```
9 * 1 = 9
9 * 2 = 18
9 * 3 = 27
9 * 4 = 36
9 * 5 = 45
9 * 6 = 54
9 * 7 = 63
9 * 8 = 72
9 * 9 = 81
```

Source: http://pythonprogramminglanguage.com/

Functions

```
def convertCMtoM(xcm):
    m = xcm/100
    return m

cm = 180
m = convertCMtoM(cm)
print(str(m))
```

```
1.8
```

Lists

```
x = [60, 70, 80, 90]
print(len(x))
print(x[0])
print(x[1])
print(x[-1])
```

```
4
60
70
90
```

Tuples

A tuple in Python is a collection that cannot be modified.

A tuple is defined using parenthesis.

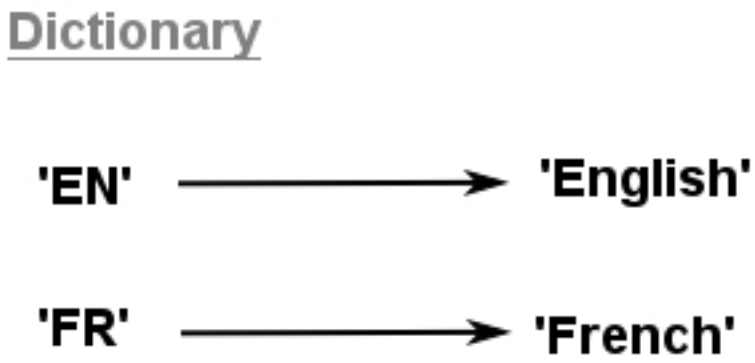
```
x = (10, 20, 30, 40, 50)
print(x[0])
print(x[1])
print(x[2])
print(x[-1])
```

```
10
20
30
50
```

Source: http://pythonprogramminglanguage.com/tuples/

Dictionary

```
k = { 'EN':'English', 'FR':'French' }
print(k['EN'])
```



English

Source: http://pythonprogramminglanguage.com/dictionary/

python™

Sets

```
animals = {'cat', 'dog'}
```

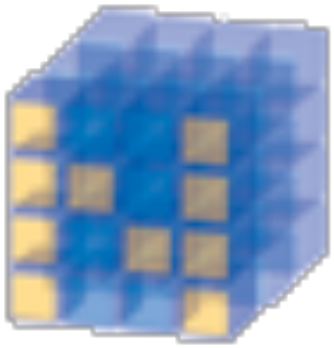
```
animals = {'cat', 'dog'}
print('cat' in animals)  # Check if an element is in a set; prints "True"
print('fish' in animals) # prints "False"
animals.add('fish')      # Add an element to a set
print('fish' in animals) # Prints "True"
print(len(animals))      # Number of elements in a set; prints "3"
animals.add('cat')       # Adding an element that is already in the set does nothing
print(len(animals))      # Prints "3"
animals.remove('cat')    # Remove an element from a set
print(len(animals))      # Prints "2"
```

```
True
False
True
3
3
2
```

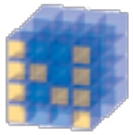
```
animals = {'cat', 'dog'}
print('cat' in animals)
print('fish' in animals)
animals.add('fish')
print('fish' in animals)
print(len(animals))
animals.add('cat')
print(len(animals))
animals.remove('cat')
print(len(animals))
```

Source: http://cs231n.github.io/python-numpy-tutorial/

Numpy



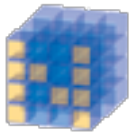
NumPy
Base
N-dimensional array
package



NumPy

NumPy

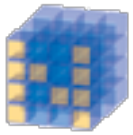
- NumPy provides a multidimensional array object to store homogenous or heterogeneous data; it also provides optimized functions/methods to operate on this array object.



NumPy

NumPy

```
v = range(1, 6)
print(v)
2 * v
import numpy as np
v = np.arange(1, 6)
v
2 * v
```



NumPy

Base
N-dimensional
array package

```
v = range (1, 6)
print(v)
```

```
[1, 2, 3, 4, 5]
```

```
2 * v
```

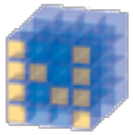
```
[1, 2, 3, 4, 5, 1, 2, 3, 4, 5]
```

```
import numpy as np
v = np.arange(1, 6)
v
```

```
array([1, 2, 3, 4, 5])
```

```
2 * v
```

```
array([ 2,  4,  6,  8, 10])
```



NumPy

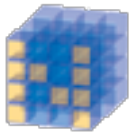
NumPy

```
import numpy as np
a = np.array([1, 2, 3])
b = np.array([4, 5, 6])
c = a * b
c
```

```
import numpy as np
a = np.array([1, 2, 3])
b = np.array([4, 5, 6])
c = a * b
c
```

```
array([ 4, 10, 18])
```

Source: Yves Hilpisch (2014), Python for Finance: Analyze Big Financial Data, O'Reilly



NumPy

NumPy

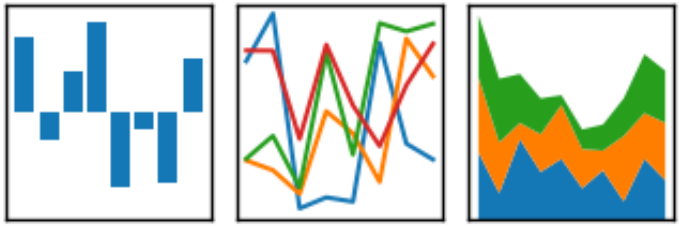
```python
import numpy as np

a = np.zeros((2,2))  # Create an array of all zeros
print(a)             # Prints "[[ 0.  0.]
                     #          [ 0.  0.]]"

b = np.ones((1,2))   # Create an array of all ones
print(b)             # Prints "[[ 1.  1.]]"

c = np.full((2,2), 7) # Create a constant array
print(c)               # Prints "[[ 7.  7.]
                       #          [ 7.  7.]]"

d = np.eye(2)        # Create a 2x2 identity matrix
print(d)             # Prints "[[ 1.  0.]
                     #          [ 0.  1.]]"

e = np.random.random((2,2)) # Create an array filled with random values
print(e)                    # Might print "[[ 0.91940167  0.08143941]
                            #               [ 0.68744134  0.87236687]]"
```

```
[[ 0.  0.]
 [ 0.  0.]]
[[ 1.  1.]]
[[ 7.  7.]
 [ 7.  7.]]
[[ 1.  0.]
 [ 0.  1.]]
[[ 0.22886991  0.68473232]
 [ 0.20683825  0.16589995]]
```

Source: http://cs231n.github.io/python-numpy-tutorial/

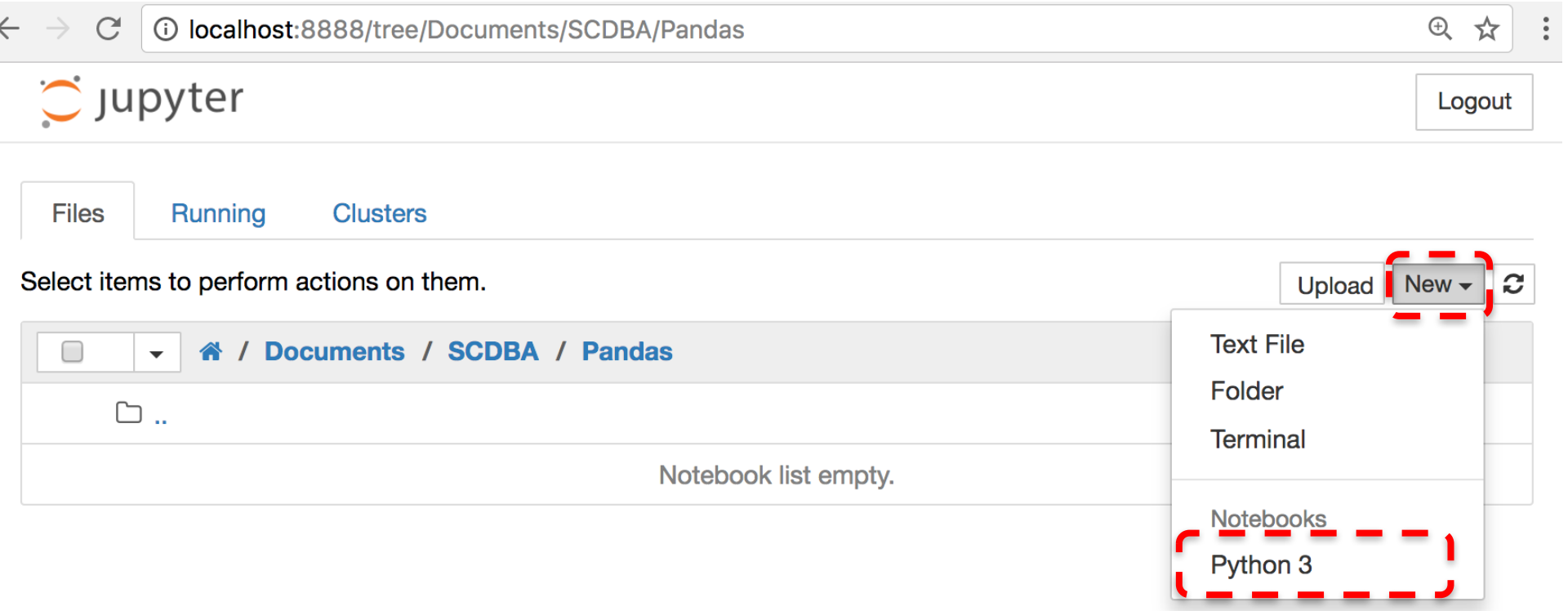
pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



Python Pandas for Finance

Jupyter Notebook New Python 3



Creating pd.DataFrame

	a	b	c
1	4	7	10
2	5	8	11
3	6	9	12

In [1]:
```
import numpy as np
import pandas as pd
df = pd.DataFrame({"a": [4, 5, 6],
                   "b": [7, 8, 9],
                   "c": [10, 11, 12]},
                  index = [1, 2, 3])
df
```

Out[1]:

	a	b	c
1	4	7	10
2	5	8	11
3	6	9	12

```
df = pd.DataFrame({"a": [4, 5, 6],
                   "b": [7, 8, 9],
                   "c": [10, 11, 12]},
                  index = [1, 2, 3])
```

Source: https://github.com/pandas-dev/pandas/blob/master/doc/cheatsheet/Pandas_Cheat_Sheet.pdf

