

# Setting up your Python environment

## Introduction to Machine Learning

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L3 MIASHS — Semestre 2

2023-2024

# Outline

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- 1 What is Python ?
- 2 Installing Python
- 3 Package management using pip
- 4 Working with virtual environment
- 5 Working with Jupyter
- 6 Practicalities for labs
- 7 Questions

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

# What is Python ?

# Programming languages

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Programming languages

The goal of a **programming language** is to write instructions in a way that is **understandable** by the computer.

# Programming languages

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Programming languages

The goal of a **programming language** is to write instructions in a way that is **understandable** by the computer.

A programming language can be:

- **Compiled**: machine code is generated from source code;
- **Interpreted**: code can be read directly by the computer without the need of transforming it.

# What is Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python

Python is a **high-level, general-purpose programming language**, which emphasizes code readability.

# What is Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python

Python is a **high-level, general-purpose programming language**, which emphasizes code readability.

Python is **interpreted** and needs an **interpreter** to be executed on the target system.

# Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python is widely used across the academic and industrial community:



# Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python is widely used across the academic and industrial community:

- Leader in Data Science/Deep Learning;

# Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

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- Leader in Data Science/Deep Learning;
- Web applications;

# Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python is widely used across the academic and industrial community:

- Leader in Data Science/Deep Learning;
- Web applications;
- Client/Server applications

# Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python is widely used across the academic and industrial community:

- Leader in Data Science/Deep Learning;
- Web applications;
- Client/Server applications
- And many more applications ...!

# Why Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

This semester focuses on Python (instead of R, which would be the closest concurrent) because:

# Why Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

This semester focuses on Python (instead of R, which would be the closest concurrent) because:

- Very easy to learn and understand;

# Why Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

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- Very easy to learn and understand;
- Can be scripted or properly packaged to be production ready;

# Why Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

This semester focuses on Python (instead of R, which would be the closest concurrent) because:

- Very easy to learn and understand;
- Can be scripted or properly packaged to be production ready;
- Many available libraries are available for Data Science;



# Why Python ?

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

This semester focuses on Python (instead of R, which would be the closest concurrent) because:

- Very easy to learn and understand;
- Can be scripted or properly packaged to be production ready;
- Many available libraries are available for Data Science;
- Can easily be compiled for better portability / performance

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

# Installing Python

# Downloading Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- Visit the official Python website:  
`https://www.python.org`
- Click on the "Downloads" tab to access the download options.
- Choose the appropriate version for your operating system (Windows, macOS, Linux).
- Make sure to select the latest stable version available.

**CAREFUL:** all libraries are not necessarily compatible with every Python version. Check carefully if you want a specific version.

# Windows Installation

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- For Windows, download the executable installer.
- Run the installer and make sure to check the box that says "Add Python x.x to PATH".
- Click "Install Now" to start the installation process.
- The installer will set up Python and the associated tools on your system.

# macOS Installation

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- For macOS, download the macOS installer package.
- Run the installer package and follow the prompts.
- Python is pre-installed on most macOS versions, but using the installer ensures you have the latest version.

# Linux Installation

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- For Linux, Python is often pre-installed. Open a terminal and check with the command `python3 --version`.
- If not installed, use your package manager to install Python.
- On Debian-based systems: `sudo apt-get install python3`
- On Red Hat-based systems: `sudo yum install python3`

# Verifying Installation

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- Open a terminal (or Powershell if you are on Windows) and type `python3` to start the Python interpreter.
- You should see the Python prompt (`>>>`), indicating that Python is installed and running.
- To exit the interpreter, type `exit()` or press `Ctrl + Z` followed by `Enter`.

# Possible troubleshooting: Adding Python to your path

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Windows sometimes behaves weirdly regarding its PATH and you need to manually add Python to be able to run it in the command line. You may also need to restart your computer for changes to take effect.



Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

# Package management using pip

# pip

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## pip

pip is the default package manager for Python, used to install, manage, and distribute Python packages.

pip comes with Python installs ever since version 3.4.

