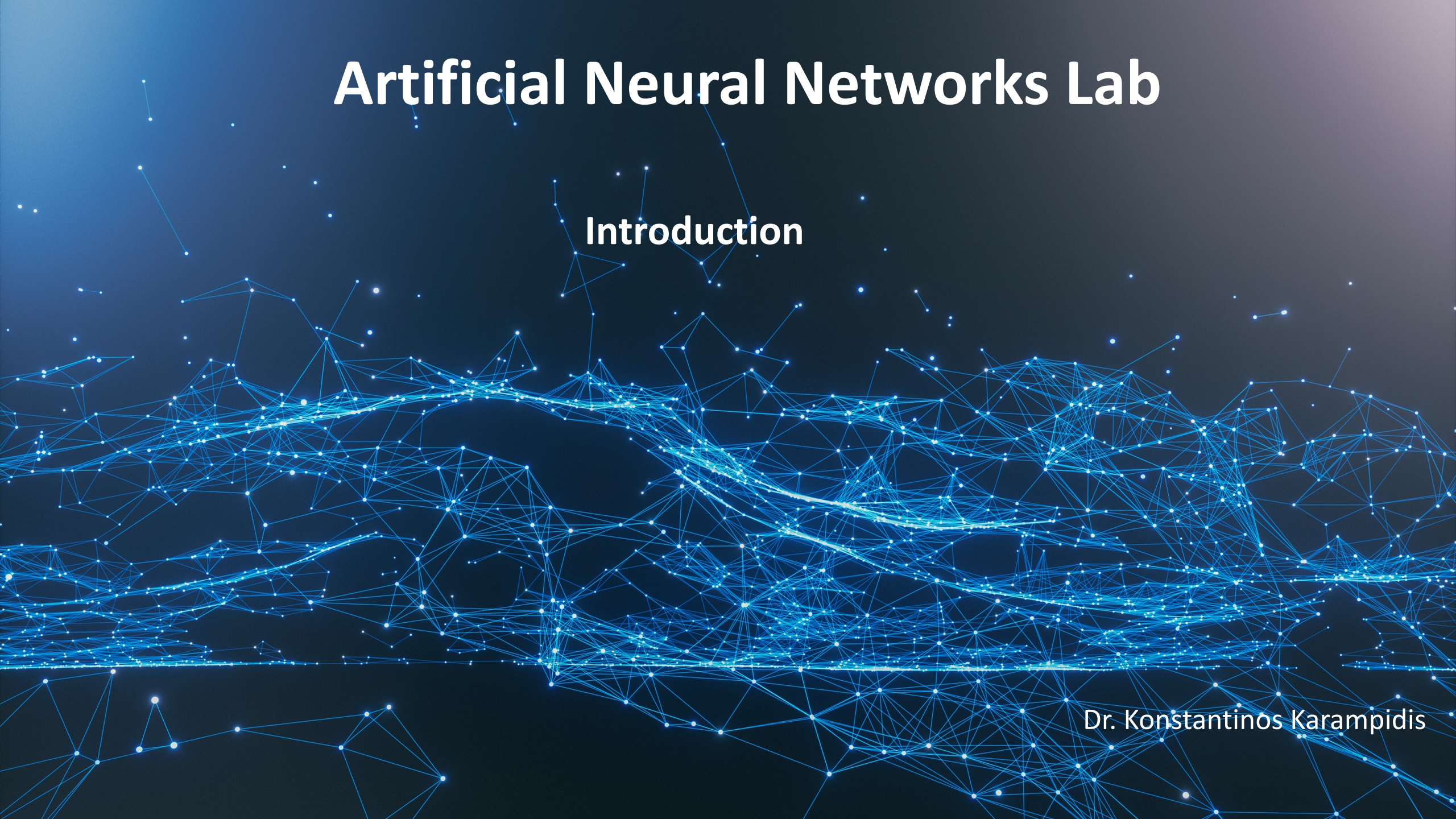
Artificial Neural Networks Lab

Introduction



Dr. Konstantinos Karampidis

Grades

Through exercises and a final project.

- 20% Exercises
- 80% Final Project

- ✓ Attendance is mandatory. Only one absence is allowed.
- ✓ No extension is given on delivery dates of the exercises!!!
- ✓ Implementation with Jupyter Notebooks.
- ✓ The exercises will be delivered strictly through eclass!!! The exercises sent to my email will be rejected.
- ✓ The exercises and the final project are mandatory!!! If you don't submit both exercises (each graded at least with 1) and the final project, the lab is considered failed.
- ✓ Those who copy -or extensively use AI- an exercise or the final project, they fail the lab immediately.
- ✓ Individual submissions only!!!
- ✓ For any subject concerning the lab, you may contact me through email: **karampidis@hmu.gr**

Anaconda

Anaconda is a Python distribution. A Python distribution provides the Python interpreter, together with a set of Python packages and sometimes other related tools, such as editors.

Why Anaconda ?

