

PYTHON

Md. Jalil Piran, PhD

Asst. Professor

Computer Science and Engineering

Sejong University

Fall, 2019



Python

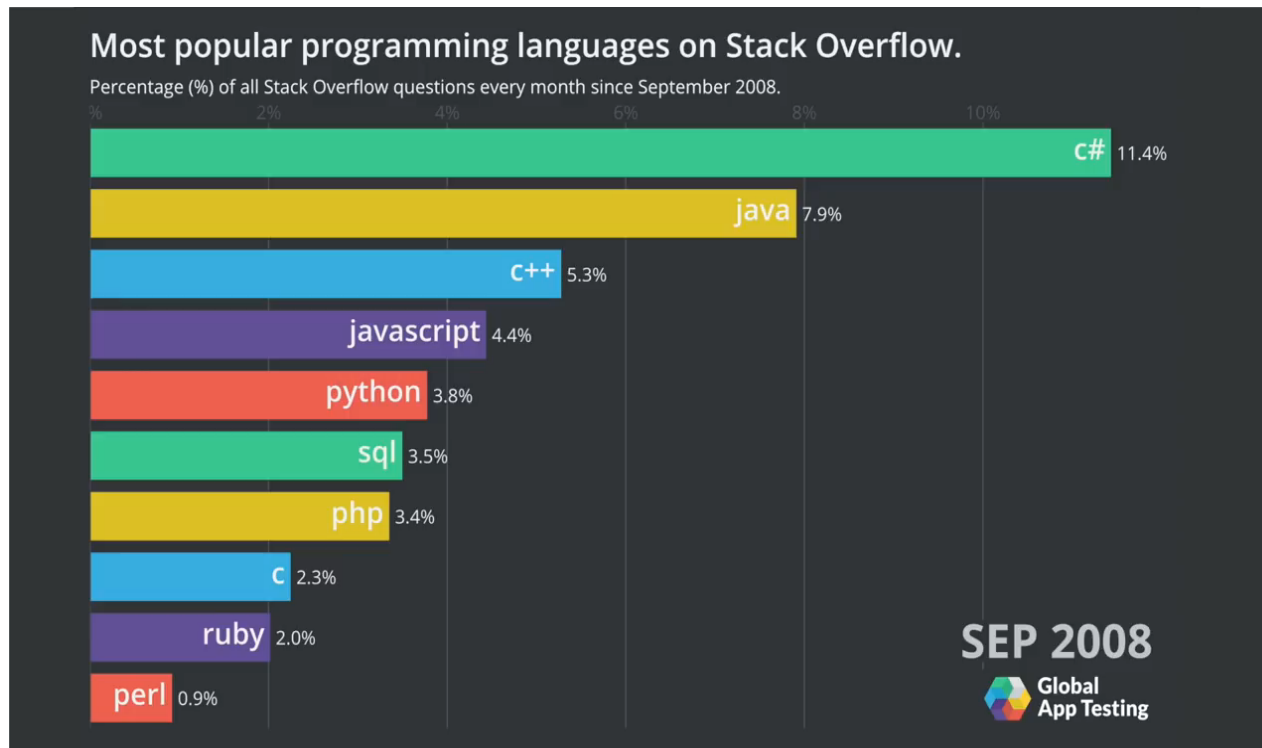


- Python is an **interpreted, high-level, general-purpose** programming language.
- Created by **Guido van Rossum**
- Released in **1991**.

<https://www.python.org/>



Guido van Rossum



<https://www.youtube.com/watch?v=cKzP61Gjf00>

Applications



- Web development (server-side),
- Software development,
- Mathematics,
- Machine learning,
- System scripting.

Advantages



- Simple **syntax**; similar to the English language.
- Runs on an **interpreter** system
- In-built **libraries**
- Moderate **learning curve**
- Easy to **integrate**
- Easy to create **prototypes**
- Free and **open source**
- **Object-oriented** paradigm
- **Portability**
- High **productivity**
- **Platform agnostic** (Windows, Mac, Linux, Raspberry Pi, etc.)

