

Python for Scientists and Engineers

Learn via: **Classroom / Virtual Classroom / Online**

Duration: **3 Gün**

<https://bilginc.com/tr/egitim/python-for-scientists-and-engineers-3193-egitimi/>

Overview

Bilim insanlarının ve mühendislerin çözmesi gereken birçok sorun için bir çeşit programlama bilgisine de ihtiyaç duyulmaktadır. Python da bu tür kullanıcılar arasında gittikçe popülerleşmektedir. Bunun nedenlerinden biri elde edilen sonuçlara kıyasla göreceli olarak çok az çalışma gerektirmesidir. Sadece arada sırada programlama yapan kişiler için Python iyi bir seçimdir. Python kaynağına hiç dokunulmadan uzun bir süre geçmiş olsa bile Python hala çok az bir çabayla okunabilir ve anlaşılabilir bir yapıdadır.

Who Should Attend

Scientists and Engineers with basic knowledge of Python. This course can be combined with introductory courses (see Recommended Module Combinations) to achieve appropriate Python skills.

Outline

OVERVIEW OF SCIENTIFIC AND TECHNICAL LIBRARIES FOR PYTHON

There is a great variety of Python libraries for scientific purposes. A short overview is presented and selected example libraries are briefly introduced.

IPYTHON

IPython is a special implementation of the interactive Python mode. The course presents the basic IPython features of the shell and GUI variant as well as the IPython Notebook. The IPython Notebook runs in the browser. A Notebook can contain markup and graphics in addition to executable code. The course will use the IPython Notebook throughout the course exploring more features along the way.

NUMERICAL CALCULATIONS WITH NUMPY

The library NumPy is the defacto standard for the work with arrays and linear algebra.

Array-Construction and Array-Properties

There are different ways to construct arrays with NumPy. The most useful way to create an array for a specific purpose is demonstrated with examples. The properties of array objects are explained.

Data Types

In contrast to Python data types that are dynamically determined at run time, data types of NumPy arrays have to be explicitly specified. This is one prerequisite to achieve the speed advantages of NumPy compared to pure Python. There are considerably more data types in NumPy than in Python. The course covers the usage of those data types and in particular their correspondence with C data types.

Slicing and Broadcasting

The technique of slicing allows read and write access to arbitrary parts of arrays. Since it works with multidimensional arrays it often allows for short and

elegant programs without loops. Experience shows that the first steps with slicing need getting used to it. Therefore, numerous exercises are included in the course to cover different types of applications.

The so called broadcasting is applied in NumPy for arrays with different shapes when they are used in computations. Missing parts of arrays are filled in if possible. A good understanding of this mechanism is a basic requirement for an effective work with NumPy.

Universal Functions

NumPy allows to apply many operations on whole arrays independent from their dimensions. Examples are used to demonstrate the usage of these universal functions.

Numerical Algebra

NumPy provides basic functionality for solving problems in numerical algebra. Examples are used to demonstrate its usage.

INTERACTIVE DATA ANALYSIS WITH PANDAS

Pandas is a very powerful Python library for effective analysis of large amount of data. The course introduces the basic features and workflows of Pandas. Core of the course are Pandas-specific data structures and the data analysis operations they support.

STORAGE AND PROCESSING OF LARGE AMOUNTS OF DATA

Applications in the scientific and engineering domain often have to deal with large amounts of data. There are several ways to store data in Python. Some of them are presented in the course.

ASCII Files

The simplest way to store data is the use of ASCII files. It is shown how ASCII files can be read and written efficiently. Techniques for conversion of column based data in Python data structures are given.

Excel Files

Many data are stored in Excel files. Python offers several ways of reading and writing data in Excel files. Access via Microsoft's COM interface are applied as well as direct binary reading and writing of files as a platform independent solution.

NetCDF Files

The file format NetCDF can be used to store large amounts of array data up to several terabytes. Python offers an interface for NetCDF. Its handling will be covered in the course.

HDF5 Files

The HDF5-Format is used for very similar purposes as the NetCDF-Format. In fact, the new version, NetCDF4, is based on HDF5. HDF stands for *hierarchical data format* and offers better opportunities to organized data. The module PyTables offers a mature and comfortable interface to HDF. In the course examples for it are given.

Databases

Frequently, data are stored in databases. Python offers a uniform API for accessing all major databases. The use of this API is taught in the course.

Pickling and Shelving

Python offers ways to conveniently store Python objects with the built-in modules *pickle* and *shelve*. Complex data structures can be stored on disk for later usage without the need to come up with a file format for storage. Application as well as advantages and disadvantages are presented in the course.

OBJECT-ORIENTED PROGRAMMING FOR SCIENTIFIC AND TECHNICAL PROJECTS

The object-oriented paradigm is currently prevailing in software engineering. Many scientists and engineers are more familiar with procedural programming. The course uses examples to show that object orientation can be advantageous also for typical scientific or engineering problems.

GRAPHICAL PRESENTATION OF SCIENTIFIC DATA

Results of scientific and technical calculations regularly need to be presented graphically. Although there are many applications available an automated production of graphics can be especially useful if many graphics need to be produced or the same graphics needs to be frequently updated.

matplotlib

The library matplotlib provides many different types of diagrams from within Python with only a few lines of code. Examples are used to exercise the use of this library.

APPLICATION INTEGRATION WITH PYTHON

Python is often termed as "glue language" because it proves to be especially useful for the connection of heterogeneous applications. This features makes it particularly attractive tool for scientific and technical tasks. Several different possibilities to connect very different applications into one uniform program are shown in the course.

OPEN TIME FOR SOLVING PARTICIPANT'S PROBLEMS

The participants are asked before the course to provide tasks that they usually need to solve at work. Solution strategies with Python are attempted in the course.