PyTorch Introduction

Deep learning Frameworks:

- **PyTorch**
  - Facebook
- **TensorFlow**
  - Google Brain
- **MxNet**
  - Apache
- **CNTK**
  - Microsoft
- **Theano**
  - Université de Montréal (MILA/LISA: Montreal Institute for Learning Algorithms)

PyTroch vs TensorFlow

https://pytorch.org/
https://www.tensorflow.org/

- TensorFlow is developed by Google Brain and actively used at Google both for research and production needs.
- Currently, TensorFlow is considered as a to-go tool by many researchers and industry professionals

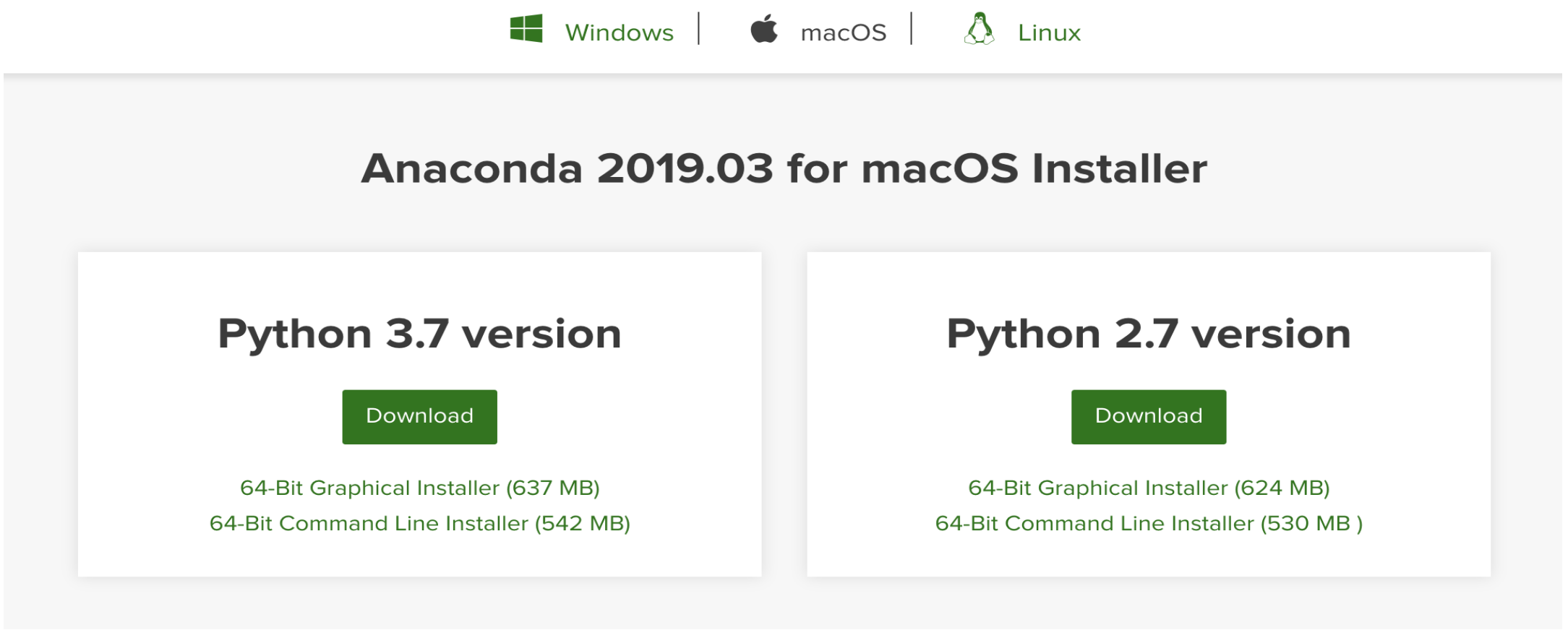
- PyTorch is a cousin of lua-based Torch framework which was developed and used at Facebook.
- PyTorch is relatively new compared to its competitor (and is still in beta), but it is quickly getting its momentum.
- See this post for detailed discussion
- https://towardsdatascience.com/pytorch-vs-tensorflow-spotting-the-difference-25c75777377b