Anaconda Navigator



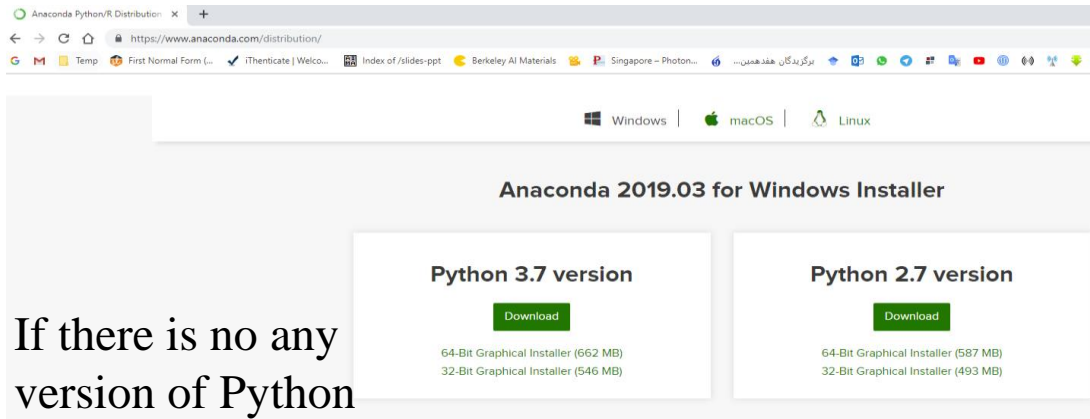
- **Conda** is an open cross-platform language agnostic package management system that is used to install Python packages.
- **Aconda** Navigator is a free and open source Environment of Python and R programming language .
- It is mostly used for data science and machine learning applications.
- It includes some nice tools such as Spyder and Jupyter notebook for Python Coding.



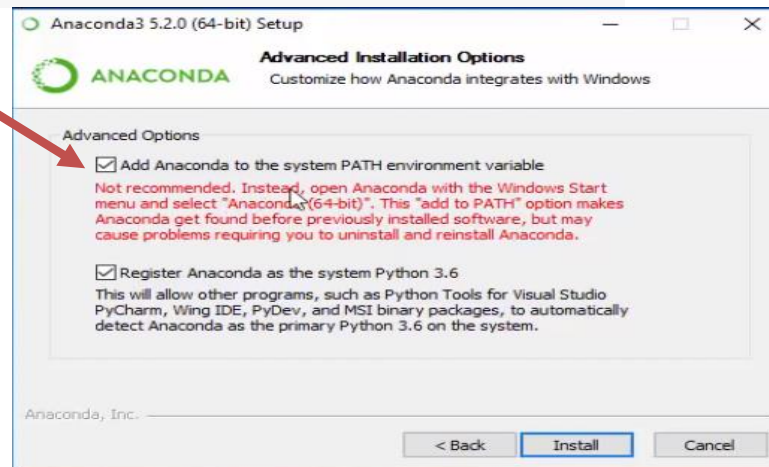
Anaconda Navigator Installation



<https://www.anaconda.com/distribution/>



If there is no any version of Python on your computer check the first option, otherwise uncheck it.





Anaconda Navigator

File Help

ANACONDA NAVIGATOR

Sign in to Anaconda Cloud

Home

Environments

Learning

Community

Documentation

Developer Blog



Applications on base (root)

Channels

Refresh



JupyterLab

0.35.4

An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.

Launch



Notebook

5.7.8

Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

Launch



Qt Console

4.4.3

PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more.

Launch



Spyder

3.3.3

Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features

Launch



Glueviz

0.13.3

Multidimensional data visualization across files. Explore relationships within and among related datasets.

Install



Orange 3

3.19.0

Component based data mining framework. Data visualization and data analysis for novice and expert. Interactive workflows with a large toolbox.

Install



RStudio

1.1.456

A set of integrated tools designed to help you be more productive with R. Includes R essentials and notebooks.

Install



VS Code

1.34.0


Streamlined code editor with support for development operations like debugging, task running and version control.