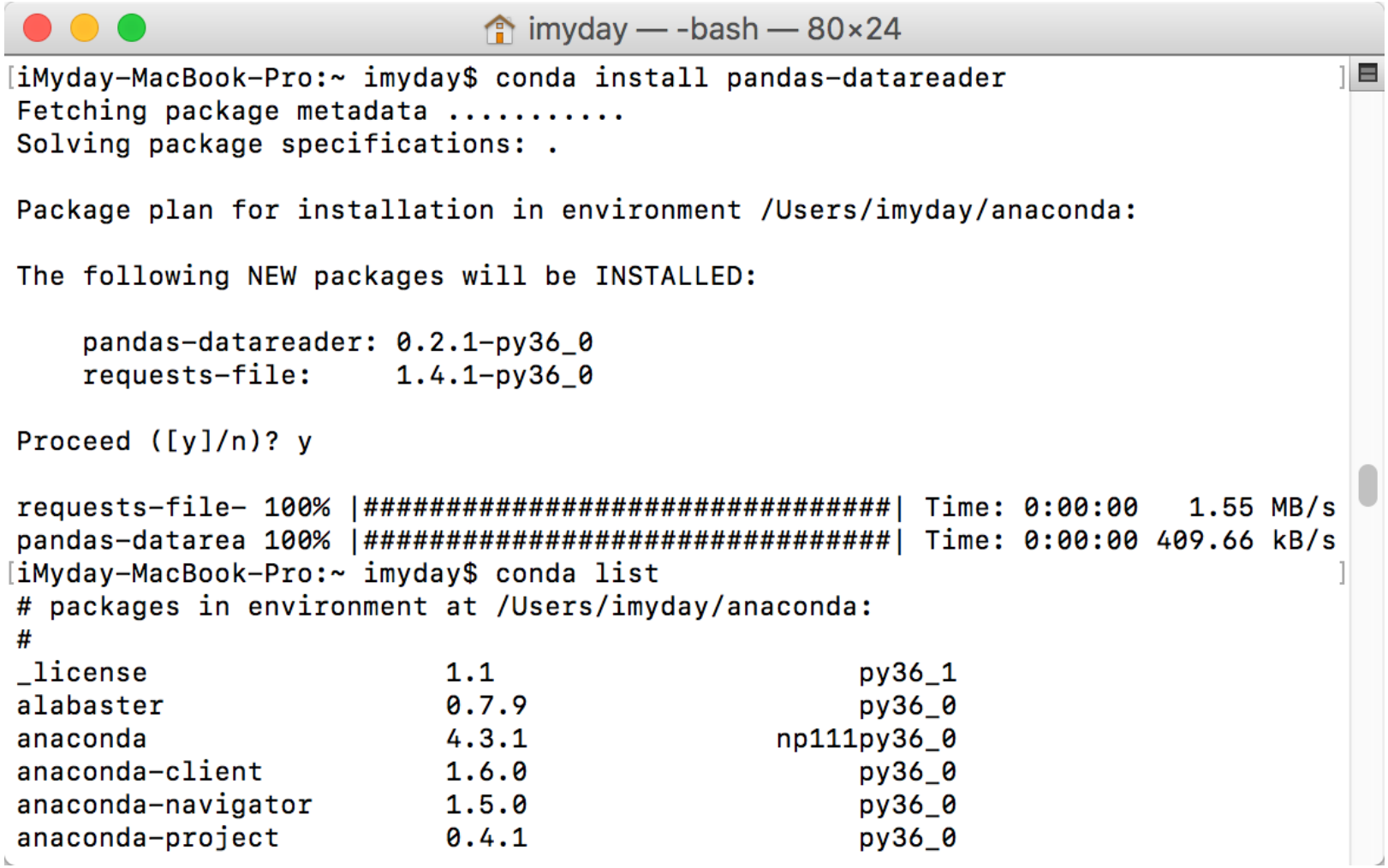
Pandas DataFrame

```
type(df)
```

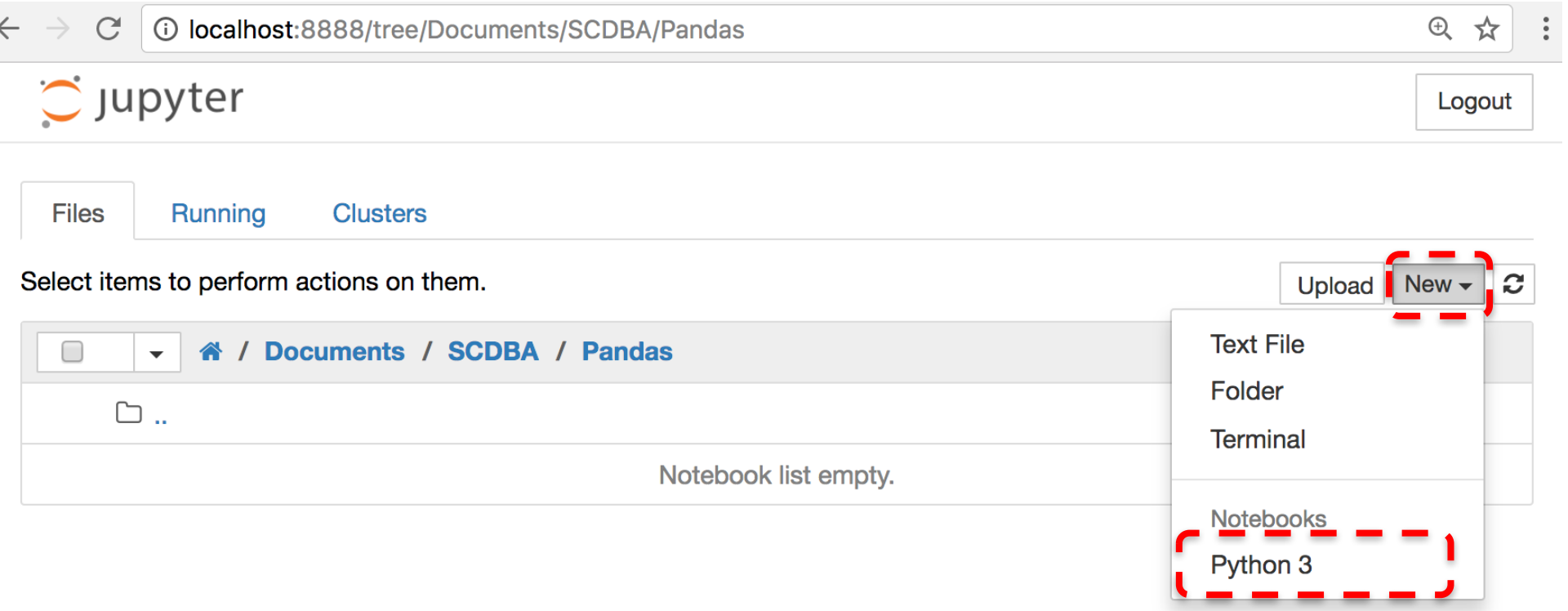
```
type(df)
```

```
pandas.core.frame.DataFrame
```

conda install pandas-datareader



Jupyter Notebook New Python 3



```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
print('Hello Pandas')
```

```
s = pd.Series([1,3,5,np.nan,6,8])
s
```

```
dates = pd.date_range('20170301',
periods=6)
dates
```

Source: http://pandas.pydata.org/pandas-docs/stable/10min.html

localhost:8888/notebooks/Documents/SCDBA/python/PythonPandasFinance.ipynb

jupyter PythonPandasFinance (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Python 3

Code CellToolbar

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
print('Hello Pandas')
```

```
Hello Pandas
```

In [2]:
```
s = pd.Series([1,3,5,np.nan,6,8])
s
```

Out[2]:
```
0    1.0
1    3.0
2    5.0
3    NaN
4    6.0
5    8.0
dtype: float64
```

In [3]:
```
dates = pd.date_range('20170301', periods=6)
dates
```

Out[3]:
```
DatetimeIndex(['2017-03-01', '2017-03-02', '2017-03-03', '2017-03-04',
               '2017-03-05', '2017-03-06'],
              dtype='datetime64[ns]', freq='D')
```

```
df = pd.DataFrame(np.random.randn(6,4), index=dates, columns=list('ABCD'))
df
```

```
df = pd.DataFrame(np.random.randn(6,4), index=dates, columns=list('ABCD'))
df
```

	A	B	C	D
2017-03-01	-1.613934	0.168983	0.686730	1.520077
2017-03-02	0.656124	-1.155197	-1.969431	0.444569
2017-03-03	-0.242393	-0.372972	-0.310283	1.102838
2017-03-04	-0.034627	-0.422640	0.489834	1.498832
2017-03-05	-1.022516	-0.841598	-0.136151	-0.767695
2017-03-06	1.208003	3.114586	-0.451570	0.579479

```
df = pd.DataFrame(np.random.randn(4,6), index=['student1','student2','student3','student4'], columns=list('ABCDEF'))
df
```

	A	B	C	D	E	F
student1	-0.420406	0.829262	-0.326521	-0.037699	-1.350555	-0.617676
student2	0.310825	-0.356479	0.149704	-0.685609	-0.744307	-0.488782
student3	-1.295312	0.765656	1.701502	-0.415809	-0.454114	0.397702
student4	0.979525	0.367767	1.869465	0.988012	0.916746	0.165911

```
df2 = pd.DataFrame({ 'A' : 1.,
'B' : pd.Timestamp('20170322'),
'C' : pd.Series(2.5,index=list(range(4)),dtype='float32'),
'D' : np.array([3] * 4,dtype='int32'),
'E' : pd.Categorical(["test","train","test","train"]),
'F' : 'foo' })
df2
```