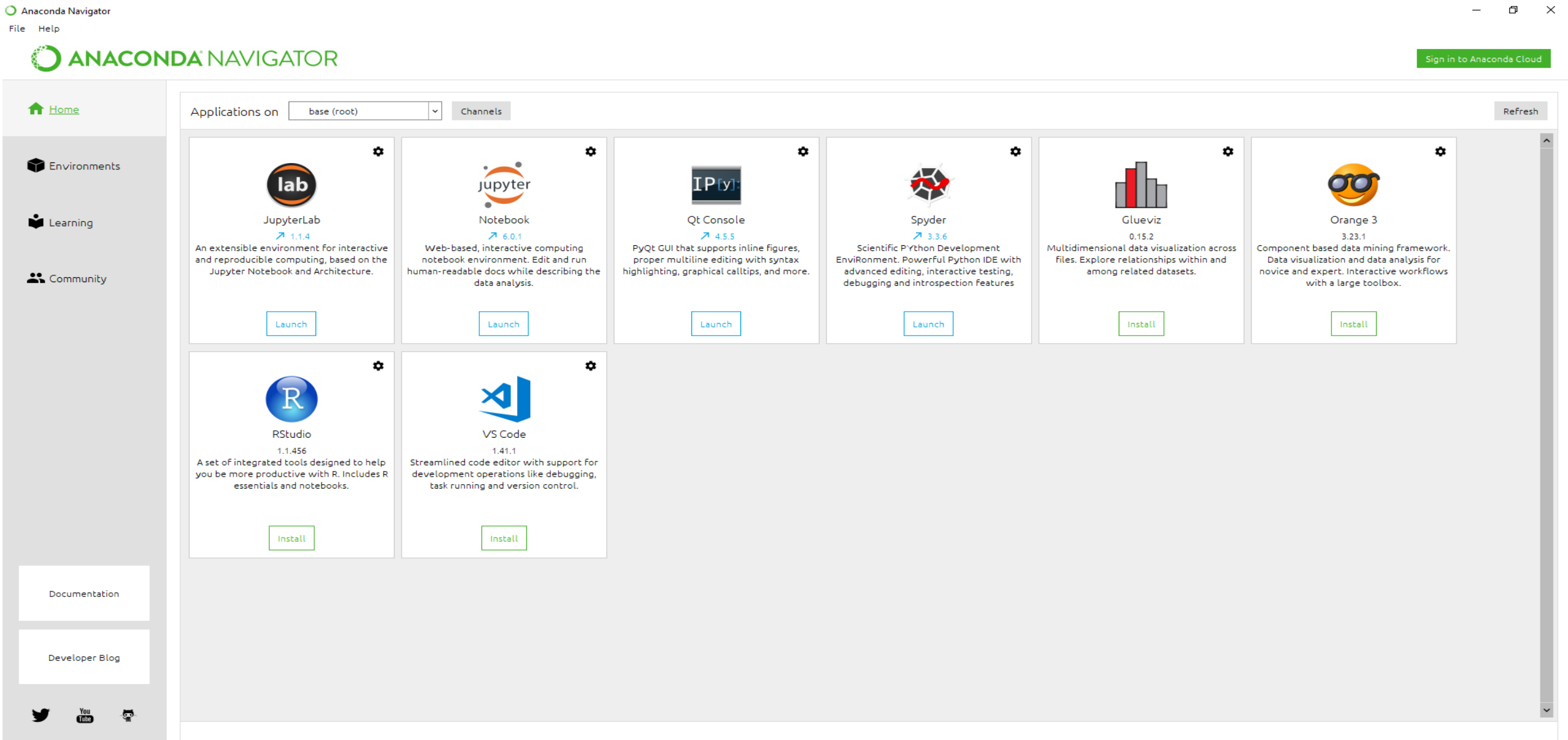
- The open-source Anaconda Distribution is the easiest way to perform Python/R data science and machine learning on Linux, Windows, and Mac OS X. With over 19 million users worldwide, it is the industry standard for developing, testing, and training on a single machine, enabling *individual data scientists* to:
- Quickly download 7,500+ Python/R data science packages
- Manage libraries, dependencies, and environments with Conda
- Develop and train machine learning and deep learning models with scikit-learn, TensorFlow, and Theano
- Analyze data with scalability and performance with Dask, NumPy, pandas, and Numba
- Visualize results with Matplotlib, Bokeh, Datashader, and Holoviews

Anaconda Installation

- Visit https://www.anaconda.com/distribution/ and download the installer that corresponds to the operating system you are using
- Make sure you choose latest Python version & 64-bit Graphical Installer

Anaconda

After installing and executing the program you will see this:



Anaconda Installation

Depending on your operating system you can find a detailed installation guide below

Windows

Linux

macOS

Anaconda Environments

Navigator uses conda to create separate environments containing files, packages, and their dependencies that will not interact with other environments.

Create a new environment named snowflakes and install a package in it:

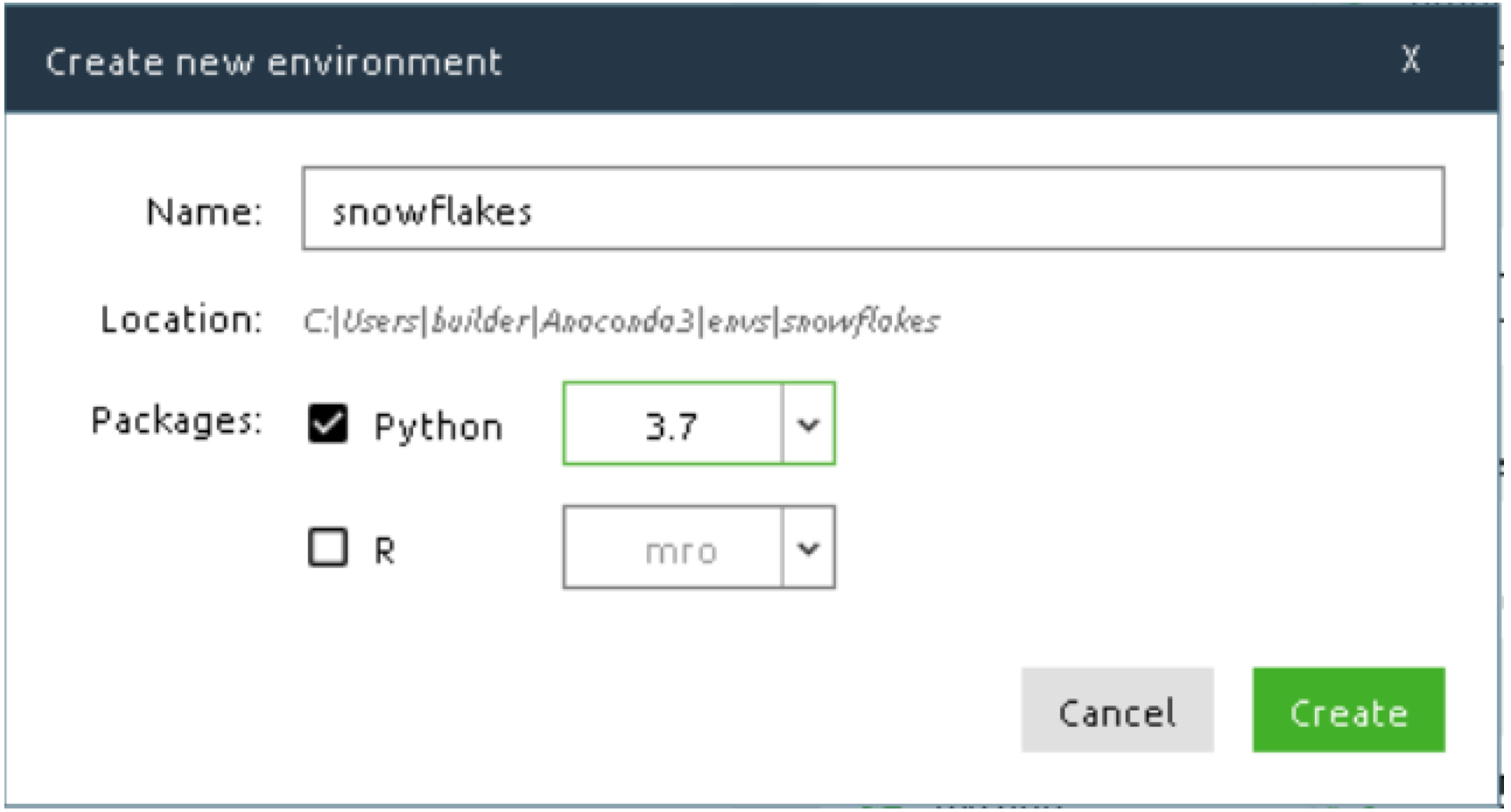
In Navigator, click the Environments tab, then click the Create button. The Create new environment dialog box appears.

