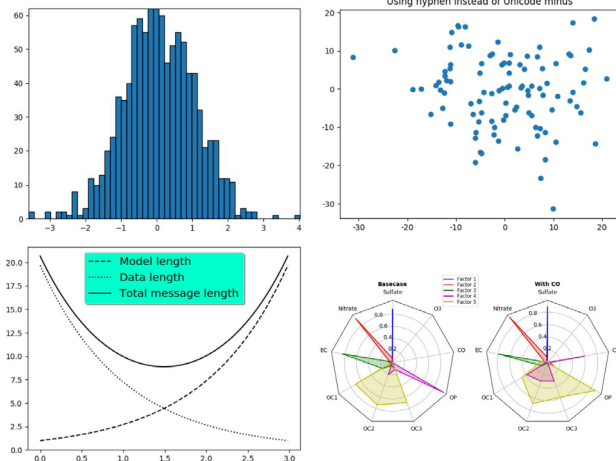


COURSE

PYTHON FOR BEGINNERS

Pavia,

5-6-12-13 October 2018



> General Objectives

The main objective of the course is to familiarize individuals from a non-programming background to the use of Python. The course itself is anchored to a pragmatic approach to Python learning, focusing on some of the most useful tools at the disposal of a

Python-based data scientist, and consolidating the knowledge acquired through a comprehensive set of pre-built exercises. This course is specifically driven towards making a beginner (even one with no knowledge in any programming language) acquainted with Python, as well as with existing frameworks that help the developer attain their objectives in a more efficient manner. At the end of the course, students should be able to:

- Be familiar with the syntax of the Python language, and a number of scripting environments available of this language;
- Build efficient Python code for a multitude of practical applications (e.g. data manipulation, processing);
- Perform complex data representations through advanced plotting strategies in Python.

> Topics Covered

The course is structured within several sub-modules within two major content groups, namely: i) a condensed summary of the major ins and outs of the Python language (e.g. syntax, variables, operators, loops); and ii) a detailed description of some of the most useful existing libraries that any Python developer has at his disposal to build more efficient code (e.g. Scipy, pandas, matplotlib). Both of these key content groups contains pre-built exercises for a “hands-on” approach to learning, which helps consolidating the contents delivered.

> Class Notes

The course is delivered through a set of provided IPython notebooks, which can be described as an interactive computational environment. These highly interactive files combine Python code execution, rich text, mathematics, plots and rich media. [Here](#) you may find a video example of this type of files. These class notes also include an installation guide for a Python distribution that the course will use.

> Lectures

Friday 05.10.2018 1A

10:00 - 13:15

Introduction to the course, highlighting its motivation and overall structure. Cover the main characteristics of the Python language syntax (e.g. identifiers, indentation). How to store data into a variable, and what types of variables exist in Python (e.g. numbers, text, lists). Types of operations allowed in Python (e.g. arithmetic, comparison). How to define and control flowed algorithms (e.g. conditional statements, loops). How to define and use self-contained, reusable blocks of code. How to import and use packages (e.g. advanced math operations, plotting library) into the code. Learn to interpret Python tracebacks in debug operations.

14:15 - 17:30

Set of simple exercises to practice contents learned so far. The focus shall be on often recurrent tasks in the Python data analysis domain. The overall objective of these exercises will be presented, and students are expected to solve them within a pre-defined timeframe, during which request for assistance from the lecturer is encouraged. Afterwards, the lecturer will show and explain the solution of the exercise in a detailed manner, highlighting common errors across the class.

Saturday 06.10.2018

10:00 - 13:15

OpenPyXL, a Python-Excel interface library. How to open an existing Excel workbook, access and extract cell. Demonstrate a simple algorithm to modify cell values and retrieve internal output (e.g. VBA macro-based) for repetitive tasks (e.g. parametric studies).

os and **shutil**, two available packages for miscellaneous operating system interfaces (e.g. list entries in directory, manage/rename/copy/move/delete files and directories).

NumPy, a low-level package for scientific computing. How to create arrays from lists and automatic array-generating functions (e.g. range, zeros, random numbers). How to manipulate arrays (e.g. indexing, slicing), and how to perform linear algebra operations on arrays. Basic data processing tools.

SciPy, a framework built on top of NumPy for higher-level scientific algorithms. Tools for numerical quadrature integration and discrete (e.g. trapezoidal rule) integration. How to interpolate upon data via splines, and the effect of different algorithms. How to employ basic optimization schemes in SciPy (e.g. minimization, brute force, curve fitting), and what to read for more complex problems (e.g. particle swarm optimization).

