



Deep Learning

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- **Introduction to Deep Learning (DL)**
- **The History of DL**
- **Programming Tools**

PROGRAMMING TOOLS



DL Programming Languages



Python



R Programming



Java



C++



Julia



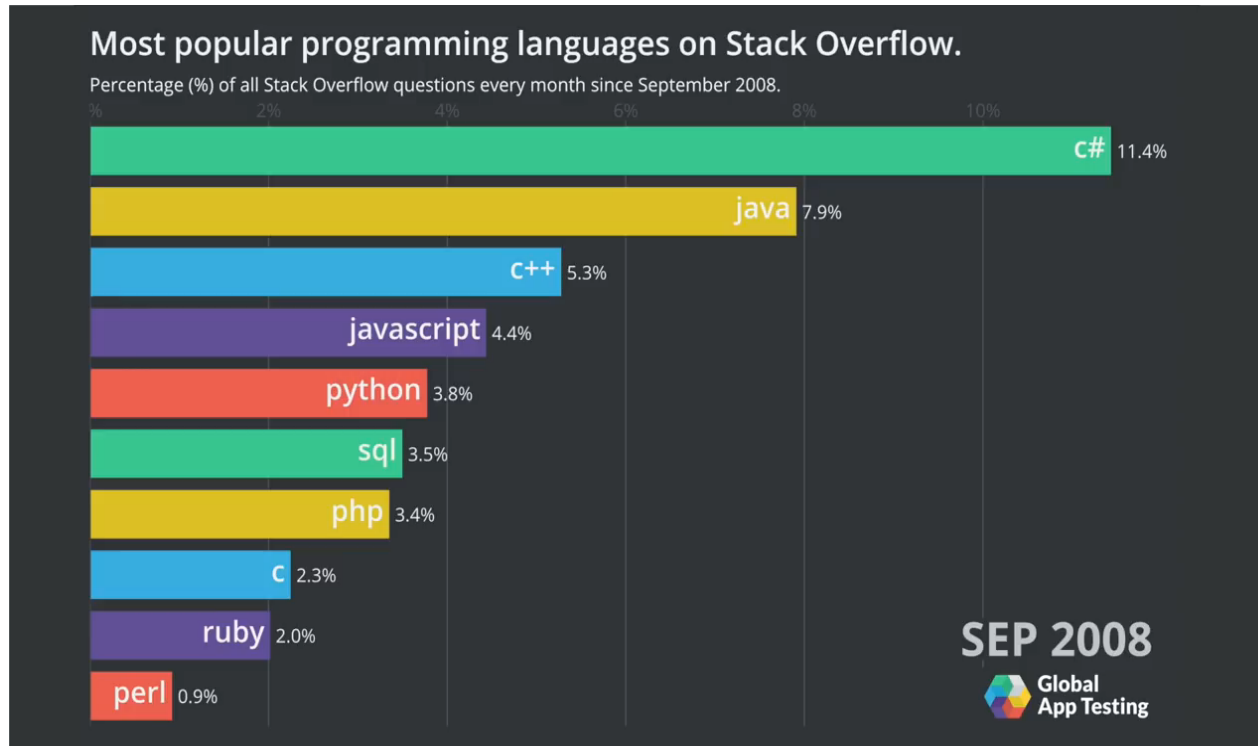
LISP

Python



- An **interpreted, high-level, general-purpose** programming language.
- Released in **1991**.