In the Environment name field, type a descriptive name for your environment.

Note that in this step you will choose the Python version you want to use. Therefore, you can have environments with different versions of Python according to your needs.

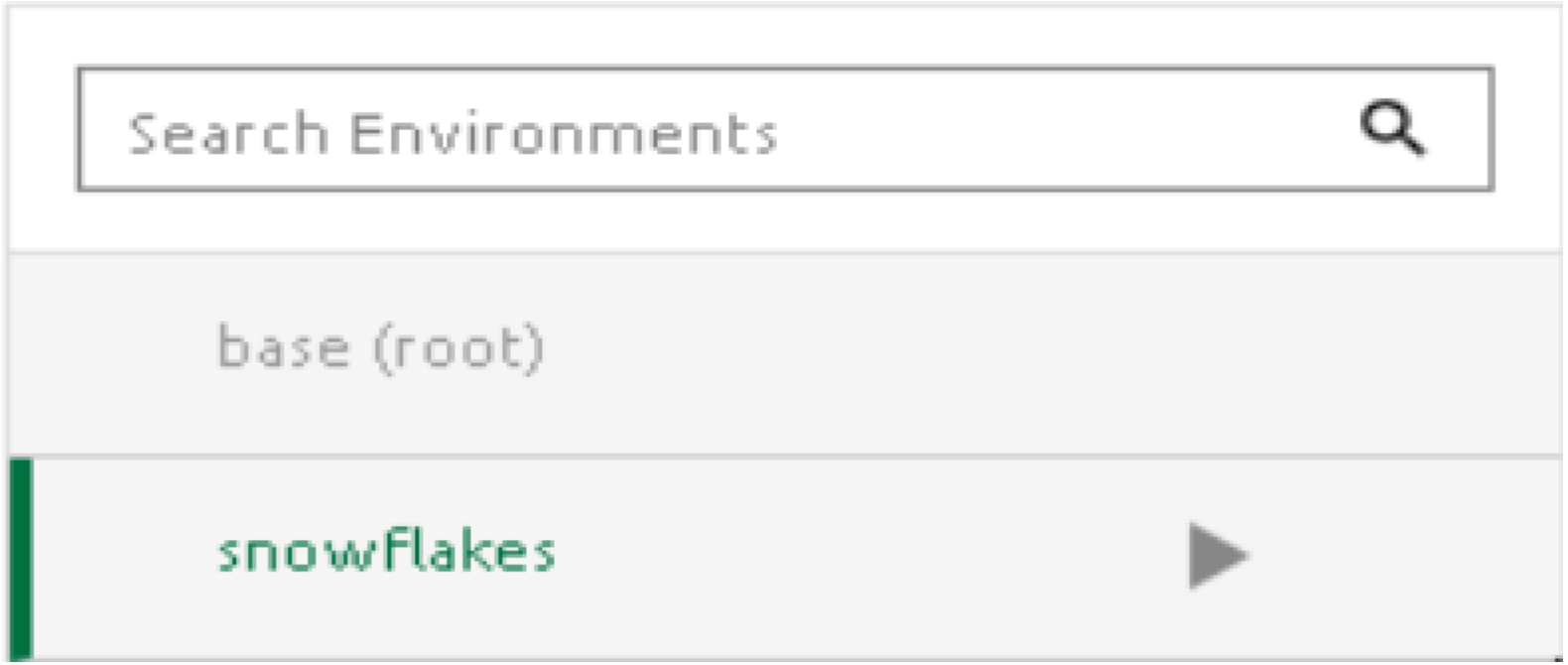
Also, you can choose to install R instead of Python.

Anaconda Environments



Anaconda Environments

Click Create. Navigator creates the new environment and activates it.



Now you have two environments, the default environment base (root), and snowflakes.

Switch between them (activate and deactivate environments) by clicking the name of the environment you want to use.

Return to the other environment by clicking its name.