14:15 - 17:30

Set of exercises to practice the contents learned so far. The focus shall be on practicing upon some of the main features shown regarding the packages shown thus far. The overall objective of these exercises will be presented, and the lecturer shall walk the students through the main steps towards their resolution. Students are expected to solve the exercises within a pre-defined timeframe, during which request for assistance from the lecturer is encouraged. Afterwards, the lecturer will show and explain the solution of the exercise in a detailed manner, highlighting common errors across the class.

Friday 12.10.2018

10:00 - 13:15

pandas, a Python package for fast and flexible processing of data structures (i.e. dataframes). How to read tabular data files (e.g. Excel, csv, html), and how to select a given series (i.e. column) of the data. How to explore, add to, rename, sort and filter series. How to handle duplicate data and how to create dataframes from other objects (e.g. lists, arrays).

Matplotlib, a plotting library for the production of publication quality figures. How to take advantage of basic plotting schemes, and what can be tweaked upon. How to perform individual line and/or scatter plots in a single figure file, and what is the notation for subplotting (i.e. multiple graphs in the same figure). Advanced algorithms for color cycling, and how to use mathematical text rendering in plots.

14:15 - 17:30

Set of exercises to practice the contents learned so far. The focus shall be on practicing upon some of the main features shown regarding the **pandas** and **Matplotlib** packages. The overall objective of these exercises will be presented, and the lecturer shall walk the students through the main steps towards their resolution. Students are expected to solve the exercises within a pre-defined timeframe, during which request for assistance from the lecturer is encouraged. Afterwards, the

lecturer will show and explain the solution of the exercise in a detailed manner, highlighting common errors across the class.

Saturday 13.10.2018

10:00 - 13:15

Set of exercises to practice contents learned so far. The focus shall be on practicing upon some of the main features shown regarding advanced data analysis problems, taking advantage of both user-defined algorithms and the relevant library tools. The overall objective of these exercises will be presented, and the lecturer shall walk the students through the main steps towards their resolution. Students are expected to solve the exercises within a pre-defined timeframe, during which request for assistance from the lecturer is encouraged. Afterwards, the lecturer will show and explain the solution of the exercise in a detailed manner, highlighting common errors across the class.

14:15 - 17:30

Final examination for self-evaluation. The lecturer shall detail an advanced Python exercise, and which tier-based objectives the student can aim to in its resolution (e.g. Tier 1: read and filter data; Tier 2: Tier 1 + process and manipulate; Tier 3: Tier 2 + plot relevant results). The students must structure their own algorithm strategy, reflecting the general strategies the lecturer has shown regarding other exercises in previous sessions.

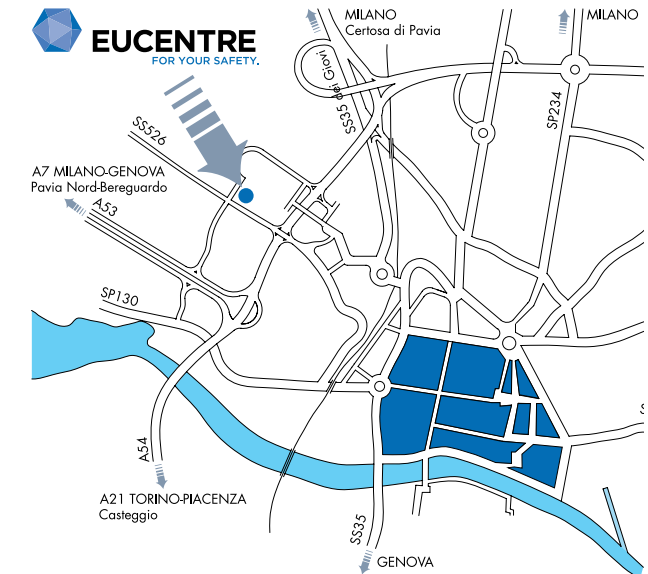
> Course Coordinator and Lecturer

António Silva
UME PhD Candidate

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CFP

> How to reach us

The Eucentre Foundation is located inside the Cravino campus of the University of Pavia.
More information on: www.eucentre.it



> Registration procedure <

Registration for the course must be confirmed by **September the 28th, 2018**. The participation fee for the Course is of € 300+IVA 22%.

The members of the Ordine degli Ingegneri di Pavia have a 10% discount.

For graduate students, Masters and PhD students the fee for participation in the course is € 200 + IVA 22%.

The Course, which has a maximum number of 48 participants, will be considered confirmed if the minimum number of members is reached, equal to 15. At the end of the Short Course a certificate of attendance will be issued.

The Course will be held in the Didactic Classroom 1 of Eucentre, in via Adolfo Ferrata, 1 - Pavia.

For further information please contact our secretariat by writing to corsi@eucentre.it