Install

- Jupyter
- VSCode
- Rstudio
- PyCharm
- Notepad
- Spyder
- Sublime Text
- Vim / Emacs

Jupyter Notebook





Notebook

5.7.8

Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

Launch

 jupyter

Quit

Logout

Files

Running

Clusters

Select items to perform actions on them.

Upload

New



<input type="checkbox"/> 0	/	Name	Last Modified	File size
<input type="checkbox"/>	3D Objects		2 months ago	
<input type="checkbox"/>	Anaconda3		17 minutes ago	
<input type="checkbox"/>	Contacts		2 months ago	
<input type="checkbox"/>	Desktop		2 days ago	
<input type="checkbox"/>	Documents		17 minutes ago	
<input type="checkbox"/>	Downloads		17 minutes ago	
<input type="checkbox"/>	Dropbox		7 months ago	
<input type="checkbox"/>	Favorites		2 months ago	
<input type="checkbox"/>	Links		2 months ago	
<input type="checkbox"/>	Music		2 months ago	
<input type="checkbox"/>	MyApplication		7 months ago	
<input type="checkbox"/>	OneDrive		5 days ago	
<input type="checkbox"/>	op_admin		7 months ago	
<input type="checkbox"/>	op_reports		a year ago	
<input type="checkbox"/>	ovtr		7 months ago	
<input type="checkbox"/>	Pictures		2 months ago	
<input type="checkbox"/>	Saved Games		2 months ago	
<input type="checkbox"/>	Searches		2 months ago	
<input type="checkbox"/>	StudioProjects		6 months ago	
<input type="checkbox"/>	Videos		2 months ago	

In order to start a new project, first select a director from this list

Jupyter Notebook



Quit

Logout

Files Running Clusters

Select items to perform actions on them.

Click on New

Documents			Upload	New	
	Name	Last Modified	File size		
<input type="checkbox"/>	..	seconds ago			
<input type="checkbox"/>	Camtasia Studio	2 months ago			
<input type="checkbox"/>	Custom Office Templates	11 days ago			
<input type="checkbox"/>	KakaoTalk Downloads	a month ago			
<input type="checkbox"/>	MATLAB	2 months ago			
<input type="checkbox"/>	My Data Sources	6 months ago			
<input type="checkbox"/>	Python Scripts	19 minutes ago			
<input type="checkbox"/>	SQL Server Management Studio	a month ago			
<input type="checkbox"/>	Visual Studio 2010	a month ago			
<input type="checkbox"/>	Visual Studio 2015	3 days ago			
<input type="checkbox"/>	Office Hours & Location-About Us.pdf	a month ago	225	kB	



Upload New

Name

Notebook:

Python 3

Other:

Text File

Folder

Terminal

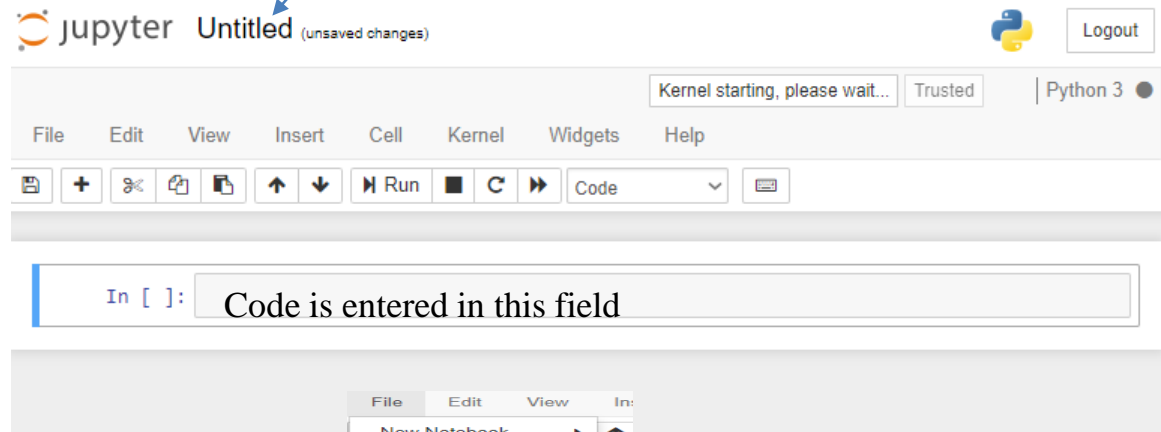
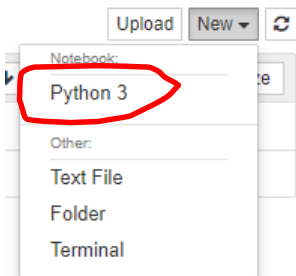
Create a new folder