PyTroch vs TensorFlow

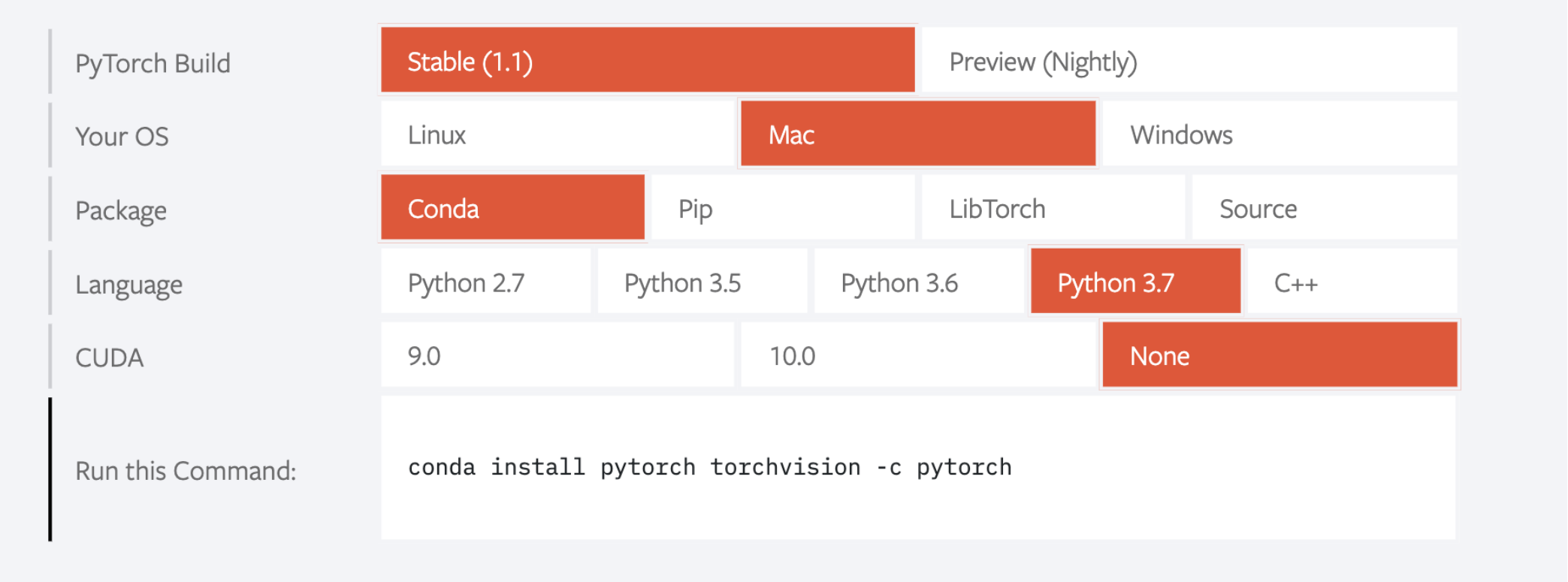
- Both frameworks operate on tensors and view any model as a directed acyclic graph (DAG), however:
- In TensorFlow, one defines a computational graph **statically** before a model can run.
  - **tf.Session** object (All communication with outer world is performed)
  - **tf.Placeholder** (tensors that will be substituted by external data at runtime)
- In PyTorch, one defines a computational graph **dynamically.**
  - changing and executing nodes as you go
  - no special session interfaces or placeholders.
- Debuging in tensorflow at runtime is very limitted, while Debuging in PyTorch at runtime is easy.
- Data Parallelizing in PyTorch is easier than TensorFlow.

PyTorch Installation

- We recommend you install Pytorch through **Anaconda** which is a package manager.
- Go to the https://www.anaconda.com/distribution/
- Select your operating system
- Select Python 3.7



- Once you install Anaconda, you can install Pytorch.
- To do that:
- Go to https://pytorch.org/ and config your installation
- For instance:
  - OS: MAC Package: Conda Language: Python 3.7 CPU version (Cuda: None)



- Please note that if you have NVIDIA GPU in your system, you can select the appropriate CUDA version.
- In this way, you can install the GPU version of the PyTorch.
- Then, if you are on Mac or Linux:
  - Open your terminal
  - If you are on Windows, open Anaconda terminal
- Then type the following command from the config page in the PyTroch webpage (slide 6):

conda install pytorch torchvision -c pytorch

NOTE:

The above command will install PyTorch to your root. We recommend you first create a virtual envorionment and install PyTroch and all the packages there. To create a virtual envorionment:

conda create --name myenv

(myenv is the name you have to select). Then type "y"

This creates the myenv environment in /envs/.