```
df2 = pd.DataFrame({ 'A' : 1.,
'B' : pd.Timestamp('20170322'),
'C' : pd.Series(2.5,index=list(range(4)),dtype='float32'),
'D' : np.array([3] * 4,dtype='int32'),
'E' : pd.Categorical(["test","train","test","train"]),
'F' : 'foo' })
df2
```

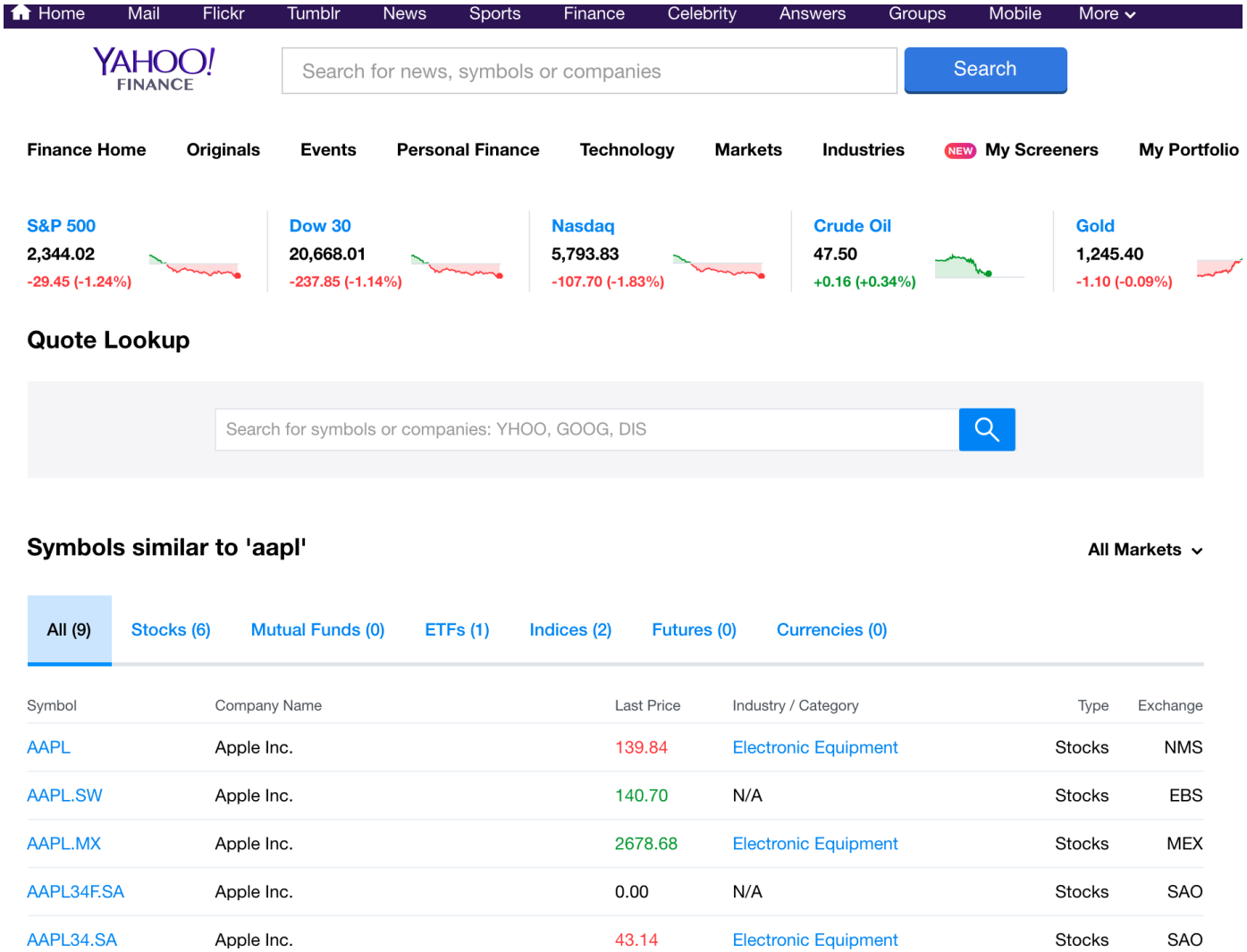
	A	B	C	D	E	F
0	1.0	2017-03-22	2.5	3	test	foo
1	1.0	2017-03-22	2.5	3	train	foo
2	1.0	2017-03-22	2.5	3	test	foo
3	1.0	2017-03-22	2.5	3	train	foo

df2.dtypes

