

Matetials: Python Basics

pppppass

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Everything is optional except that marked with **(Required)**. The information is updated on December 2, 2017.

1 Installation and configuration

There are Python distributions of Windows version, but I do not recommend because it takes time to get around the differences between Windows and Unix-like systems, including line feed (`\n` in Linux but `\n\r` in Windows), path separator (`/` in Linux and `\` in Windows) and so on. Additionally, some packages like NumPy and PyTorch does not work well in Windows.

Python is included in many Linux distributions, but I personally recommend use Anaconda to create virtual environments.

2 Resources

2.1 Tutorials

If you are familiar with C++ or some other object-oriented language, official Python Tutorial should be sufficient. Details in Section 6.4, Section 9.5.1, Section 10–13, Section 15–16 can be skipped. The outline is based on this tutorial.

Xuefeng Liao's Python Tutorial is also recommended if you cannot stand so much English. This tutorial covers more topics than the official Python Tutorial, but I consider some topics too detailed as a introductory tutorial instead of a manual. The sections before IO Programming inclusive should be adequate.

Google provides a Python Class but this class does not cover any object-oriented or functional topics.

For books, I have heard of *Python Cookbook* and *Learn Python the Hard Way*.

Discussions on Zhihu provides lists of resources like 如何系统地自学 Python 的? and 你是如何自学 Python 的? A list of resources are also provided officially.

2.2 PEPs

It is strongly recommened to read through *PEP 20 – The Zen of Python* to get familiar with the ideas of Python.

I personally recommend to get through *PEP 8 – Style Guide for Python Code*. As component of a project, this guide are detailed, so pay attention not to be trapped in details. Note that PyCharm and some other IDEs have PEP8 Code formatting support.

PEP 0 – Index of Python Enhancement Proposals offers an insight to the whole Python project and community, and *PEP 7 – Style Guide for C Code* shows guidelines for the Python project.

2.3 Websites

Stack Overflow is a community for programmers, and many Q&A can be found. It's is suggested to search Stack Overflow first if some bugs occur.

Python has its own Forum and Wiki.

3 Assignment

Question 1 (Required) Use a generator to generate all permutations of n (given) numbers. Solution can be found in `permutation.py`.

Question 2 Use a generator to solve the eight queens puzzle. Further information can be found in OpenJudge. (The names in the code is a little confusing) Solution wanted.

Question 3 (Required) Let $(x_i, y_i) \in \mathbb{R}^2$ where $i = 1, 2, \dots, n$. The least square regression problem is to find a and b such that

$$F(a, b) = \frac{1}{2} \sum_{i=1}^n (y_i - a - bx_i)^2 \quad (1)$$

reaches its minimum. We're going to solve this problem by gradient method. That is, we fix

some $a^{(0)}$ and $b^{(0)}$ first, and then update them by

$$a^{(i+1)} = a^{(i)} - \eta \frac{\partial F}{\partial a}, \quad (2)$$

$$b^{(i+1)} = b^{(i)} - \eta \frac{\partial F}{\partial b}. \quad (3)$$

The file `utils.py` in folder `trainer` provides three functions. Function `generate_config` generate values, `loss_func` returns the value of F , and `train_func` performs an update.

- (1) Install NumPy first. This can be done by using Anaconda (recommended) or `pip`.
- (2) Encapsule these functions into a class `Trainer`, which provides interfaces to:
 - (i) set configurations. (This can also be done in initialization)
 - (ii) train for an arbitrary number of iterations.
 - (iii) print the result.

Solutions are provided in `trainer.py` and `trainer.ipynb`.

Question 4 Try to add an interface to modify the step size η in Question 3. Can you implement dimishing step size ($\eta^{(i)} = C_1/(i + C_2)$)? Solution wanted.

Additional exercise can be found in the Practise part of PySchools. Note that there are a huge number of exercises, and it is not recommended to finished them all.

Project Euler is a website offering mathematical problems. These problems may be solved by Python.