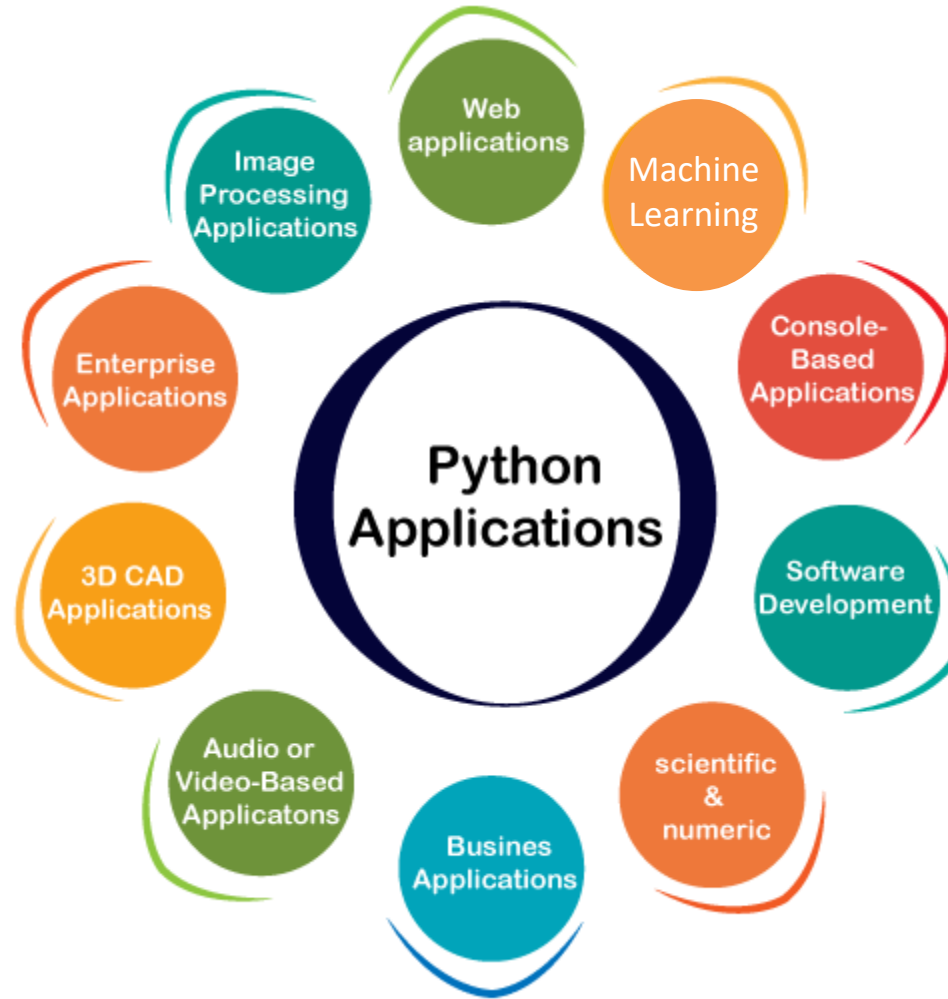
<https://www.python.org/>



Guido van Rossum

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

Python Applications



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.)

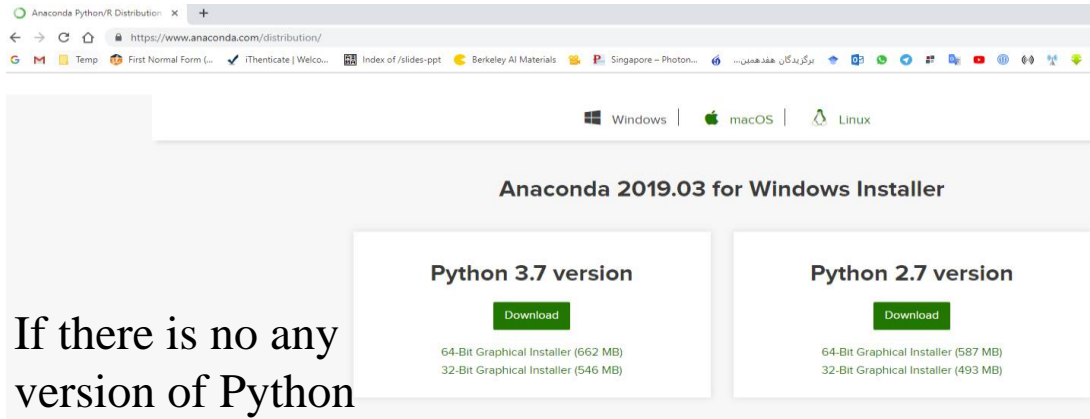
Anaconda Navigator

- **Conda:** an open cross-platform language agnostic package management system
 - Used to install Python packages.
- **Anaconda Navigator:** a free and open source Environment of Python and R programming language .
 - Mostly used for data science and ML applications.
 - Includes Jupyter and Spyder notebook for Python Coding.