```
df2.dtypes
```

```
A              float64
B    datetime64[ns]
C              float32
D                int32
E             category
F               object
dtype: object
```

Yahoo Finance Symbols: AAPL Apple Inc. (AAPL)



http://finance.yahoo.com/q?s=AAPL

Apple Inc. (AAPL) -NasdaqGS

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Apple Inc. (AAPL)

NasdaqGS - NasdaqGS Delayed Price. Currency in USD

Add to watchlist

139.84 -1.62 (-1.15%)
At close: 4:00PM EDT

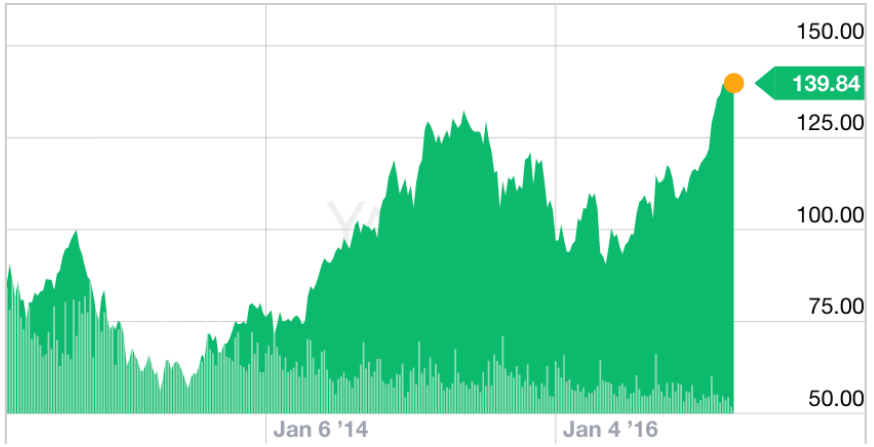
139.35 -0.49 (-0.35%)
After hours: 7:59PM EDT

Summary | Conversations | Statistics | Profile | Financials | Options | Holders | Historical Data | Analysts

Previous Close	141.46	Market Cap	733.68B
Open	142.11	Beta	1.45
Bid	139.31 x 100	PE Ratio (TTM)	16.79
Ask	139.40 x 1300	EPS (TTM)	8.33
Day's Range	139.73 - 142.80	Earnings Date	Apr 24, 2017 - Apr 28, 2017
52 Week Range	89.47 - 142.80	Dividend & Yield	2.28 (1.63%)
Volume	39,529,912	Ex-Dividend Date	N/A
Avg. Volume	26,889,183	1y Target Est	143.29

Trade prices are not sourced from all markets

1D 5D 1M 6M YTD 1Y 2Y **5Y** 10Y MAX | Interactive chart

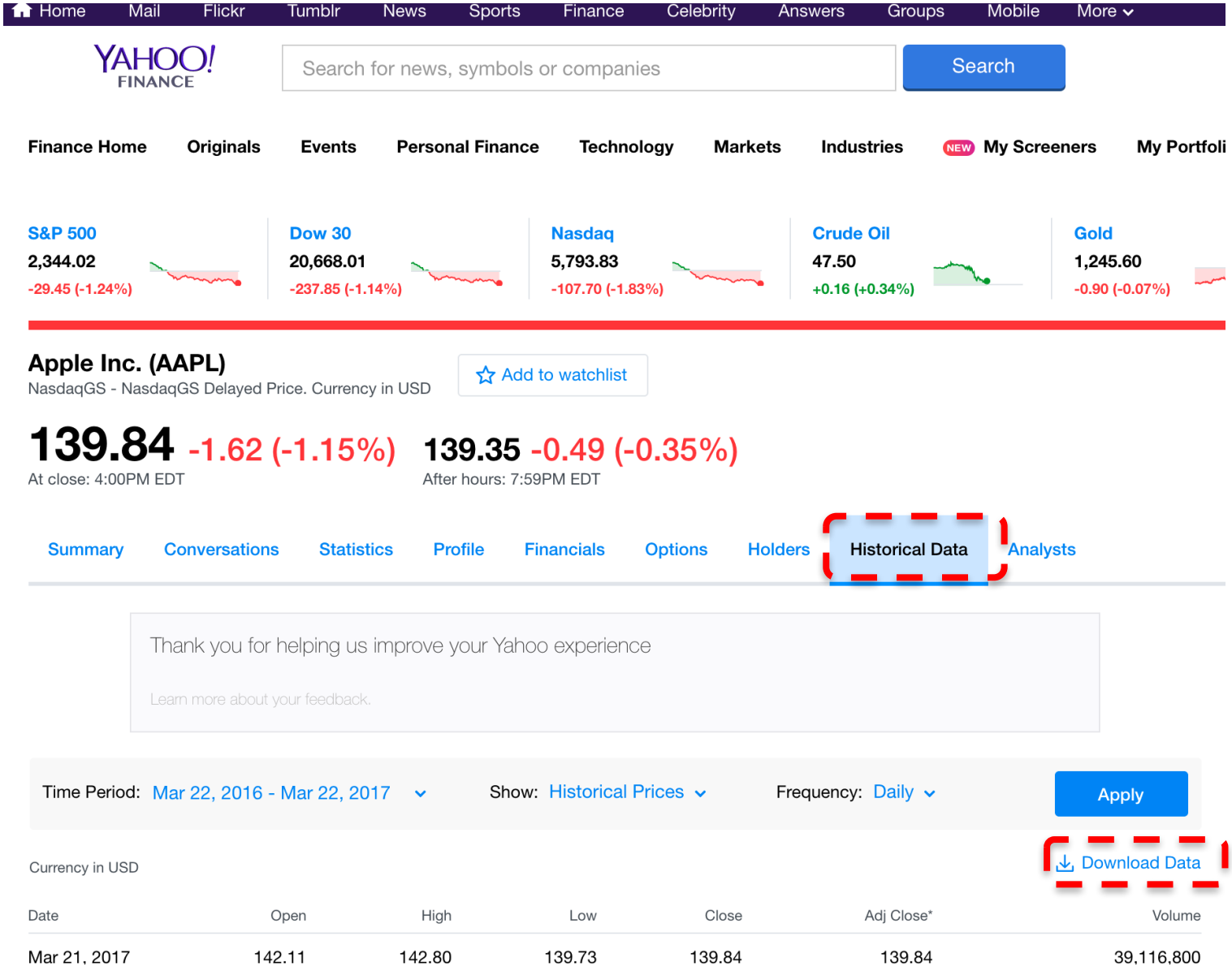


http://finance.yahoo.com/quote/AAPL?p=AAPL

Yahoo Finance Charts: Apple Inc. (AAPL)

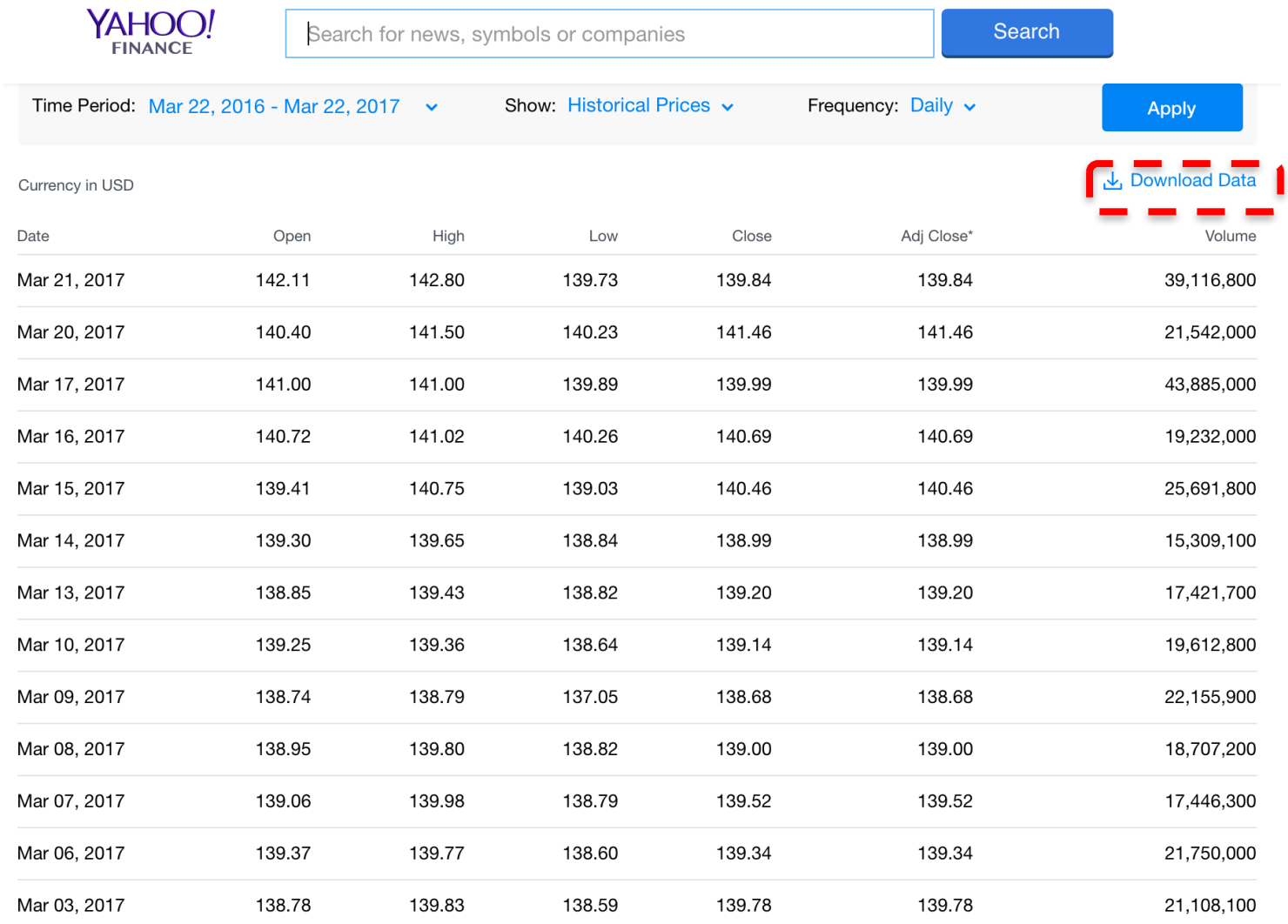
http://finance.yahoo.com/chart/AAPL

Apple Inc. (AAPL) Historical Data



http://finance.yahoo.com/q/hp?s=AAPL+Historical+Prices

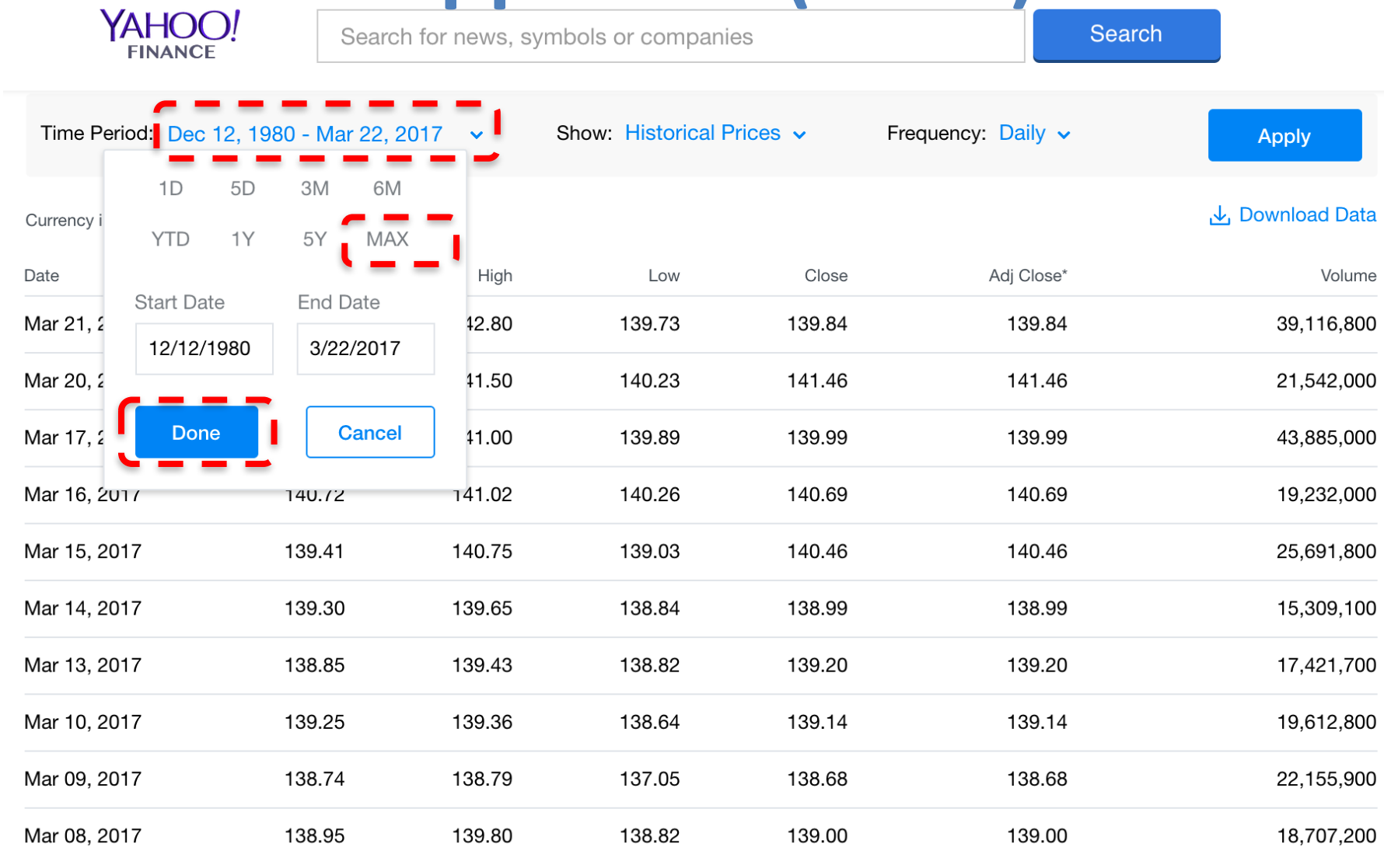
Yahoo Finance Historical Prices Apple Inc. (AAPL)



Date	Open	High	Low	Close	Adj Close*	Volume
Mar 21, 2017	142.11	142.80	139.73	139.84	139.84	39,116,800
Mar 20, 2017	140.40	141.50	140.23	141.46	141.46	21,542,000
Mar 17, 2017	141.00	141.00	139.89	139.99	139.99	43,885,000
Mar 16, 2017	140.72	141.02	140.26	140.69	140.69	19,232,000
Mar 15, 2017	139.41	140.75	139.03	140.46	140.46	25,691,800
Mar 14, 2017	139.30	139.65	138.84	138.99	138.99	15,309,100
Mar 13, 2017	138.85	139.43	138.82	139.20	139.20	17,421,700
Mar 10, 2017	139.25	139.36	138.64	139.14	139.14	19,612,800
Mar 09, 2017	138.74	138.79	137.05	138.68	138.68	22,155,900
Mar 08, 2017	138.95	139.80	138.82	139.00	139.00	18,707,200
Mar 07, 2017	139.06	139.98	138.79	139.52	139.52	17,446,300
Mar 06, 2017	139.37	139.77	138.60	139.34	139.34	21,750,000
Mar 03, 2017	138.78	139.83	138.59	139.78	139.78	21,108,100

http://finance.yahoo.com/quote/AAPL/history

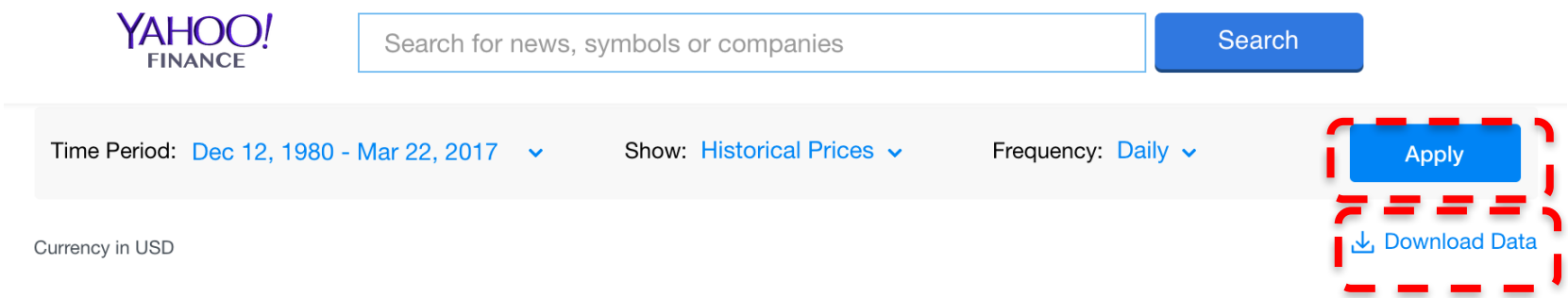
Yahoo Finance Historical Prices
Apple Inc. (AAPL)



Date		High	Low	Close	Adj Close*	Volume
Mar 21, 2		42.80	139.73	139.84	139.84	39,116,800
Mar 20, 2		41.50	140.23	141.46	141.46	21,542,000
Mar 17, 2		41.00	139.89	139.99	139.99	43,885,000
Mar 16, 2017	140.72	141.02	140.26	140.69	140.69	19,232,000
Mar 15, 2017	139.41	140.75	139.03	140.46	140.46	25,691,800
Mar 14, 2017	139.30	139.65	138.84	138.99	138.99	15,309,100
Mar 13, 2017	138.85	139.43	138.82	139.20	139.20	17,421,700
Mar 10, 2017	139.25	139.36	138.64	139.14	139.14	19,612,800
Mar 09, 2017	138.74	138.79	137.05	138.68	138.68	22,155,900
Mar 08, 2017	138.95	139.80	138.82	139.00	139.00	18,707,200

http://finance.yahoo.com/quote/AAPL/history?period1=345398400&period2=1490112000&interval=1d&filter=history&frequency=1d

Yahoo Finance Historical Prices Apple Inc. (AAPL)



Currency in USD

Date	Open	High	Low	Close	Adj Close*	Volume
Mar 21, 2017	142.11	142.80	139.73	139.84	139.84	39,116,800
Mar 20, 2017	140.40	141.50	140.23	141.46	141.46	21,542,000
Mar 17, 2017	141.00	141.00	139.89	139.99	139.99	43,885,000
Mar 16, 2017	140.72	141.02	140.26	140.69	140.69	19,232,000
Mar 15, 2017	139.41	140.75	139.03	140.46	140.46	25,691,800
Mar 14, 2017	139.30	139.65	138.84	138.99	138.99	15,309,100
Mar 13, 2017	138.85	139.43	138.82	139.20	139.20	17,421,700
Mar 10, 2017	139.25	139.36	138.64	139.14	139.14	19,612,800
Mar 09, 2017	138.74	138.79	137.05	138.68	138.68	22,155,900
Mar 08, 2017	138.95	139.80	138.82	139.00	139.00	18,707,200

http://finance.yahoo.com/quote/AAPL/history?period1=345398400&period2=1490112000&interval=1d&filter=history&frequency=1d

Yahoo Finance Historical Prices

http://ichart.finance.yahoo.com/table.csv?s=AAPL

table.csv