Anaconda Environments

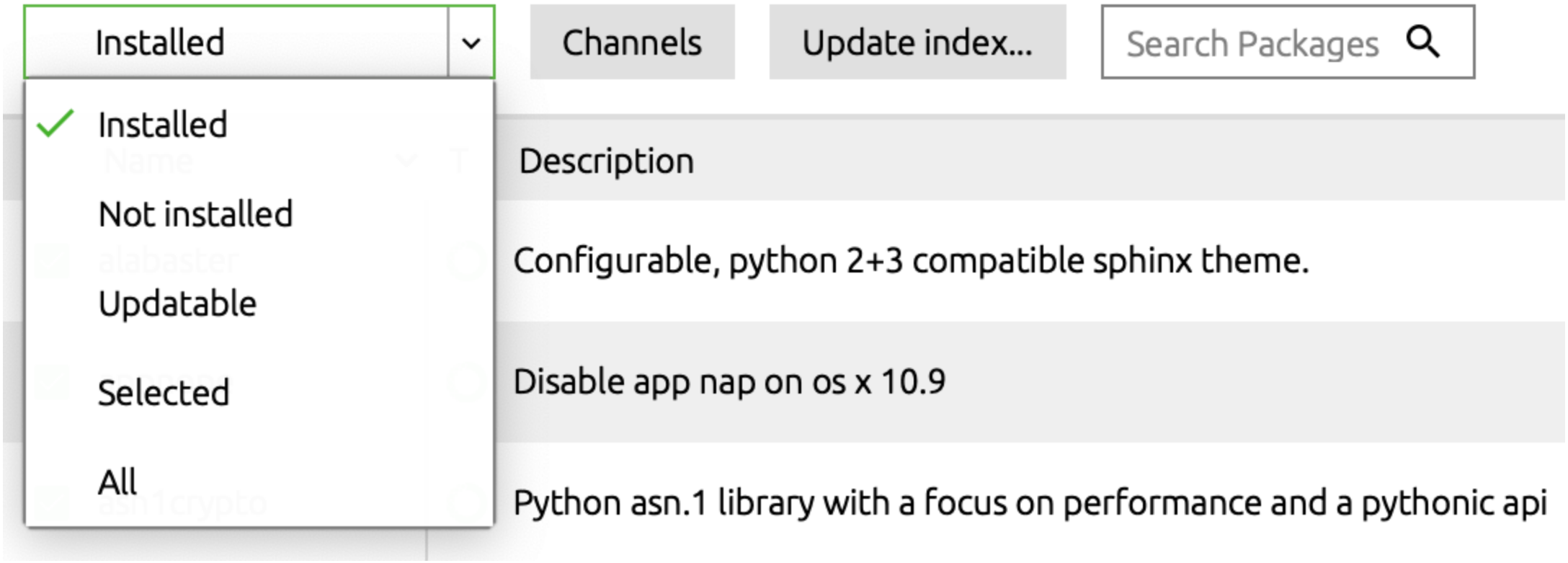
Managing packages

In this section, you check which packages you have installed, check which are available, and look for a specific package and install it.

To find a package you have already installed, click the name of the environment you want to search. The installed packages are displayed in the right panel.

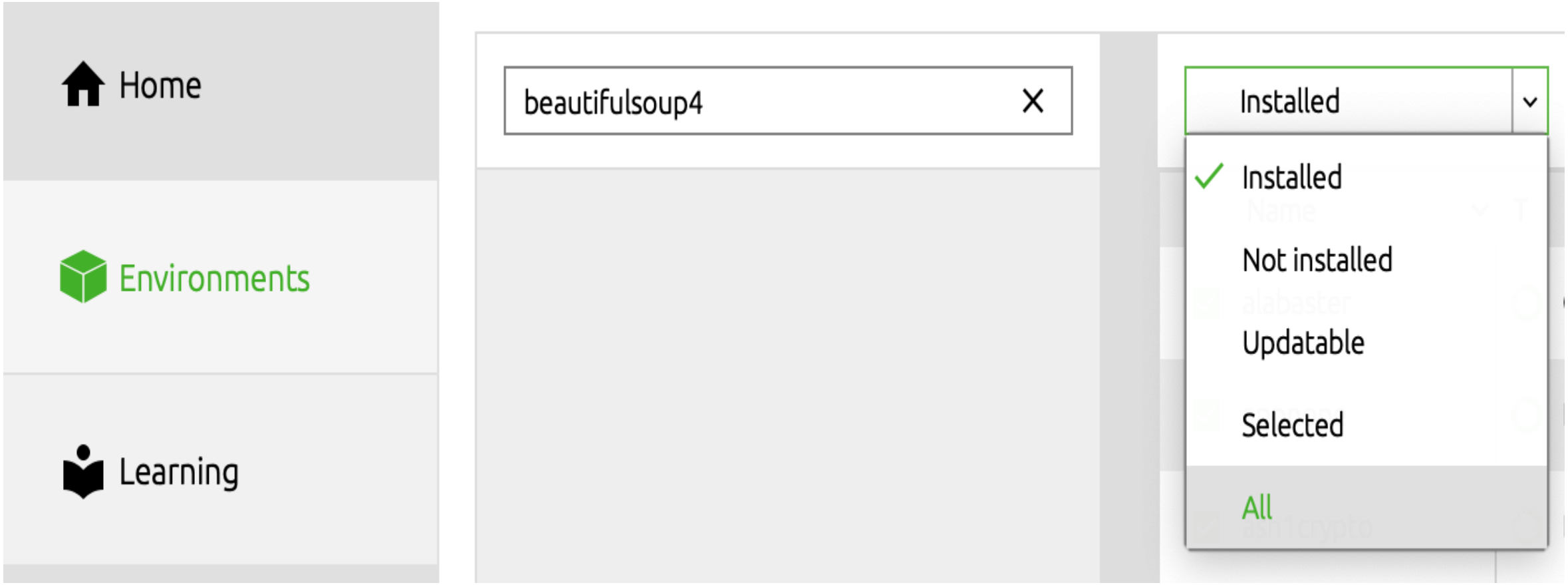
You can change the selection of packages displayed in the right panel at any time by clicking the drop-down box above it and selecting Installed, Not Installed, Updatable, Selected, or All.