# pip

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## pip

pip is the default package manager for Python, used to install, manage, and distribute Python packages.

pip comes with Python installs ever since version 3.4.

To check if pip is properly installed on your system, run in your terminal:

```
>>> python3 -m pip list
```

# Installing Packages

## Python packages

A Python package is a collection of **related modules, organized in a directory hierarchy, providing sets of functions, classes, and variables**. Packages allow you to benefit from features developed by other computer scientists instead of **redeveloping yours from scratch**.

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

# Installing Packages

## Python packages

A Python package is a collection of **related modules, organized in a directory hierarchy, providing sets of functions, classes, and variables**. Packages allow you to benefit from features developed by other computer scientists instead of **redeveloping yours from scratch**.

- To install a package, open a terminal and use the command:
- `pip install <package_name>`
- `pip` will download and install the specified package and its dependencies.

## Example

To check if you have a working install of `pip`, run `pip install numpy`.

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using `pip`

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions



# Listing Installed Packages

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- To see a list of installed packages, use the command:
- `pip list`
- This will show all installed packages along with their versions.

# Listing Installed Packages

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- To see a list of installed packages, use the command:
- `pip list`
- This will show all installed packages along with their versions.

## Example

Check if `numpy` that you have previously installed is properly listed.

# Uninstalling Packages

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- To uninstall a package, use the command:
- `pip uninstall <package_name>`
- This will remove the specified package from your system.

## Example

Remove numpy by running `pip uninstall numpy`.



# Requirements Files

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- A requirements file (`requirements.txt`) lists all the packages required for a project.
- To install all the packages listed in a requirements file, use the command:
- `pip install -r requirements.txt`

Starting tomorrow, for each lab session, you will be able to install the dependency for each lab using the command `pip install -r requirements.txt`.

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

# Working with virtual environment

# Virtual environments

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python virtual environments

A **Python virtual environment\*** is a self-contained directory that contains a Python installation and its own set of packages.

# Virtual environments

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python virtual environments

A **Python virtual environment\*** is a self-contained directory that contains a Python installation and its own set of packages.

- Allows you to manage multiple isolated Python environments on the same system.

# Virtual environments

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python virtual environments

A **Python virtual environment\*** is a self-contained directory that contains a Python installation and its own set of packages.

- Allows you to manage multiple isolated Python environments on the same system.
- Useful for projects with different dependencies or versions, preventing conflicts.

# Virtual environments

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Python virtual environments

A **Python virtual environment\*** is a self-contained directory that contains a Python installation and its own set of packages.

- Allows you to manage multiple isolated Python environments on the same system.
- Useful for projects with different dependencies or versions, preventing conflicts.
- Helps maintain a clean and organized development environment.

# Creating a Virtual Environment

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- Using the built-in 'venv' module (Python 3.3+):
  - `python3 -m venv <path/to/venv>`
- Activating the virtual environment:
  - On Windows: `<path/to/venv>/Scripts/activate`
  - On macOS and Linux: `source <path/to/venv>/bin/activate`
- Deactivating the virtual environment:
  - `deactivate`

# Using a Virtual Environment

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Once activated, the virtual environment's Python interpreter and packages take precedence over the system-wide Python.

- Install packages using `pip`, which installs them into the virtual environment.
- To check which packages are installed in the virtual environment: `pip list`



# Benefits

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Working with Python environment is **A MUST DO** in Python.

# Benefits

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Working with Python environment is **A MUST DO** in Python.

Benefits:

- **Isolation:** Prevents conflicts between project dependencies.

# Benefits

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Working with Python environment is **A MUST DO** in Python.

Benefits:

- **Isolation:** Prevents conflicts between project dependencies.
- **Reproducibility:** Easily share environment specifications for consistent setups.

# Benefits

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Working with Python environment is **A MUST DO** in Python.

Benefits:

- **Isolation:** Prevents conflicts between project dependencies.
- **Reproducibility:** Easily share environment specifications for consistent setups.
- **Easy cleanup:** Delete the virtual environment folder to remove all associated packages.