```
Date,Open,High,Low,Close,Volume,Adj Close
2017-03-21,142.110001,142.800003,139.729996,139.839996,39116800,139.839996
2017-03-20,140.399994,141.50,140.229996,141.460007,20213100,141.460007
2017-03-17,141.00,141.00,139.889999,139.990005,43597400,139.990005
2017-03-16,140.720001,141.020004,140.259995,140.690002,19132500,140.690002
2017-03-15,139.410004,140.75,139.029999,140.460007,25566800,140.460007
2017-03-14,139.300003,139.649994,138.839996,138.990005,15189700,138.990005
2017-03-13,138.850006,139.429993,138.820007,139.199997,17042400,139.199997
2017-03-10,139.25,139.360001,138.639999,139.139999,19488000,139.139999
2017-03-09,138.740005,138.789993,137.050003,138.679993,22065200,138.679993
2017-03-08,138.949997,139.800003,138.820007,139.00,18681800,139.00
2017-03-07,139.059998,139.979996,138.789993,139.520004,17267500,139.520004
2017-03-06,139.369995,139.770004,138.600006,139.339996,21155300,139.339996
2017-03-03,138.779999,139.830002,138.589996,139.779999,21108100,139.779999
2017-03-02,140.00,140.279999,138.759995,138.960007,26153300,138.960007
2017-03-01,137.889999,140.149994,137.600006,139.789993,36272400,139.789993
2017-02-28,137.080002,137.440002,136.699997,136.990005,23403500,136.990005
2017-02-27,137.139999,137.440002,136.279999,136.929993,20196400,136.929993
2017-02-24,135.910004,136.660004,135.279999,136.660004,21690900,136.660004
2017-02-23,137.380005,137.479996,136.300003,136.529999,20704100,136.529999
2017-02-22,136.429993,137.119995,136.110001,137.110001,20745300,137.110001
```

Yahoo Finance Charts Alphabet Inc. (GOOG)

http://finance.yahoo.com/echarts?s=GOOG+Interactive#{"showArea":false,"showLine":false,"showCandle":true,"lineType":"candle","range":"5y","allowChartStacking":true}

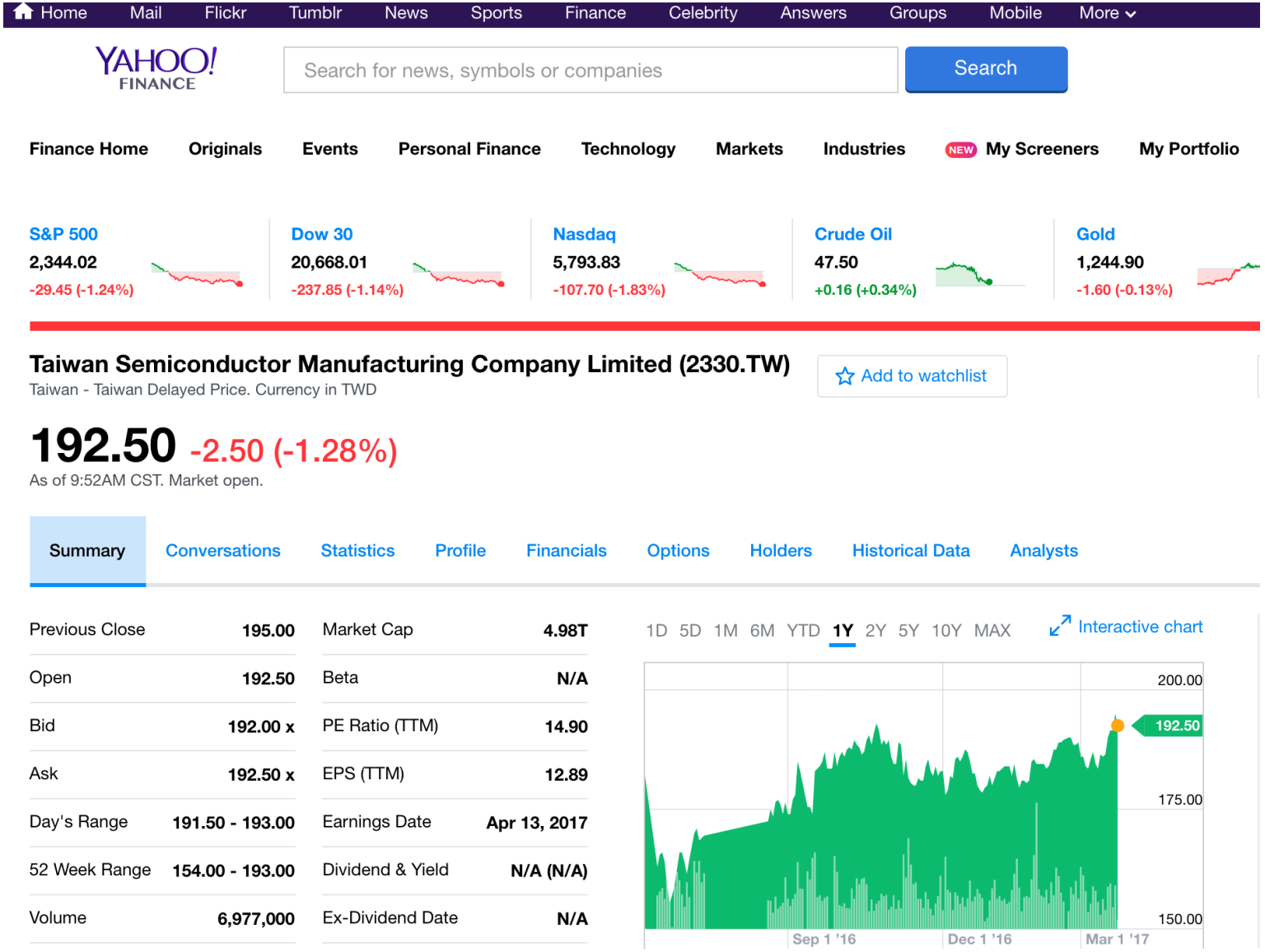
Dow Jones Industrial Average (^DJI)

http://finance.yahoo.com/chart/^DJI

TSEC weighted index (^TWII) - Taiwan

http://finance.yahoo.com/chart/^DJI

Taiwan Semiconductor Manufacturing Company Limited (2330.TW)



http://finance.yahoo.com/q?s=2330.TW

Yahoo Finance Charts
TSMC (2330.TW)

http://finance.yahoo.com/chart/2330.TW

```
import pandas as pd
import pandas_datareader.data as web
df = web.DataReader('AAPL', data_source='yahoo',
start='1/1/2010', end='3/21/2017')
df.to_csv('AAPL.csv')
df.tail()
```

```
import pandas as pd
import pandas_datareader.data as web
#df = web.DataReader('AAPL', 'yahoo')
df = web.DataReader('AAPL', data_source='yahoo', start='1/1/2010', end='3/21/2017')
#df = web.DataReader('AAPL', data_source='google', start='1/1/2010', end='3/21/2017')
df.to_csv('AAPL.csv')
df.tail()
```

	Open	High	Low	Close	Volume	Adj Close
Date						
2017-03-15	139.410004	140.750000	139.029999	140.460007	25566800	140.460007
2017-03-16	140.720001	141.020004	140.259995	140.690002	19132500	140.690002
2017-03-17	141.000000	141.000000	139.889999	139.990005	43597400	139.990005
2017-03-20	140.399994	141.500000	140.229996	141.460007	20213100	141.460007
2017-03-21	142.110001	142.800003	139.729996	139.839996	39116800	139.839996

```
df = web.DataReader('GOOG',
data_source='yahoo', start='1/1/1980',
end='3/21/2017')
df.head(10)
```