Anaconda Enviroments



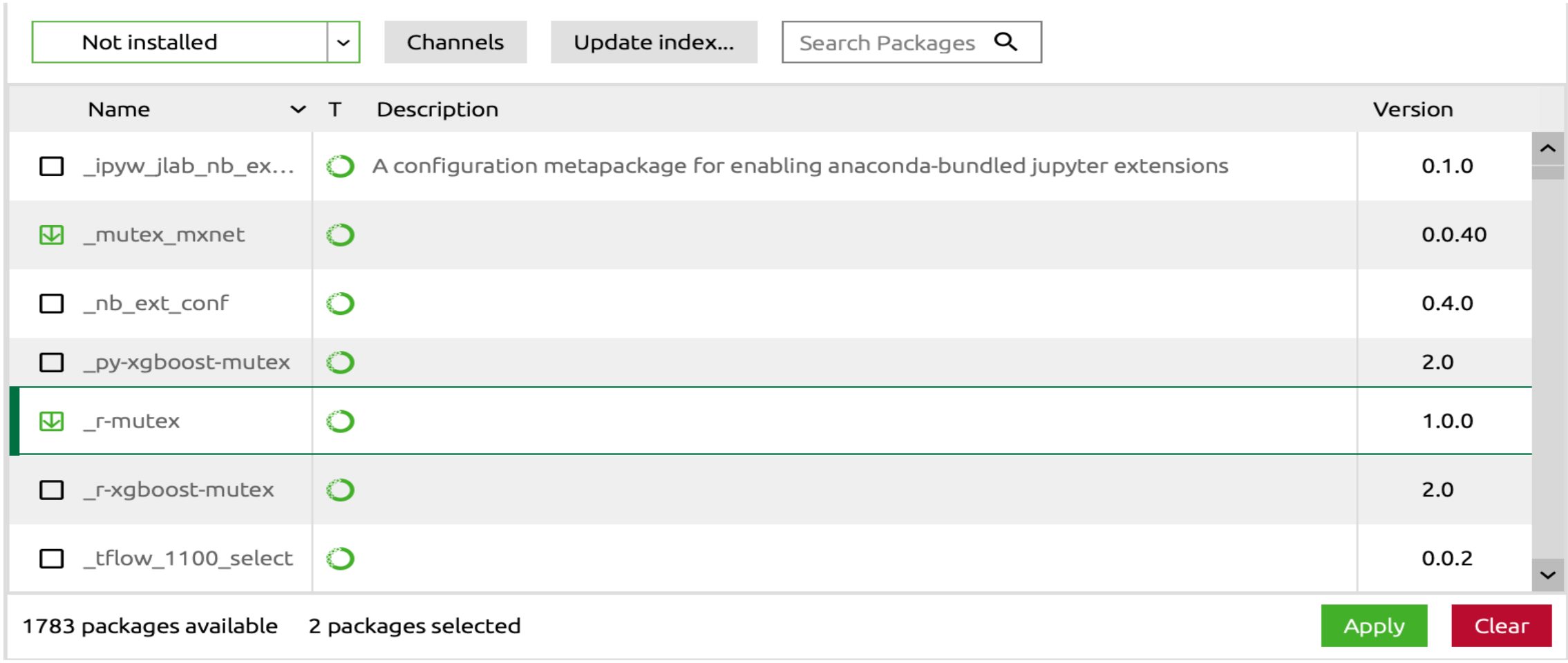
Anaconda Environments

Check to see if a package you have not installed named “beautifulsoup4” is available from the Anaconda repository (must be connected to the Internet). On the Environments tab, in the Search Packages box, type beautifulsoup4, and from the Search Subset box select All or Not Installed.



Anaconda Environments

To install the package into the current environment, check the checkbox next to the package name, then click the bottom Apply button.



Jupyter Notebook

The Jupyter Notebook is an interactive programming environment , in which you can combine Python code and execution results with annotations, equations, figures, links, etc.

The Jupyter Notebook will run in the internet browser of our computer and does not require internet access, it will access to our local files via the browser interface.

Notebooks are similar to Word documents and we can edit them interactively in the internet browser. Notebooks are saved in its own format with the ‘. ipynb extension, but can be also downloaded as PDFs, HTML pages or Python code.

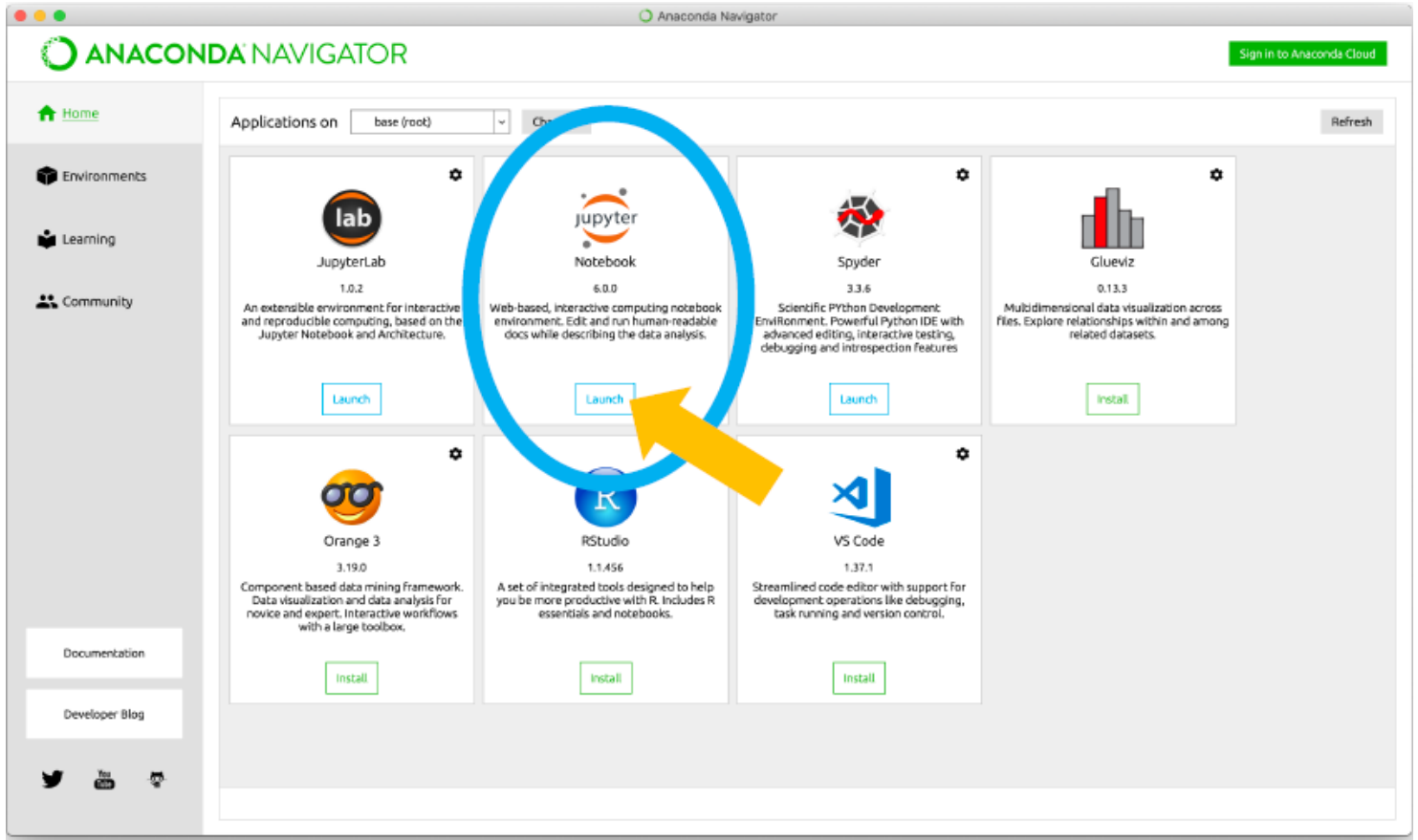
Jupyter Notebook

There are 3 ways to launch Jupyter Notebook:

1) Using Anaconda Navigator

   a) Open the application called Anaconda Navigator

   b) Click on “Launch” in the Jupyter Notebook box



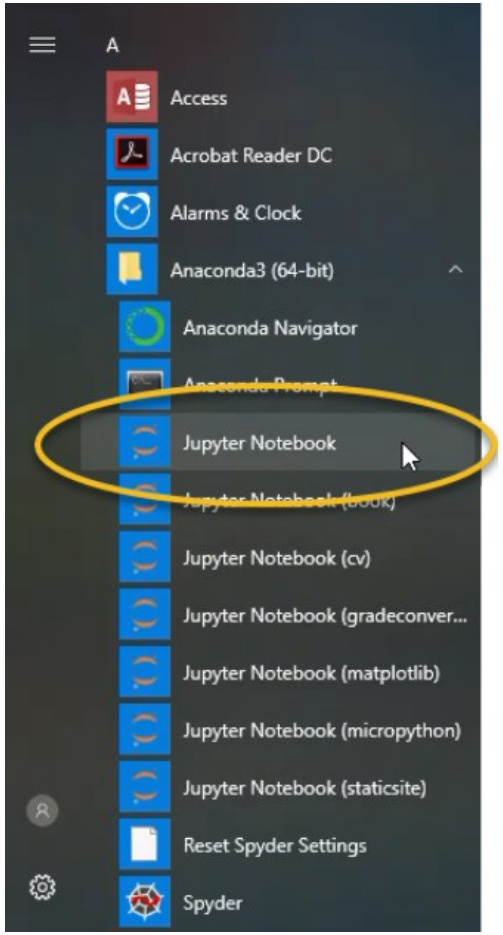
Jupyter Notebook

2) Using Anaconda Prompt

   a) Open the application called Anaconda Prompt

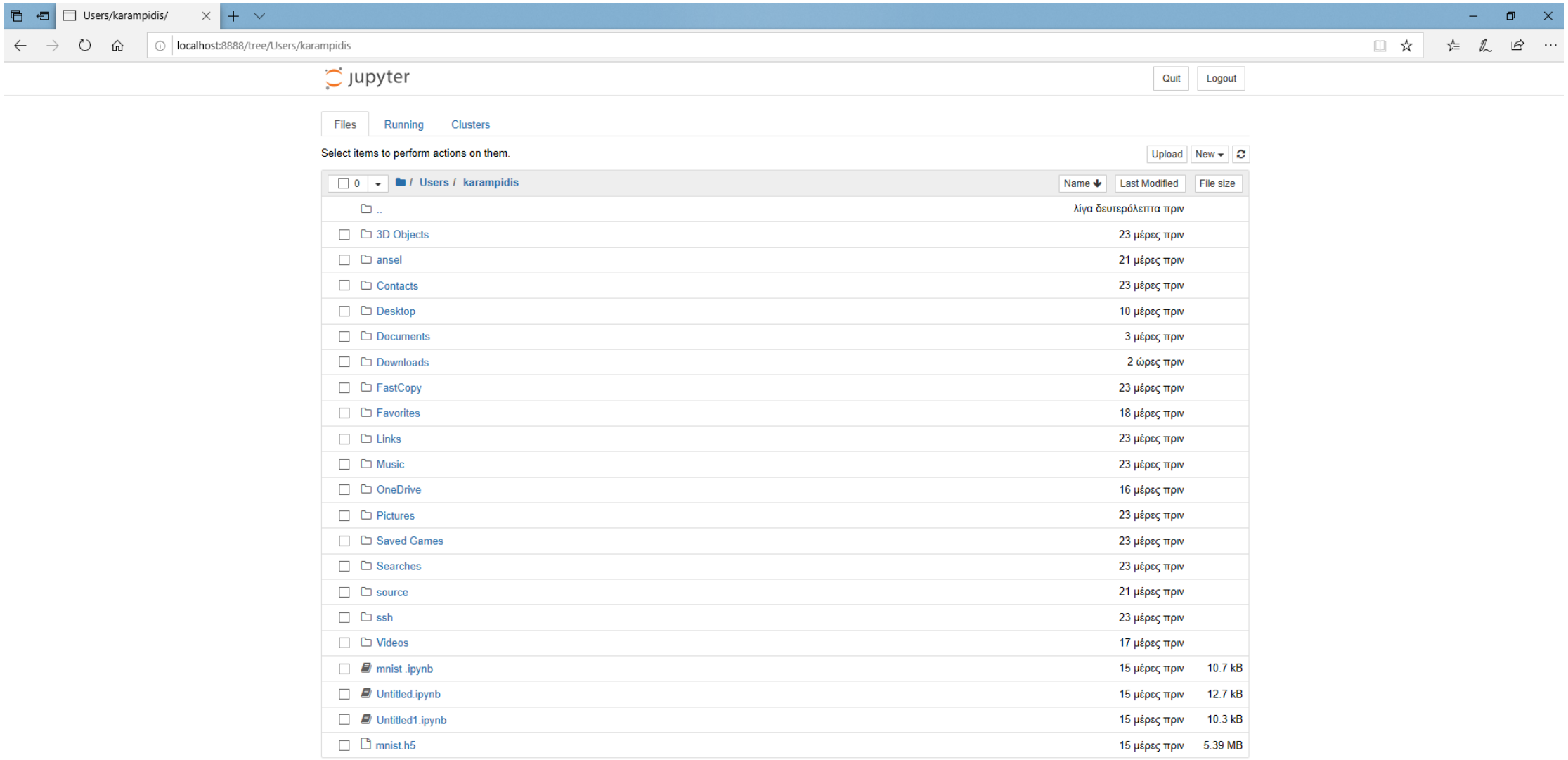
   b) Type “jupyter notebook” (without quotes) and hit the return key