- Once you created a virtual enviornment, then you have to switch to this environemnt by activating it:

conda activate myenv

- Now you can intall pytorch in your created virtual enviornment.
- Once you are done you can deactivate your virtual enviornment by the following command:

conda deactivate

NOTE:

Please make sure that you have installed all the computation packages like Numpy before installing the PyTorch

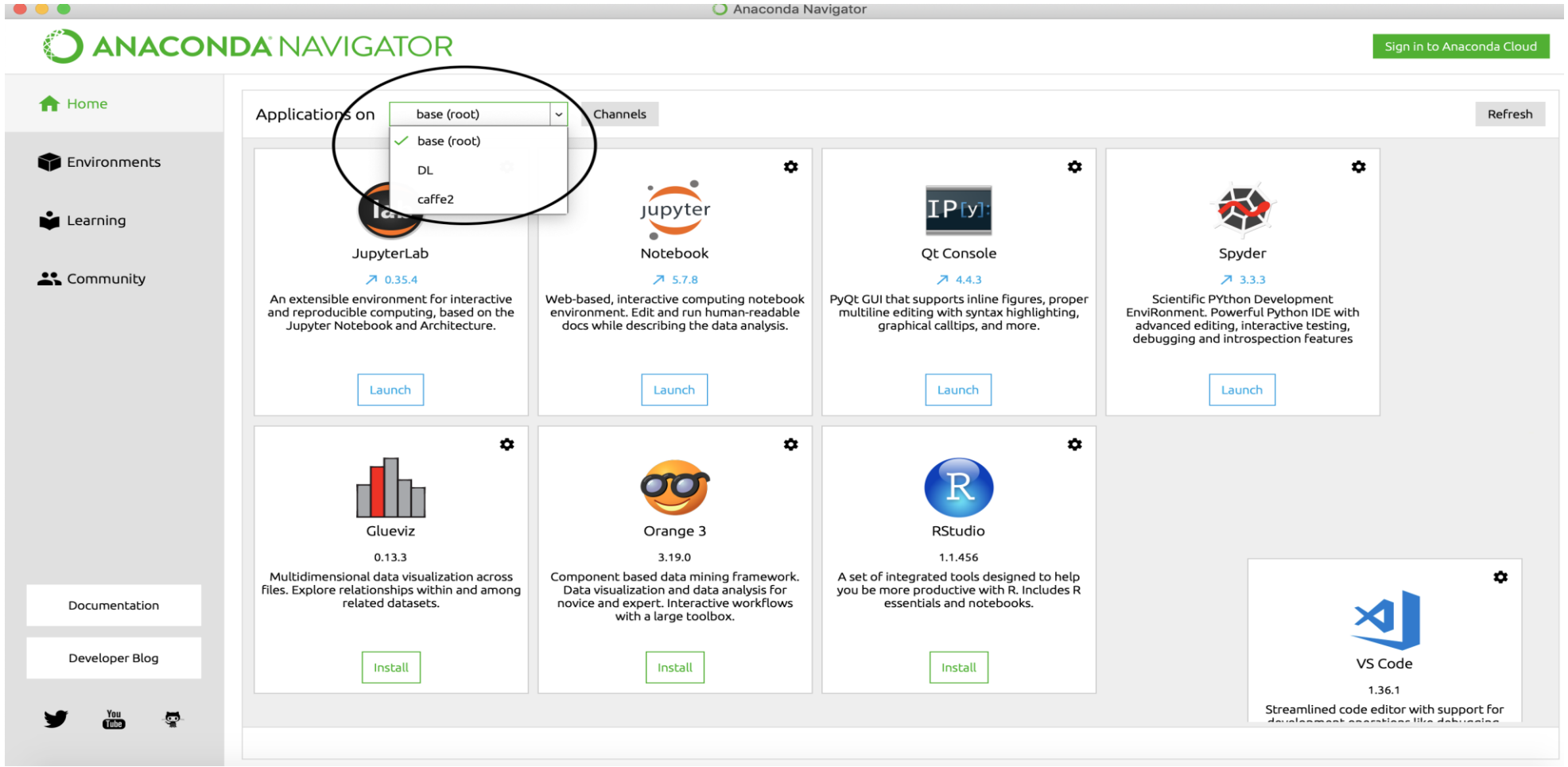
- To install a pckage in your virtual environment, please activate the virtual enviornment first and then install the package by:

conda install -n myenv [package_name]