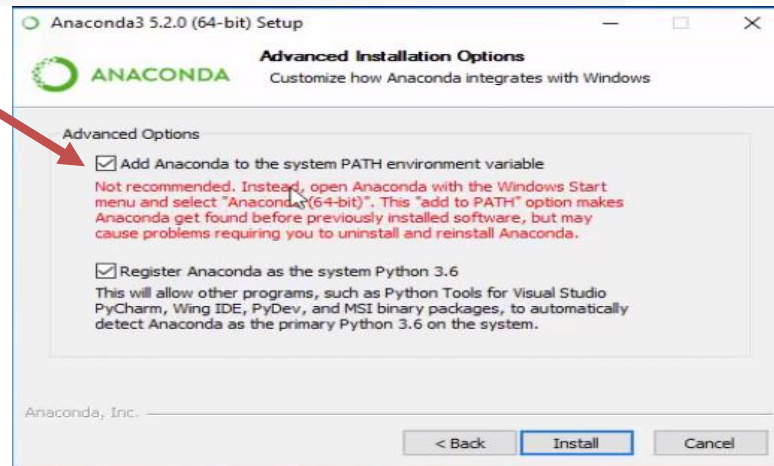


Anaconda Navigator Installation

<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 Installation


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

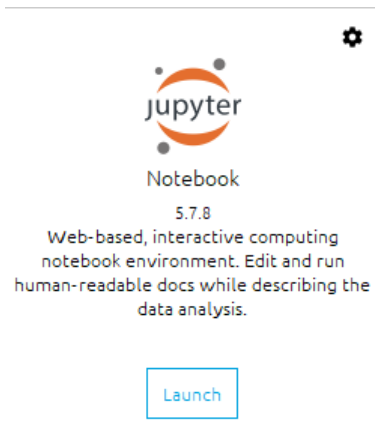
Streamlined code editor with support for development operations like debugging, task running and version control.

Install

IDEs

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

Jupyter Notebook



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



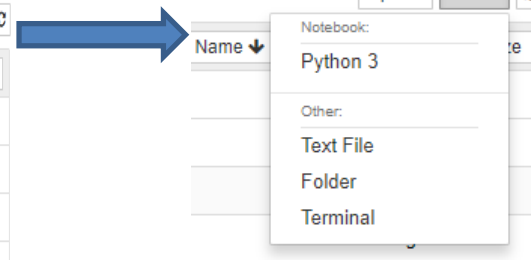
Quit Logout

Files Running Clusters

Select items to perform actions on them.

Click on New

<input type="checkbox"/> 0	/ Documents	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