# Benefits

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Working with Python environment is **A MUST DO** in Python.

Benefits:

- **Isolation:** Prevents conflicts between project dependencies.
- **Reproducibility:** Easily share environment specifications for consistent setups.
- **Easy cleanup:** Delete the virtual environment folder to remove all associated packages.
- **Version compatibility:** Maintain different Python versions for different projects.

# Running Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python can be run:

# Running Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python can be run:

- Interactively, through your terminal, iPython or using Jupyter Notebook;

# Running Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python can be run:

- Interactively, through your terminal, iPython or using Jupyter Notebook;
- As a script;



# Running Python

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

Python can be run:

- Interactively, through your terminal, iPython or using Jupyter Notebook;
- As a script;
- As a structured package, with an entry point.

# Running python scripts

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

A python script is a file with the extension `.py`, which can be run using the interpreter.

# Running python scripts

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

A python script is a file with the extension `.py`, which can be run using the interpreter.

## Example script

Write the command `print("I love learning Python!")` in a file, save it as `test.py` and run it using `python test.py`.

# Writing Python package

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

More advanced Python software engineering consists in organizing the code into **modules** and providing **entrypoints** for user to use our code.

# Writing Python package

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

More advanced Python software engineering consists in organizing the code into **modules** and providing **entrypoints** for user to use our code.

Over this semester, we will focus on **interactive** Python using Jupyter Notebook.

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

**Working with  
Jupyter**

Practicalities  
for labs

Questions

# Working with Jupyter

# Jupyter notebooks

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Jupyter notebooks

Jupyter Notebooks are **interactive, web-based environments** for creating and sharing documents containing live code, equations, visualizations, and narrative text.

Jupyter notebooks are widely used for **data analysis, scientific computing and machine learning**. It also provides easy sandboxing environment to learn Python !

# Installation

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

## Running this in your previously created virtual environment:

- Install jupyter using pip: `pip install jupyter`
- Once installed, you can start Jupyter Notebook from the command line in the desired folder: `jupyter notebook`
- Open the Jupyter Notebook interface in your web browser (or click on the provided URL depending on your version)



# Notebook Interface

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- The Jupyter Notebook interface consists of cells.
- Cells can contain code or text (Markdown).
- You can execute code cells individually.
- Keyboard shortcuts help navigate and interact with the interface efficiently.

# Code Execution

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- To execute a code cell, select it and press **Shift + Enter**.
- Output will be displayed below the cell.
- Variables and outputs persist across cells within the same notebook.
- You can also interrupt or restart the kernel, which clears all variables and resets the notebook's state.

# Markdown Cells

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- Markdown cells allow you to include formatted text, headings, lists, links, images, and more.
- They provide rich narrative capabilities to document your code and analysis.
- You can render equations using LaTeX syntax within Markdown cells.

# Sharing and exporting your notebooks

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

Working with  
Jupyter

Practicalities  
for labs

Questions

- Jupyter Notebooks can be saved in the `.ipynb` file format.
- Notebooks can be easily shared with colleagues or published online via platforms like GitHub, Jupyter Notebook Viewer, or Jupyter Hub.
- Notebooks can also be exported to various formats, including HTML, PDF, LaTeX, and slides.

Setting up  
your Python  
environment

Sophie Robert

What is  
Python ?

Installing  
Python

Package  
management  
using pip

Working with  
virtual  
environment

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**Practicalities  
for labs**

Questions

# Practicalities for labs

# Accessing the lab material

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All material is accessible on the course

[https://github.com/SphRbtHyk/miashs;ntroduction\\_ml/tree/main](https://github.com/SphRbtHyk/miashs;ntroduction_ml/tree/main).

You should either:

- `git clone` the repository (if you know a bit of git)
- Download before each session the github repository.

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Jupyter

Practicalities  
for labs

Questions

# Questions

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your Python  
environment

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Python

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virtual  
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We will use Jupyter and Python all semester !