- If you do not mention "–n myenv", the package will be installed to the root Python installation.
- Please see the following for more details
  - https://docs.conda.io/projects/conda/en/latest/user-guide/tasks/manage-environments.html
  - https://uoa-eresearch.github.io/eresearch-cookbook/recipe/2014/11/20/conda/

Starting PyTorch:

- Assuming you have successfully installed PyTorch, open your anconda navigator (from Start menu in windows or Application in Mac).
- Then choose the created enviornment from the top menu:

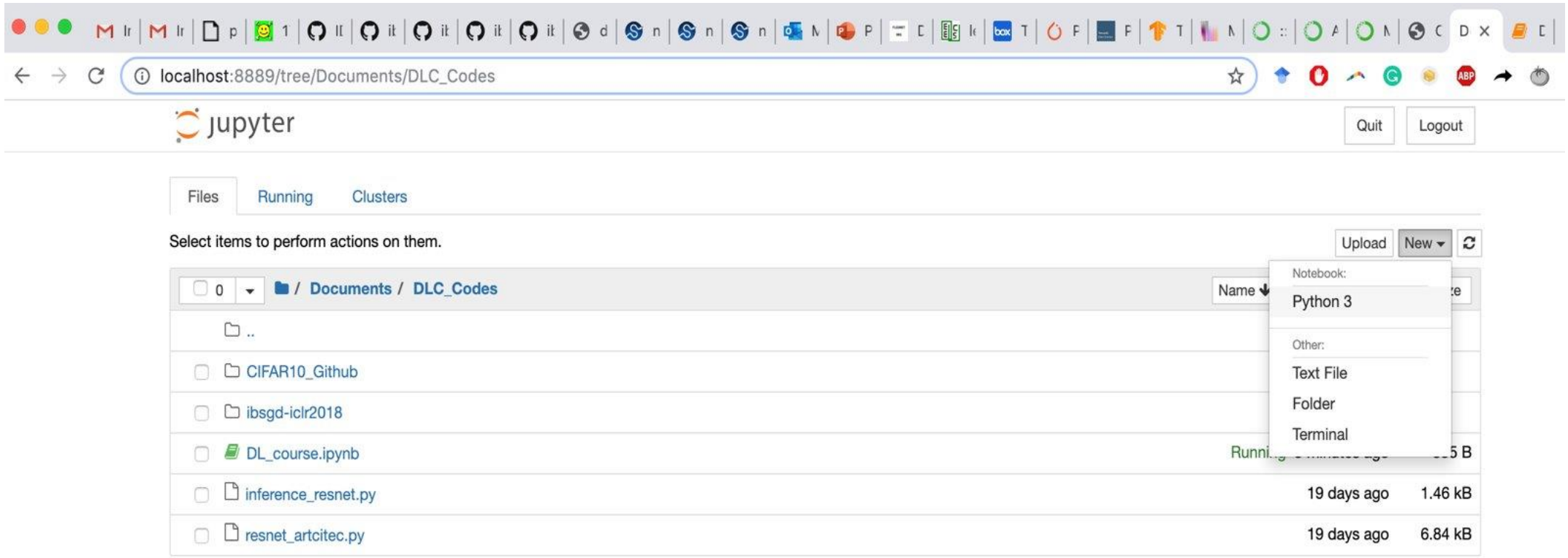


Starting PyTorch:

- Now, please select your desired IDE to start coding.
- Here we use Jupyter note book as an interactive IDE for writng Python codes and run them immidiately.
- If this is your first time you are satrting Jupyter, selet install, and after that launch it.
- This will open a Jupyter note book in your default browser.