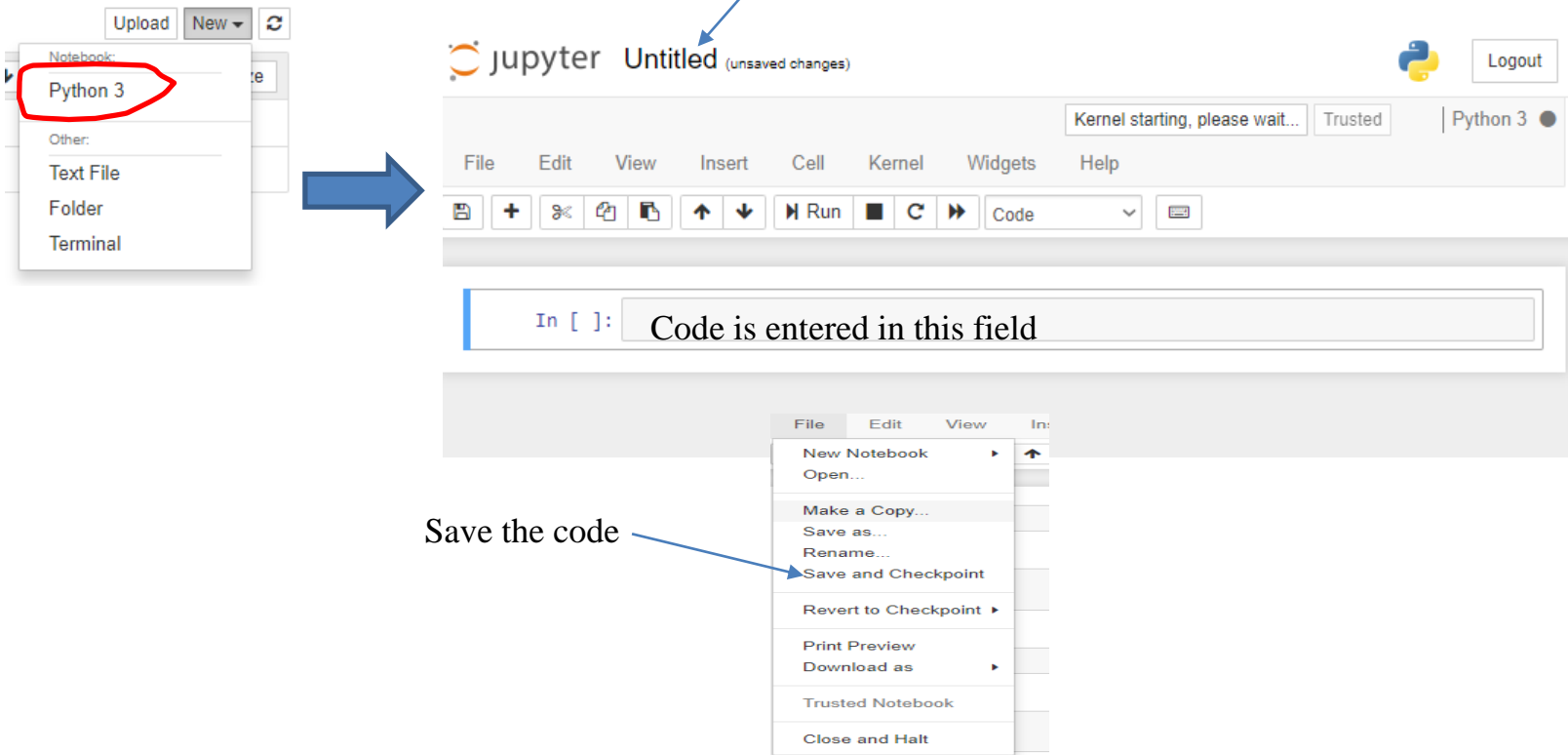


Create a new folder

<input type="checkbox"/> 0	/ Documents	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



The image shows the Jupyter Notebook interface. On the left, a 'New' dropdown menu is open, showing options: 'Notebook:', 'Python 3' (highlighted with a red circle), 'Other:', 'Text File', 'Folder', and 'Terminal'. A blue arrow points from this menu to the main workspace. The main workspace has a header bar with 'jupyter Untitled (unsaved changes)' and a 'Logout' button. Below the header is a menu bar with 'File', 'Edit', 'View', 'Insert', 'Cell', 'Kernel', 'Widgets', and 'Help'. Below the menu bar is a toolbar with icons for file operations and execution. The main area contains a code cell with the prompt 'In []:' and the text 'Code is entered in this field'. A blue arrow points from the text 'Save the code' to the 'File' menu, which is open, showing options like 'New Notebook', 'Open...', 'Make a Copy...', 'Save as...', 'Rename...', 'Save and Checkpoint', 'Revert to Checkpoint', 'Print Preview', 'Download as', 'Trusted Notebook', and 'Close and Halt'.