Documents			Upload	New	
	Name	Last Modified	File size		
<input type="checkbox"/>	..	seconds ago			
<input type="checkbox"/>	Camtasia Studio	2 months ago			
<input type="checkbox"/>	Custom Office Templates	11 days ago			
<input type="checkbox"/>	KakaoTalk Downloads	a month ago			
<input type="checkbox"/>	MATLAB	2 months ago			
<input type="checkbox"/>	My Data Sources	6 months ago			
<input type="checkbox"/>	Python	a minute ago			
<input type="checkbox"/>	Python Scripts	21 minutes ago			
<input type="checkbox"/>	SQL Server Management Studio	a month ago			
<input type="checkbox"/>	Untitled Folder 1	seconds ago			
<input type="checkbox"/>	Visual Studio 2010	a month ago			
<input type="checkbox"/>	Visual Studio 2015	3 days ago			
<input type="checkbox"/>	Office Hours & Location-About Us.pdf	a month ago	225	kB	

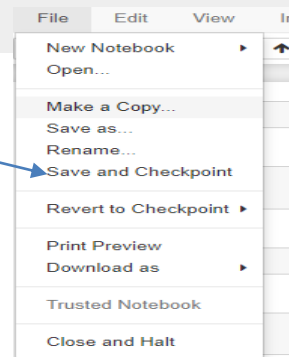
Jupyter Notebook



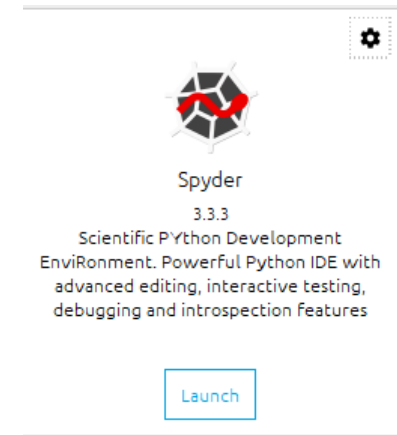
Click here to select a name



Save the code



- **Spyder** is an open source cross-platform integrated development environment (IDE) for scientific programming in the Python language.
- Spyder integrates with a number of prominent packages in the scientific Python stack, including **NumPy**, **SciPy**, **Matplotlib**, **pandas**, **IPython**, **SymPy** and **Cython**, as well as other open source software.



Spyder (Python 3.7)

File Edit Search Source Run Debug Consoles Projects Tools View Help

temp.py* x

```
1 # -*- coding: utf-8 -*-
2 """
3 Spyder Editor
4
5 This is a temporary script file.
6 """
7 |
8
```

Usage

Here you can get help of any object by pressing Ctrl+I in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in *Preferences > Help*.

New to Spyder? Read our [tutorial](#)

Variable explorer File explorer Help

IPython console

Console 1/A x

Python 3.7.3 (default, Mar 27 2019, 17:13:21) [MSC v.1915 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.4.0 -- An enhanced Interactive Python.