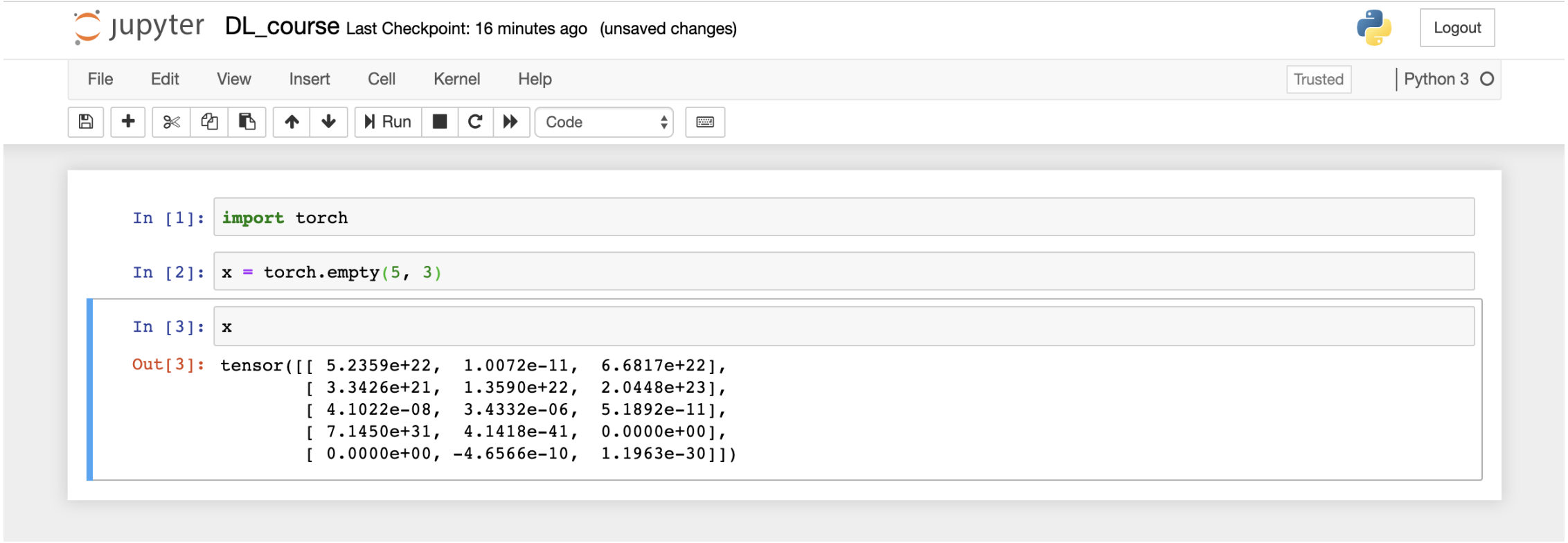
Starting PyTorch:

- Navigate to your desired folder and select a Python 3 file in that location.
- After that, double click on it to open the Python file.



Now you are ready to write your codes

- For example , the following shows how to Construct an uninitialized 5x3 matrix
- First, we have to import Torch



- Compuatation in PyTorch is like Numpy.
- You can refresh your Numpy skill through the following website:
- http://cs231n.github.io/python-numpy-tutorial/
- For learning more about the Jupyter note book:
- http://cs231n.github.io/ipython-tutorial/
- Here we show how to construct a random matrix and manipulate it

Construct a 5×3 matrix

```
In [5]: x = torch.rand(5, 3)

In [6]: x
Out[6]: tensor([[0.3244, 0.9274, 0.2472],
                [0.1480, 0.5345, 0.5600],
                [0.7934, 0.9753, 0.7837],
                [0.8286, 0.5041, 0.6952],
                [0.2620, 0.3697, 0.8282]])
```

The size of a tensor

```
In [8]: x.size()
Out[8]: torch.Size([5, 3])
```

Adding to Tensor

```
In [11]: y = torch.ones(5,3)
         a = x + y
         a
Out[11]: tensor([[1.3244, 1.9274, 1.2472],
                 [1.1480, 1.5345, 1.5600],
                 [1.7934, 1.9753, 1.7837],
                 [1.8286, 1.5041, 1.6952],
                 [1.2620, 1.3697, 1.8282]])
```

- We highly recommend you to go to the following tutorial, and read it:

DEEP LEARNING WITH PYTORCH: A 60 MINUTE BLITZ