```
df = web.DataReader('GOOG', data_source='yahoo', start='1/1/1980', end='3/21/2017')
df.head(10)
```

	Open	High	Low	Close	Volume	Adj Close
Date						
2004-08-19	100.000168	104.060182	95.960165	100.340176	44871300	50.119968
2004-08-20	101.010175	109.080187	100.500174	108.310183	22942800	54.100990
2004-08-23	110.750191	113.480193	109.050183	109.400185	18342800	54.645447
2004-08-24	111.240189	111.600192	103.570177	104.870176	15319700	52.382705
2004-08-25	104.960181	108.000187	103.880180	106.000184	9232100	52.947145
2004-08-26	104.950180	107.950188	104.660179	107.910182	7128600	53.901190
2004-08-27	108.100185	108.620186	105.690180	106.150181	6241200	53.022069
2004-08-30	105.280178	105.490184	102.010172	102.010172	5221400	50.954132
2004-08-31	102.300173	103.710180	102.160177	102.370175	4941200	51.133953
2004-09-01	102.700174	102.970180	99.670169	100.250171	9181600	50.075011

df.tail(10)

```
df.tail(10)
```

	Open	High	Low	Close	Volume	Adj Close
Date						
2017-03-08	833.510010	838.150024	831.789978	835.369995	988700	835.369995
2017-03-09	836.000000	842.000000	834.210022	838.679993	1259900	838.679993
2017-03-10	843.280029	844.909973	839.500000	843.250000	1701100	843.250000
2017-03-13	844.000000	848.684998	843.250000	845.539978	1149500	845.539978
2017-03-14	843.640015	847.239990	840.799988	845.619995	779900	845.619995
2017-03-15	847.590027	848.630005	840.770020	847.200012	1379600	847.200012
2017-03-16	849.030029	850.849976	846.130005	848.780029	970400	848.780029
2017-03-17	851.609985	853.400024	847.109985	852.119995	1712300	852.119995
2017-03-20	850.010010	850.219971	845.150024	848.400024	1190300	848.400024
2017-03-21	851.400024	853.500000	829.020020	830.460022	2442900	830.460022

df.count()

```
df.count()
```

```
Open          3169
High          3169
Low           3169
Close         3169
Volume        3169
Adj Close     3169
dtype: int64
```

df.ix['2015-12-31']

```
df.ix['2015-12-31']
```

```
Open          7.695000e+02
High          7.695000e+02
Low           7.583400e+02
Close         7.588800e+02
Volume        1.489600e+06
Adj Close     7.588800e+02
Name: 2015-12-31 00:00:00, dtype: float64
```

```
df.to_csv('2330.TW.Yahoo.Finance.Data.csv')
```

2330.TW.Yahoo.Finance.Data.csv

```
Date,Open,High,Low,Close,Volume,Adj Close
2010-01-01,64.5,64.5,64.5,64.5,0,52.8308
2010-01-04,65.0,65.0,64.0,64.9,39407000,53.1584
2010-01-05,65.0,65.1,63.9,64.5,37138000,52.8308
2010-01-06,64.5,64.9,63.7,64.9,49261000,53.1584
2010-01-07,64.9,65.0,64.2,64.2,42134000,52.5851
2010-01-08,63.5,64.3,63.5,64.0,46076000,52.4213
2010-01-11,64.0,64.9,63.5,64.5,36799000,52.8308
2010-01-12,64.4,64.4,63.3,63.6,49853000,52.0936
2010-01-13,63.0,63.1,62.6,62.8,47976000,51.4384
2010-01-14,63.6,63.6,63.0,63.2,36149000,51.766
2010-01-15,62.9,63.5,62.8,63.5,47852000,52.0117
2010-01-18,62.8,63.1,62.8,62.9,30136000,51.5203
2010-01-19,63.0,63.2,62.0,62.5,47202000,51.1926
2010-01-20,62.9,63.2,62.2,63.0,52281000,51.6022
```

Python Pandas for Finance

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
import pandas as pd
import pandas_datareader.data as web
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
%matplotlib inline
```

```
#Python for Stocks: 1
#Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/
#Import Packages Required
import pandas as pd
import pandas_datareader.data as web
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
%matplotlib inline
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
#Read Stock Data from Yahoo Finance
end = dt.datetime.now()
#start = dt.datetime(end.year-2, end.month, end.day)
start = dt.datetime(2015, 1, 1)
df = web.DataReader("AAPL", 'yahoo', start, end)
df.to_csv('AAPL.csv')
df.from_csv('AAPL.csv')
df.tail()
```

```
#Read Stock Data from Yahoo Finance
end = dt.datetime.now()
#start = dt.datetime(end.year-2, end.month, end.day)
start = dt.datetime(2015, 1, 1)
df = web.DataReader("AAPL", 'yahoo', start, end)
df.to_csv('AAPL.csv')
df.from_csv('AAPL.csv')
df.tail()
```

	Open	High	Low	Close	Volume	Adj Close
Date						
2017-03-15	139.410004	140.750000	139.029999	140.460007	25566800	140.460007
2017-03-16	140.720001	141.020004	140.259995	140.690002	19132500	140.690002
2017-03-17	141.000000	141.000000	139.889999	139.990005	43597400	139.990005
2017-03-20	140.399994	141.500000	140.229996	141.460007	20213100	141.460007
2017-03-21	142.110001	142.800003	139.729996	139.839996	39116800	139.839996

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
df['Adj Close'].plot(legend=True, figsize=(12, 8), title='AAPL', label='Adj Close')
```

```
df['Adj Close'].plot(legend=True, figsize=(12, 8), title='AAPL', label='Adj Close')
<matplotlib.axes._subplots.AxesSubplot at 0x1150bac88>
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
plt.figure(figsize=(12,9))
top = plt.subplot2grid((12,9), (0, 0),
rowspan=10, colspan=9)
bottom = plt.subplot2grid((12,9), (10,0),
rowspan=2, colspan=9)
top.plot(df.index, df['Adj Close'],
color='blue') #df.index gives the dates
bottom.bar(df.index, df['Volume'])

# set the labels
top.axes.get_xaxis().set_visible(False)
top.set_title('AAPL')
top.set_ylabel('Adj Close')
bottom.set_ylabel('Volume')
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
<matplotlib.text.Text at 0x115630860>
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
plt.figure(figsize=(12,9))
top = plt.subplot2grid((12,9), (0, 0), rowspan=10, colspan=9)
bottom = plt.subplot2grid((12,9), (10,0), rowspan=2, colspan=9)
top.plot(df.index, df['Adj Close'], color='blue') #df.index gives the dates
bottom.bar(df.index, df['Volume'])

# set the labels
top.axes.get_xaxis().set_visible(False)
top.set_title('AAPL')
top.set_ylabel('Adj Close')
bottom.set_ylabel('Volume')
```

```
<matplotlib.text.Text at 0x115630860>
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

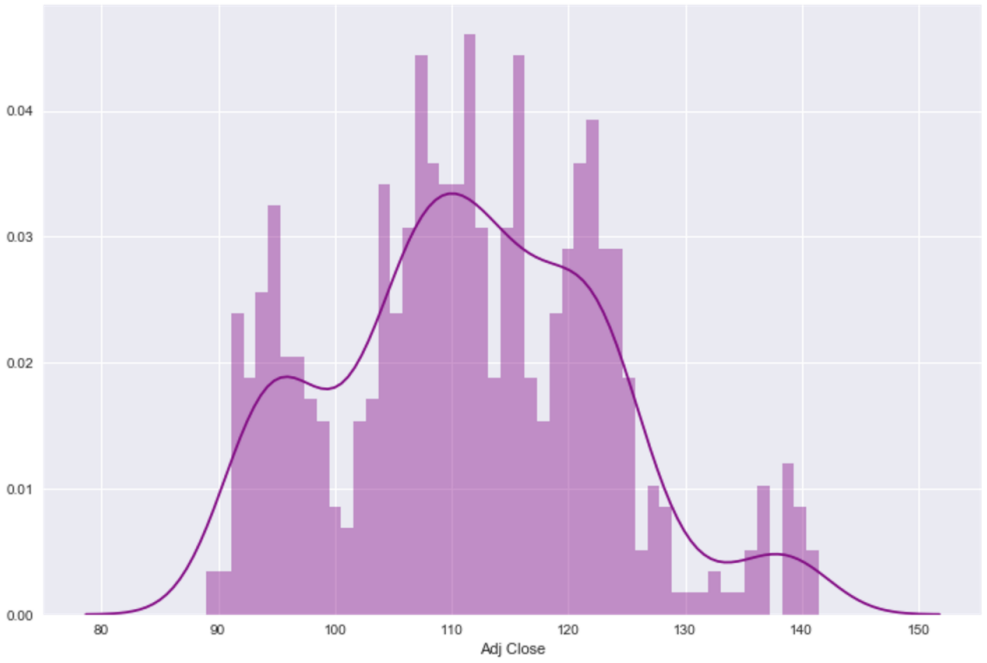
Python Pandas for Finance

```
plt.figure(figsize=(12,9))
sns.distplot(df['Adj Close'].dropna(),
bins=50, color='purple')
```

```
plt.figure(figsize=(12,8))
sns.distplot(df['Adj Close'].dropna(), bins=50, color='purple')
```

```
/Users/imyday/anaconda/lib/python3.6/site-packages/statsmodels/nonparametric/kdetools
g: using a non-integer number instead of an integer will result in an error in the fu
  y = X[:m/2+1] + np.r_[0,X[m/2+1:],0]*1j
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x116309780>
```