3) Clicking on the Jupyter Notebook App in the Start Menu



Jupyter Notebook

You must see a page similar to this



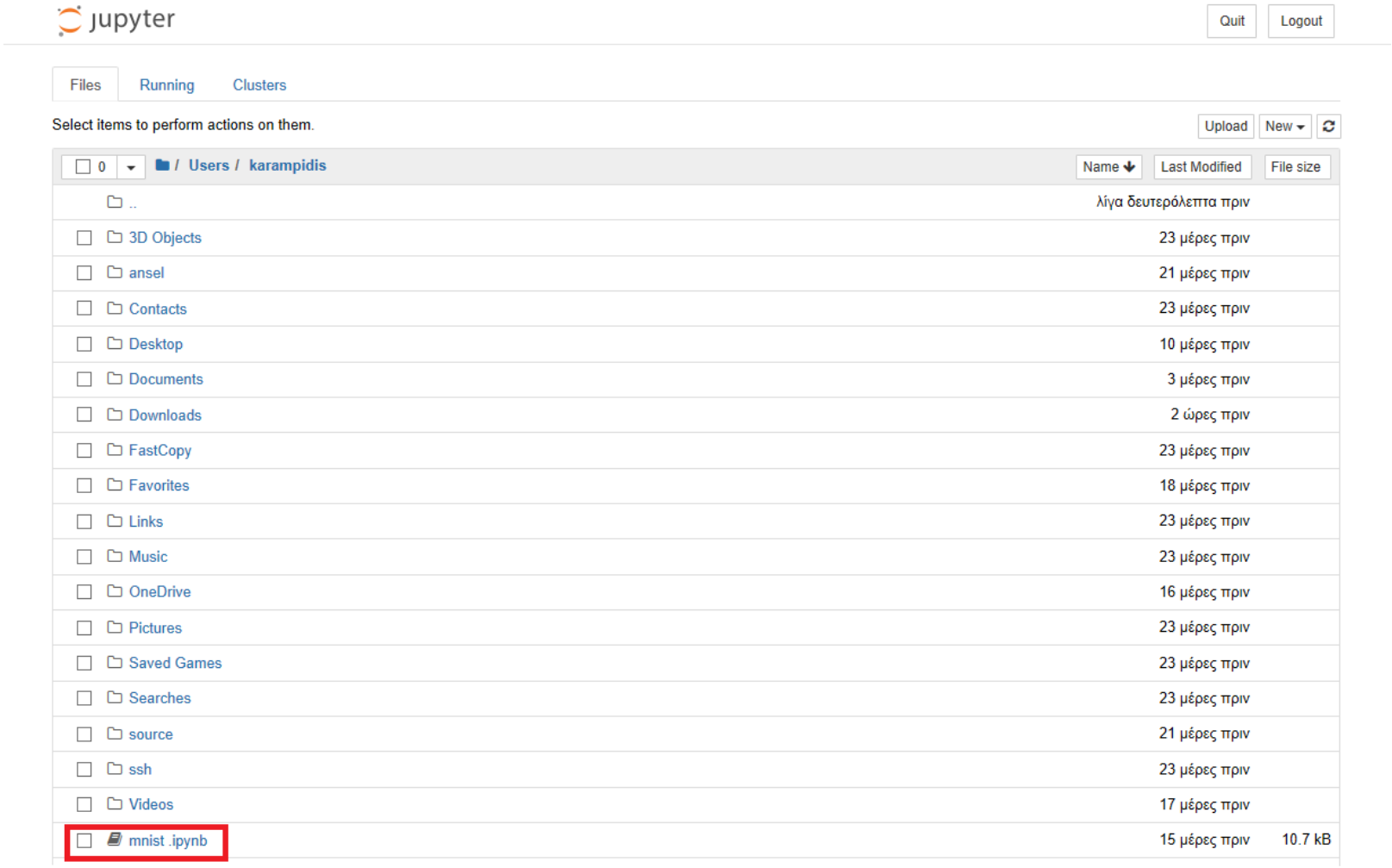
Jupyter Notebook

- Navigate through your folders until you get to the directory you want to save your notebooks.
- Open a new Notebook file by clicking on the “New” menu on the upper right

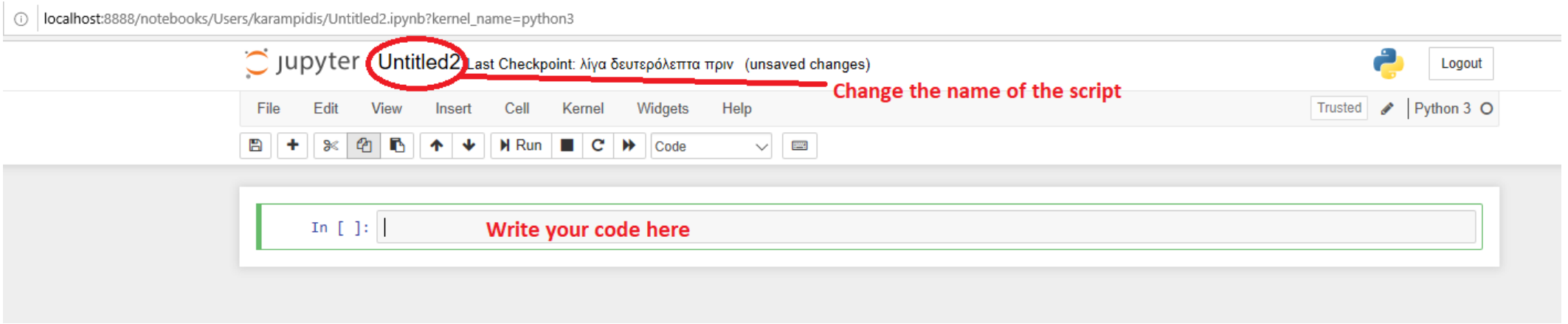
Jupyter Notebook

Open a previously saved Notebook file by clicking on the name of the file.