Upload New

Notebook:

Python 3

Other:

Text File

Folder

Terminal

jupyter Untitled (unsaved changes)

Logout

Kernel starting, please wait... Trusted Python 3

File Edit View Insert Cell Kernel Widgets Help

In []: Code is entered in this field

File Edit View In:

New Notebook

Open...

Make a Copy...

Save as...

Rename...

Save and Checkpoint

Revert to Checkpoint

Print Preview

Download as

Trusted Notebook

Close and Halt

Save the code

Colab Notebooks

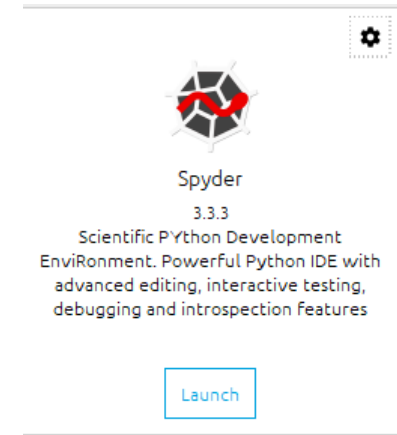
- **Colaboratory**, “Colab”,
- A Google research project
- Created to help disseminate ML education and research.
- It's a Jupyter notebook environment
- Requires no setup to use and runs entirely in the cloud, while providing free access to computing resources including GPUs.
- Free to use.



<https://colab.research.google.com/>

Spyder IDE

- **Spyder**: an open source cross-platform IDE for scientific programming in Python language.
- Spyder integrates with a number of prominent packages in the scientific Python stack, including:
 - **NumPy**,
 - **SciPy**,
 - **Matplotlib**,
 - **Pandas**,
 - **IPython**,
 - **SymPy**



Spyder IDE

Spyder (Python 3.7)

File Edit Search Source Run Debug Consoles Projects Tools View Help

Editor - C:\Users\Piran\.spyder-py3\temp.py

```
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

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

The Libraries



- **Pandas**: used for data analysis
- **Numpy**: multidimensional arrays
- **TensorFlow**: ML approaches
- **Matplotlib**, **seaborn**, **Bokeh**: data visualization
- **Keras**: high-level neural network API
- **scikit-learn**: ML 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**: ML algorithms
- **Pattern**: natural language processing

- **Tensor**: a container for data in N-dimensions.
- **TensorFlow**: an end-to-end open-source platform for ML.
- Use TF to describe computations as a **graph**
- TF **schedules** computations on devices - CPU, GPU...
- Performs **automatic differentiation** (like JuMP!)
- Main focus on training and inference for DL
- Free.





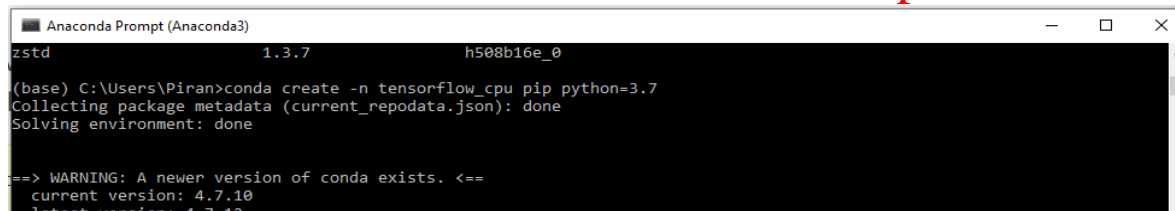
- **Keras:** a model-level library,
- Provides high-level building blocks for developing DL models.
- An open-source neural-network library.
- acts as an interface for the TensorFlow library.
- It is capable of running on top of:
 - TensorFlow,
 - Microsoft Cognitive Toolkit,
 - Theano,
 - PlaidML.

install Keras

`conda install -c anaconda keras`

- 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



```
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

- A subsidiary of **Google LLC**
- An **online community** of data scientists and ML practitioners.
- To find and publish data sets,
- Explore and build models in a web-based data-science environment,
- Work with other data scientists and ML engineers,
- Enter competitions to solve data science challenges.



<https://www.kaggle.com/>