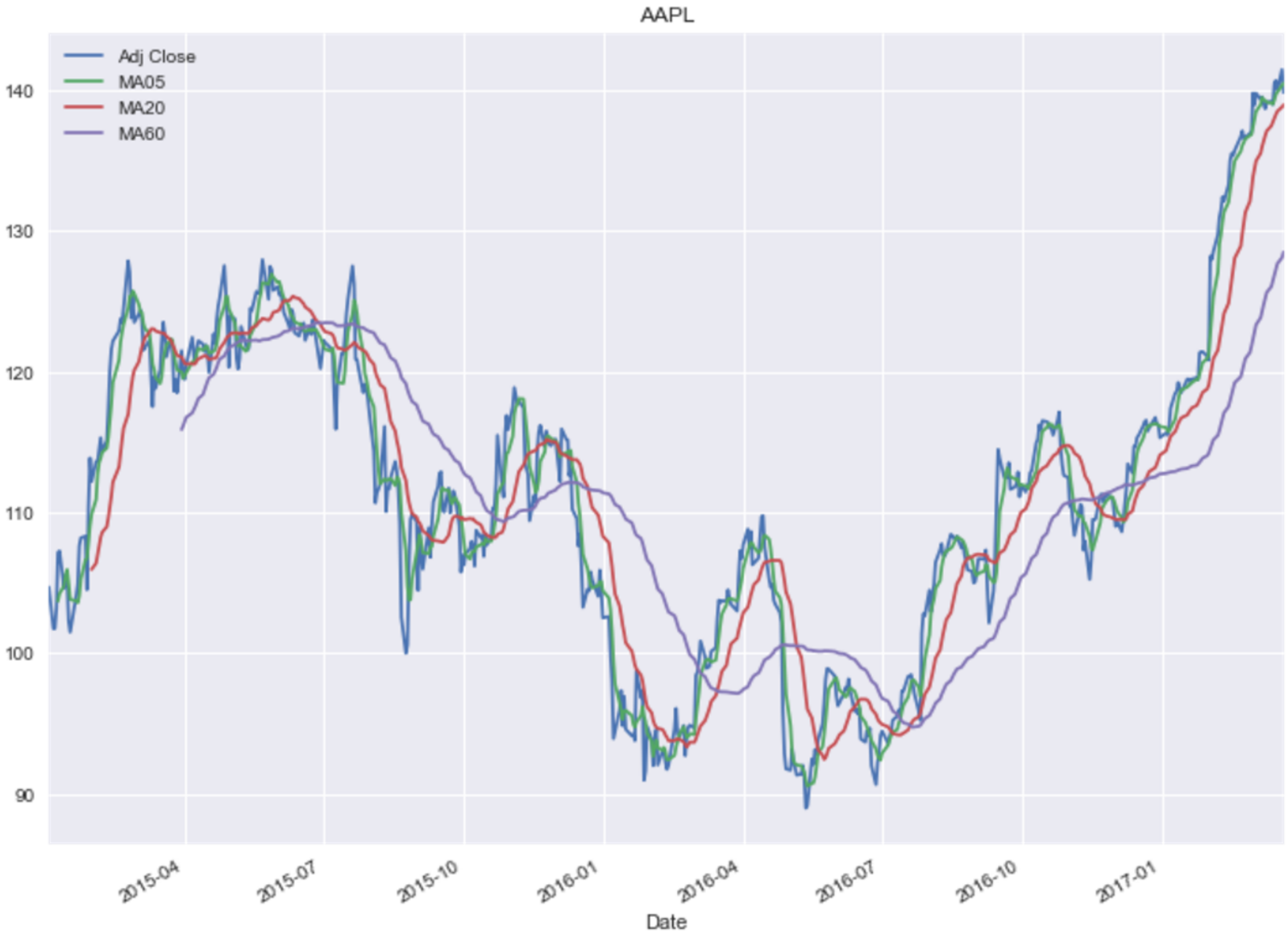
Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean()
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days

df2 = pd.DataFrame({'Adj Close': df['Adj
Close'],'MA05': df['MA05'],'MA20':
df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True,
title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
plt.show()
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

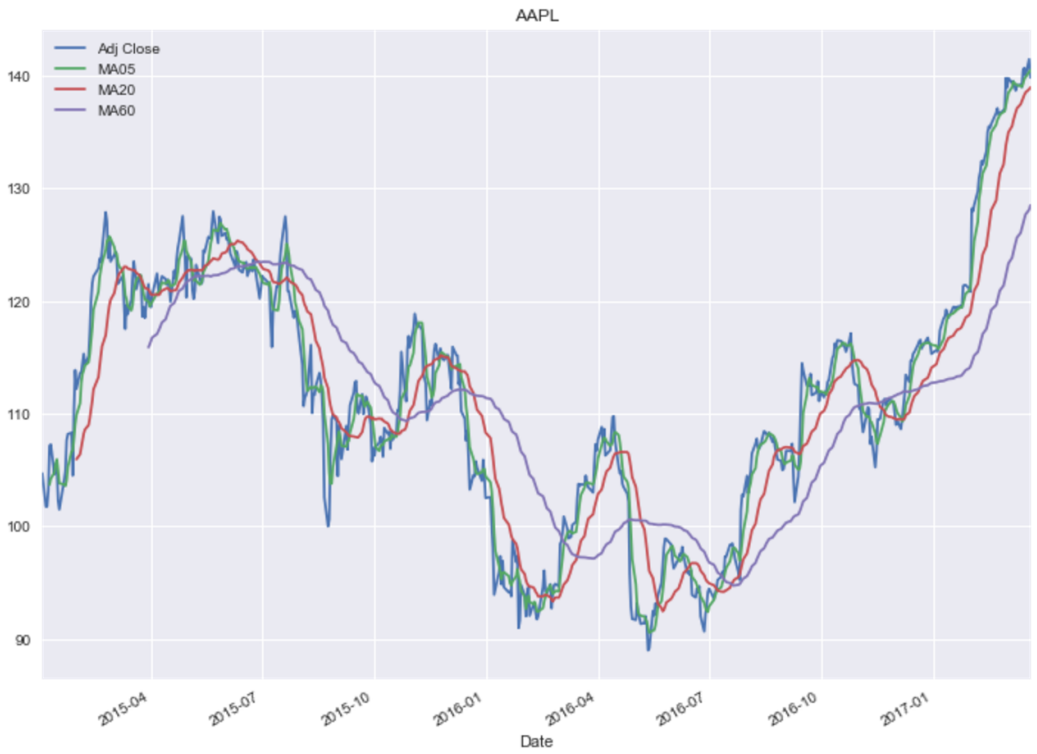
Python Pandas for Finance



Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean() #5 days
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days

df2 = pd.DataFrame({'Adj Close': df['Adj Close'],'MA05': df['MA05'],'MA20': df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True, title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
```



Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

```
import pandas as pd
import pandas_datareader.data as web
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
%matplotlib inline

#Read Stock Data from Yahoo Finance
end = dt.datetime.now()
#start = dt.datetime(end.year-2, end.month, end.day)
start = dt.datetime(2015, 1, 1)
df = web.DataReader("AAPL", 'yahoo', start, end)
df.to_csv('AAPL.csv')
df.from_csv('AAPL.csv')
df.tail()

df['Adj Close'].plot(legend=True, figsize=(12, 8), title='AAPL', label='Adj Close')
plt.figure(figsize=(12,9))
top = plt.subplot2grid((12,9), (0, 0), rowspan=10, colspan=9)
bottom = plt.subplot2grid((12,9), (10,0), rowspan=2, colspan=9)
top.plot(df.index, df['Adj Close'], color='blue') #df.index gives the dates
bottom.bar(df.index, df['Volume'])

# set the labels
top.axes.get_xaxis().set_visible(False)
top.set_title('AAPL')
top.set_ylabel('Adj Close')
bottom.set_ylabel('Volume')

plt.figure(figsize=(12,9))
sns.distplot(df['Adj Close'].dropna(), bins=50, color='purple')

# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean() #5 days
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days
df2 = pd.DataFrame({'Adj Close': df['Adj Close'],'MA05': df['MA05'],'MA20': df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True, title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
plt.show()
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Examples: Python Pandas for Finance

In [11]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

import pandas.io.data as web
import random

import datetime
import time
import timeit

import io
import os

import re
import codecs
import requests
get_ipython().magic('matplotlib inline')

from scipy import stats

#pd.set_option('display.notebook_repr_html', False)
pd.set_option('display.max_columns', 15)
pd.set_option('display.max_rows', 10)
pd.set_option('precision', 3)

def getDateTimeNow():
    strnow = datetime.datetime.now().strftime("%Y%m%d_%H%M%S")
    return strnow

print('Hello Pandas')
print(getDateTimeNow())
```

```
Hello Pandas
20160323_145708
```

```
sSymbol = "AAPL"
#sSymbol = "GOOG"
#sSymbol = "IBM"
#sSymbol = "MSFT"
#sSymbol = "^TWII"
#sSymbol = "000001.SS"
#sSymbol = "2330.TW"
#sSymbol = "2317.TW"

# sURL = "http://ichart.finance.yahoo.com/table.csv?s=AAPL"
# sBaseURL = "http://ichart.finance.yahoo.com/table.csv?s="
sURL = "http://ichart.finance.yahoo.com/table.csv?s=" + sSymbol
#req = requests.get("http://ichart.finance.yahoo.com/table.csv?s=2330.TW")
#req = requests.get("http://ichart.finance.yahoo.com/table.csv?s=AAPL")
req = requests.get(sURL)

sText = req.text
#print(sText)
#df = web.DataReader(sSymbol, 'yahoo', starttime, endtime)
#df = web.DataReader("2330.TW", 'yahoo')

sPath = "data/"
sPathFilename = sPath + sSymbol + ".csv"
print(sPathFilename)

f = open(sPathFilename, 'w')
f.write(sText)
f.close()
sIOdata = io.StringIO(sText)
df = pd.DataFrame.from_csv(sIOdata)
df.head(5)
```

In [13]:
```
starttime = datetime.datetime(2000, 1, 1)
endtime = datetime.datetime(2015, 12, 31)
sSymbol = "AAPL"
#sSymbol = "GOOG"
#sSymbol = "IBM"
#sSymbol = "MSFT"
#sSymbol = "^TWII"
#sSymbol = "000001.SS"
#sSymbol = "2330.TW"
#sSymbol = "2317.TW"
#"^TWII"
#"AAPL"
#SHA:000016"
#"600000.SS"
#"2330.TW"
df = web.DataReader(sSymbol, 'yahoo', starttime, endtime)
#df_01 = web.DataReader("2330.TW", 'yahoo')
sSymbol = sSymbol.replace(":","_")
sSymbol = sSymbol.replace("^","_")
sPath = "data/financedata/"
#sPath = "/users/imyday/SCDBA/data/"  #Mac OS X
#sPath = "C:\data\"                   #Windows

sPathFilename = sPath + sSymbol + "_Yahoo_Finance.csv"
print(sPathFilename)
df.to_csv(sPathFilename)
df.head(5)
```

```
data/financedata/AAPL_Yahoo_Finance.csv
```

Out[13]:

	Open	High	Low	Close	Volume	Adj Close
Date						
2000-01-03	104.875	112.500	101.688	111.938	133949200	3.702
2000-01-04	108.250	110.625	101.188	102.500	128094400	3.390

df.tail(5)