The extension for a Jupyter Notebook file is ".ipynb", which is short for "interactive python notebook"



Jupyter Notebook



In a jupyter notebook you can have equations, text , code , plots etc.

Jupyter Notebook

jupyter spectrogram (autosaved)

File Edit View Insert Cell Kernel Help | Python 3

Markdown CellToolbar

Simple spectral analysis

An illustration of the Discrete Fourier Transform

$$X_k = \sum_{n=0}^{N-1} x_n \exp^{\frac{-2\pi i}{N} kn} \quad k = 0, \ldots, N-1$$

Equations

```
In [2]: from scipy.io import wavfile
        rate, x = wavfile.read('test_mono.wav')
```

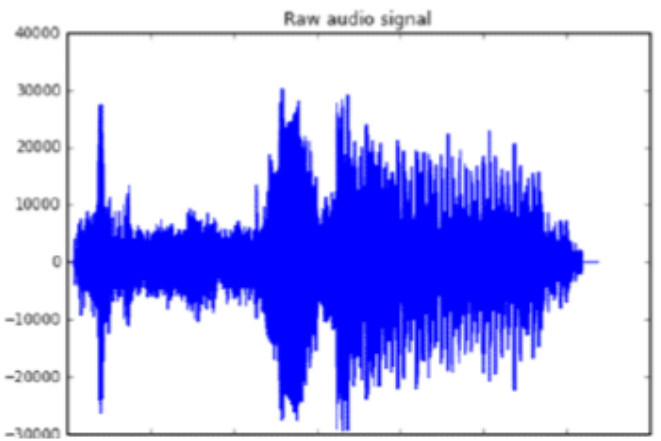
Code

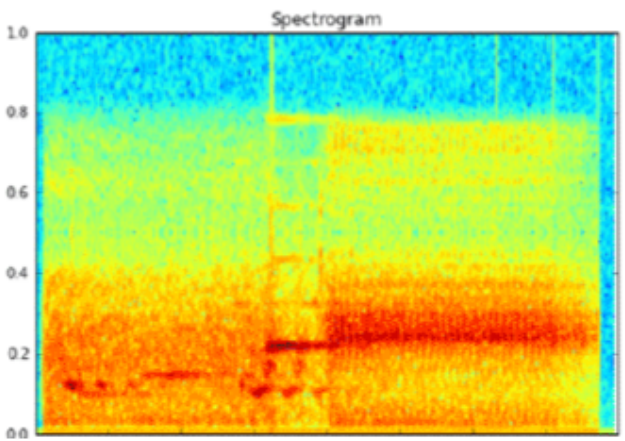
And we can easily view it's spectral structure using matplotlib's builtin specgram routine:

Text

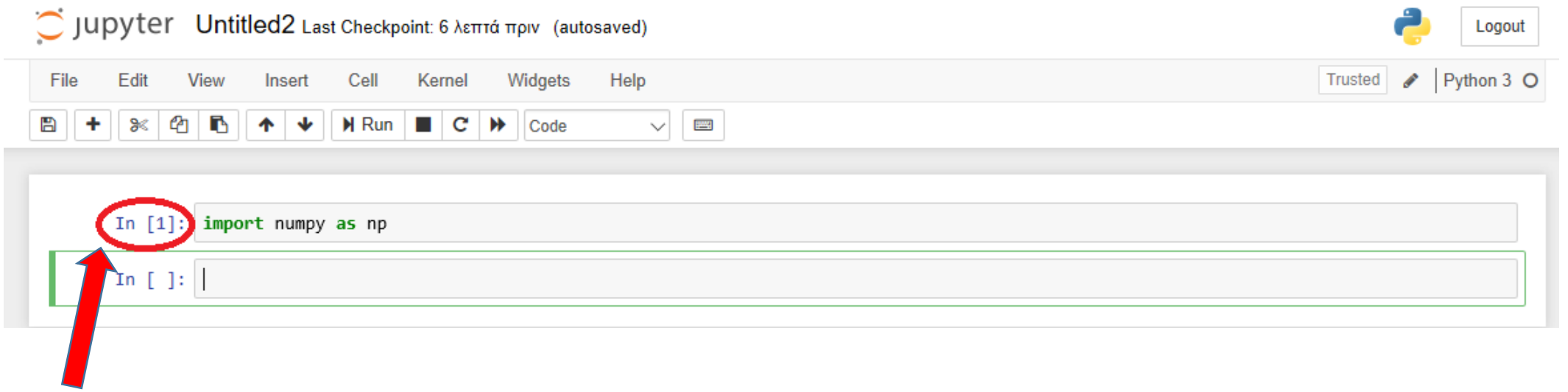
```
In [5]: fig, (ax1, ax2) = plt.subplots(1,2,figsize(16,5))
        ax1.plot(x); ax1.set_title('Raw audio signal')
        ax2.specgram(x); ax2.set_title('Spectrogram');
```

Plots





Jupyter Notebook



If there is a number , then the cell has been evaluated! This means that the code written in that cell has been run. A cell is evaluated by either clicking “Run” or by typing Shift+Return.

Environment Setup

In order to work flawlessly this semester you need to:

- Create a new environment
- Select the new environment and install these packages:
  - numpy
  - scikit-learn
  - matplotlib
  - pandas
  - seaborn

Open Anaconda prompt as administrator and issue the command:
activate <your_enviroment_name>
pip install neurolab yellowbrick

Environment Setup

Environment setup through Anaconda prompt

Open Anaconda prompt and issue the following commands:

conda create --name neural
conda activate neural
conda install numpy scikit-learn matplotlib pandas seaborn keras
pip install neurolab yellowbrick
conda install jupyter

Load data

In order to load data into a jupyter notebook you can use the .read_csv() method* form pandas

Example:

```
import pandas as pd

mydata = pd.read_csv("path_to_file/your_data.csv")

print(mydata)
```

Alternatively, you can see the header of the file along with the first five patterns

```
df = pd.DataFrame(mydata)

df.head()
```

* with this method you can also import .data files

Load data

To load txt files you can use the following

```
import numpy as np
from urllib.request import urlopen
data = np.loadtxt(urlopen(“url_to_txt_file"),delimiter=",")
```

or convert the txt file to csv and use the previous method