In [1]: runfile('C:/Users/Piran/.spyder-py3/temp.py', wdir='C:/Users/Piran/.spyder-py3')

In [2]: runfile('C:/Users/Piran/.spyder-py3/temp.py', wdir='C:/Users/Piran/.spyder-py3')

In [3]:

IPython console History log

Permissions: RW End-of-lines: CRLF Encoding: UTF-8 Line: 7 Column: 1 Memory: 72 %

To Run:
Highlight the code and press
shift+Enter

Python Tools



- **Pandas**: used for data analysis
- **Numpy**: multidimensional arrays
- **TensorFlow**: machine learning
- **Matplotlib, seaborn, Bokeh**: data visualization
- **Keras**: high-level neural network API
- **scikit-learn**: machine learning algorithms
- **SciPy**: algorithms to use with Numpy
- **SQLAlchemy**: Python SQL Toolkit
- **Theano**: Deep Neural Networks
- **SymPy**: Symbolic math
- **AirFlow, Dask, Luigi**: data engineering tool
- **PyBrain**: machine learning algorithms
- **Pattern**: natural language processing

- A **tensor** is a container which can house data in N-dimensions.
- **TensorFlow** is an open-source machine learning library used for research.
- Use TF to describe computations as a **graph**
- TF **schedules** computations on devices - CPU, GPU...
- Performs **automatic differentiation** (like JuMP!)





- **Keras** is a model-level library, providing high-level building blocks for developing deep learning models.
- It is an **open-source neural-network** library written in Python.
- It does not handle low-level operations such as tensor products, convolutions and so on itself. Instead, it relies on a specialized, well optimized tensor manipulation library to do so, serving as the "backend engine" of Keras.
- It is capable of running on top of TensorFlow, Microsoft Cognitive Toolkit, Theano, or PlaidML.
- Keras is designed to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible.

install Keras

```
conda install -c anaconda keras
```

TensorFlow



- Two types:
 - **TensorFlow CPU**; simple to install, slow performance.
 - **TensorFlow GPU**; recommended if a Nvidia graphic card is installed.
- Installation if TensorFlow CPU
 - Open a new *Anaconda/Command Prompt* window
 - Create a new virtual environment with name 'tensorflow_cpu'

conda create -n tensorflow_cpu pip python=3.6

- Activate the newly created virtual environment:

activate tensorflow_cpu

A screenshot of an Anaconda Prompt terminal window. The window title is 'Anaconda Prompt (Anaconda3)'. The terminal shows the command 'conda create -n tensorflow_cpu pip python=3.7' being executed. The output indicates that package metadata is being collected and the environment is being solved. A warning message at the bottom states: 'WARNING: A newer version of conda exists. <== current version: 4.7.10 latest version: 4.7.12'.

```
Anaconda Prompt (Anaconda3)
zstd 1.3.7 h508b16e_0

(base) C:\Users\Piran>conda create -n tensorflow_cpu pip python=3.7
Collecting package metadata (current_repodata.json): done
Solving environment: done

==> WARNING: A newer version of conda exists. <==
current version: 4.7.10
latest version: 4.7.12
```

conda install pip

- Once you have activated your virtual environment, the name of the environment should be displayed within brackets at the beginning of your cmd path specifier, e.g.:

A screenshot of an Anaconda Prompt window. The title bar reads "Anaconda Prompt (Anaconda3)". The command prompt shows the environment name "(tensorflow_cpu)" followed by the path "C:\Users\Piran>".

```
Anaconda Prompt (Anaconda3)
(tensorflow_cpu) C:\Users\Piran>
```

- Then

pip install --ignore-installed --upgrade tensorflow==1.9

- Note)** the Python version must be 3.6.x! You can see your python version using “conda list” command.

- Test your installation by running

`python`

```
>>> import tensorflow as tf
```

```
>>> hello = tf.constant('Hello, TensorFlow!')
```

```
>>> sess = tf.Session()
```

If you see the following, it means successfully done!

2019-02-28 11:59:25.810663: I T:\src\github\tensorflow\tensorflow\core\p

- Test it:

```
>>> print(sess.run(hello))
```

```
b'Hello, TensorFlow!'
```

- Install Keras

`pip install Keras`

Note you no longer need to import Keras, use 'tf.keras' instead

- An **online community** of data scientists and machine learning.
- It allows users to find and publish data sets, explore and build models in a web-based data-science environment, work with other data scientists and machine learning engineers, and enter competitions to solve data science challenges.