```
In [14]: df.tail(5)
```

Out[14]:

	Open	High	Low	Close	Volume	Adj Close
Date						
2015-12-24	109.00	109.00	107.95	108.03	13596700	107.447
2015-12-28	107.59	107.69	106.18	106.82	26704200	106.243
2015-12-29	106.96	109.43	106.86	108.74	30931200	108.153
2015-12-30	108.58	108.70	107.18	107.32	25213800	106.741
2015-12-31	107.01	107.03	104.82	105.26	40912300	104.692

```
sSymbol = "AAPL”

# sURL = "http://ichart.finance.yahoo.com/table.csv?s=AAPL"
sURL = "http://ichart.finance.yahoo.com/table.csv?s=" + sSymbol
#req = requests.get("http://ichart.finance.yahoo.com/table.csv?s=AAPL")
req = requests.get(sURL)

sText = req.text
#print(sText)

sPath = "data/"
sPathFilename = sPath + sSymbol + ".csv"
print(sPathFilename)

f = open(sPathFilename, 'w')
f.write(sText)
f.close()
sIOdata = io.StringIO(sText)
df = pd.DataFrame.from_csv(sIOdata)
df.head(5)
```

In [15]:
```
sSymbol = "AAPL"
#sSymbol = "GOOG"
#sSymbol = "IBM"
#sSymbol = "MSFT"
#sSymbol = "^TWII"
#sSymbol = "000001.SS"
#sSymbol = "2330.TW"
#sSymbol = "2317.TW"

# sURL = "http://ichart.finance.yahoo.com/table.csv?s=AAPL"
# sBaseURL = "http://ichart.finance.yahoo.com/table.csv?s="
sURL = "http://ichart.finance.yahoo.com/table.csv?s=" + sSymbol
#req = requests.get("http://ichart.finance.yahoo.com/table.csv?s=2330.TW")
#req = requests.get("http://ichart.finance.yahoo.com/table.csv?s=AAPL")
req = requests.get(sURL)

sText = req.text
#print(sText)
#df = web.DataReader(sSymbol, 'yahoo', starttime, endtime)
#df = web.DataReader("2330.TW", 'yahoo')

sPath = "data/"
sPathFilename = sPath + sSymbol + ".csv"
print(sPathFilename)

f = open(sPathFilename, 'w')
f.write(sText)
f.close()
sIOdata = io.StringIO(sText)
df = pd.DataFrame.from_csv(sIOdata)
df.head(5)
```

```
data/AAPL.csv
```

```
data/AAPL.csv
```

Out[15]:

	Open	High	Low	Close	Volume	Adj Close
Date						
2016-03-22	105.25	107.29	105.21	106.72	32232600	106.72
2016-03-21	105.93	107.65	105.14	105.91	35180800	105.91
2016-03-18	106.34	106.50	105.19	105.92	43402300	105.92
2016-03-17	105.52	106.47	104.96	105.80	34244600	105.80
2016-03-16	104.61	106.31	104.59	105.97	37893800	105.97

```
def getYahooFinanceData(sSymbol, starttime, endtime, sDir):
    #GetMarketFinanceData_From_YahooFinance
    #"^TWII"
    #"000001.SS"
    #"AAPL"
    #SHA:000016"
    #"600000.SS"
    #"2330.TW"
    #sSymbol = "^TWII"
    starttime = datetime.datetime(2000, 1, 1)
    endtime = datetime.datetime(2015, 12, 31)
    sPath = sDir
    #sPath = "data/financedata/"
    df_YahooFinance = web.DataReader(sSymbol, 'yahoo', starttime, endtime)
    #df_01 = web.DataReader("2330.TW", 'yahoo')
    sSymbol = sSymbol.replace(":","_")
    sSymbol = sSymbol.replace("^","_")
    sPathFilename = sPath + sSymbol + "_Yahoo_Finance.csv"
    df_YahooFinance.to_csv(sPathFilename)
    #df_YahooFinance.head(5)
    return sPathFilename
    #End def getYahooFinanceData(sSymbol, starttime, endtime, sDir):
```

In [16]:
```
def getYahooFinanceData(sSymbol, starttime, endtime, sDir):
    #GetMarketFinanceData_From_YahooFinance
    #"^TWII"
    #"000001.SS"
    #"AAPL"
    #SHA:000016"
    #"600000.SS"
    #"2330.TW"
    #sSymbol = "^TWII"
    starttime = datetime.datetime(2000, 1, 1)
    endtime = datetime.datetime(2015, 12, 31)
    sPath = sDir
    #sPath = "data/financedata/"
    df_YahooFinance = web.DataReader(sSymbol, 'yahoo', starttime, endtime)
    #df_01 = web.DataReader("2330.TW", 'yahoo')
    sSymbol = sSymbol.replace(":","_")
    sSymbol = sSymbol.replace("^","_")
    sPathFilename = sPath + sSymbol + "_Yahoo_Finance.csv"
    df_YahooFinance.to_csv(sPathFilename)
    #df_YahooFinance.head(5)
    return sPathFilename
    #End def getYahooFinanceData(sSymbol, starttime, endtime, sDir):
```

```
sSymbol = "AAPL”
starttime = datetime.datetime(2000, 1, 1)
endtime = datetime.datetime(2015, 12, 31)
sDir = "data/financedata/"

sPathFilename = getYahooFinanceData(sSymbol, starttime, endtime,
sDir)
print(sPathFilename)
```

In [17]:
```
sSymbol = "AAPL"
#sSymbol = "GOOG"
#sSymbol = "IBM"
#sSymbol = "MSFT"
#sSymbol = "^TWII"
#sSymbol = "000001.SS"
#sSymbol = "2330.TW"
#sSymbol = "2317.TW"
starttime = datetime.datetime(2000, 1, 1)
endtime = datetime.datetime(2015, 12, 31)
sDir = "data/financedata/"

sPathFilename = getYahooFinanceData(sSymbol, starttime, endtime, sDir)
print(sPathFilename)
```

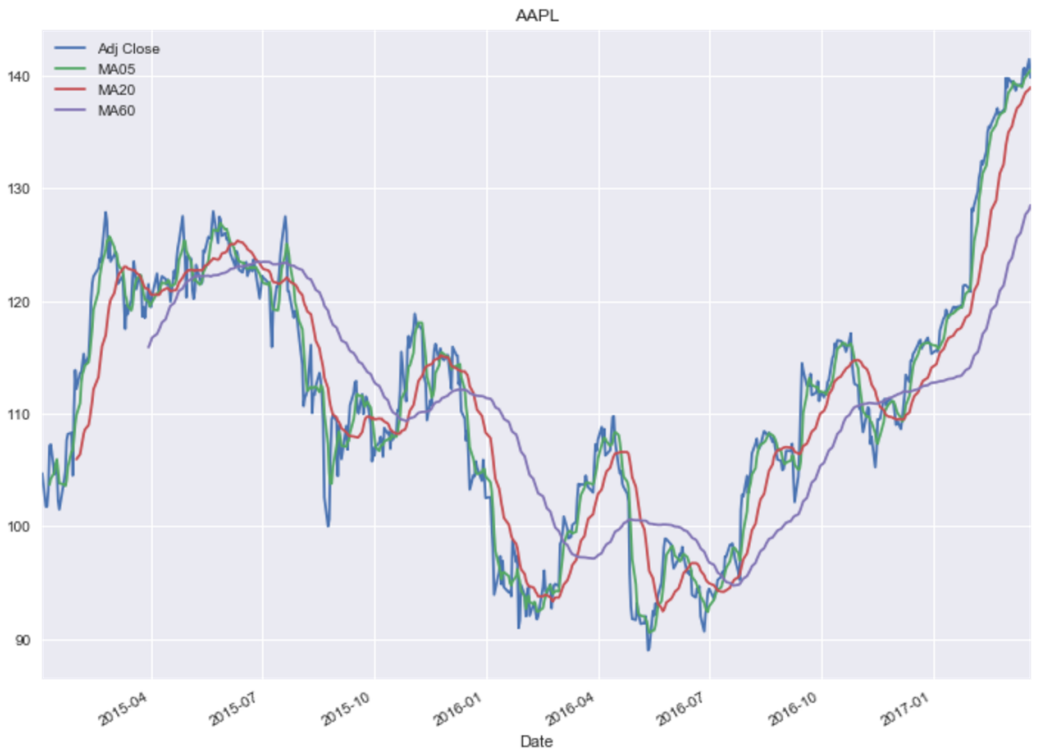
```
data/financedata/AAPL_Yahoo_Finance.csv
```

```
import pandas as pd
import pandas_datareader.data as web
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
%matplotlib inline

#Read Stock Data from Yahoo Finance
end = dt.datetime.now()
#start = dt.datetime(end.year-2, end.month, end.day)
start = dt.datetime(2015, 1, 1)
df = web.DataReader("AAPL", 'yahoo', start, end)
df.to_csv('AAPL.csv')
df.from_csv('AAPL.csv')
df.tail()

df['Adj Close'].plot(legend=True, figsize=(12, 8), title='AAPL', label='Adj Close')
plt.figure(figsize=(12,9))
top = plt.subplot2grid((12,9), (0, 0), rowspan=10, colspan=9)
bottom = plt.subplot2grid((12,9), (10,0), rowspan=2, colspan=9)
top.plot(df.index, df['Adj Close'], color='blue') #df.index gives the dates
bottom.bar(df.index, df['Volume'])

# set the labels
top.axes.get_xaxis().set_visible(False)
top.set_title('AAPL')
top.set_ylabel('Adj Close')
bottom.set_ylabel('Volume')

plt.figure(figsize=(12,9))
sns.distplot(df['Adj Close'].dropna(), bins=50, color='purple')

# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean() #5 days
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days
df2 = pd.DataFrame({'Adj Close': df['Adj Close'],'MA05': df['MA05'],'MA20': df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True, title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
plt.show()
```

Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

Python Pandas for Finance

```
# simple moving averages
df['MA05'] = df['Adj Close'].rolling(5).mean() #5 days
df['MA20'] = df['Adj Close'].rolling(20).mean() #20 days
df['MA60'] = df['Adj Close'].rolling(60).mean() #60 days

df2 = pd.DataFrame({'Adj Close': df['Adj Close'],'MA05': df['MA05'],'MA20': df['MA20'], 'MA60': df['MA60']})
df2.plot(figsize=(12, 9), legend=True, title='AAPL')
df2.to_csv('AAPL_MA.csv')
fig = plt.gcf()
fig.set_size_inches(12, 9)
fig.savefig('AAPL_plot.png', dpi=300)
```



Source: https://mapattack.wordpress.com/2017/02/12/using-python-for-stocks-1/

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