




Python数据分析 (影印版)

Python Data Analysis

Ivan Idris 著

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I would like to take this opportunity to thank the reviewers and the team at Packt Publishing for making this book possible. Also, my thanks go to my teachers, professors, and colleagues, who taught me about science and programming. Last but not least, I would like to acknowledge my parents, family, and friends for their support.

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I want to thank Silviu Preoteasa for all his support and motivation at all times.

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I would like to thank my wife, Jell, and my daughter, Louise,
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Preface

"Data analysis is Python's killer app."

– *Unknown*

Data analysis has a rich history in the natural, biomedical, and social sciences. You may have heard of *Big Data*. Although, it's hard to give a precise definition of Big Data, we should be aware of its impact on data analysis efforts. Currently, we have the following trends associated with Big Data:

- The world's population continues to grow
- More and more data is collected and stored
- The number of transistors that can be put on a computer chip cannot grow indefinitely
- Governments, scientists, industry, and individuals have a growing need to learn from data

Data analysis has gained popularity lately due to the hype around *Data Science*. Data analysis and Data Science attempt to extract information from data. For that purpose, we use techniques from statistics, machine learning, signal processing, natural language processing, and computer science.

A mind map visualizing Python software that can be used for data analysis can be found at <http://www.xmind.net/m/WvFC/>. The first thing that we should notice is that the Python ecosystem is very mature. It includes famous packages such as NumPy, SciPy, and matplotlib. This should not come as a surprise since Python has been around since 1989. Python is easy to learn and use, less verbose than other programming languages, and very readable. Even if you don't know Python, you can pick up the basics within days, especially if you have experience in another programming language. To enjoy this book, you don't need more than the basics. There are plenty of books, courses, and online tutorials that teach Python.

What this book covers

This book starts as a tutorial on NumPy, SciPy, matplotlib, and pandas. These are open source Python packages useful for numerical work, data wrangling, and visualization. Combined, they can compete with MATLAB, Mathematica, and R. The second half of the book teaches more advanced topics such as signal processing, databases, text analysis, machine learning, interoperability, and performance tuning.

Chapter 1, Getting Started with Python Libraries, guides us to achieve a successful installation of the numerical Python software and set it up step by step. Also, we will create a small application.

Chapter 2, NumPy Arrays, introduces us to NumPy fundamentals and arrays. By the end of this chapter, we will have basic understanding of NumPy arrays and the associated functions.

Chapter 3, Statistics and Linear Algebra, gives a quick overview of linear algebra and statistical functions.

Chapter 4, pandas Primer, provides a tutorial on basic pandas functionality where we learn about pandas data structures and operations.

Chapter 5, Retrieving, Processing, and Storing Data, explains how to acquire data in various formats and how to clean raw data and store it.

Chapter 6, Data Visualization, teaches how to plot data with matplotlib.

Chapter 7, Signal Processing and Time Series, contains time series and signal processing examples using sunspot cycles data. The examples mostly use NumPy/SciPy, along with statsmodels in at least one example.

Chapter 8, Working with Databases, provides information about various databases (relational and NoSQL) and related APIs.

Chapter 9, Analyzing Textual Data and Social Media, analyzes texts for sentiment analysis and topics extraction. A small example is also given of network analysis.

Chapter 10, Predictive Analytics and Machine Learning, explains artificial intelligence with weather prediction as a running example and mostly uses scikit-learn. However, some machine learning algorithms are not covered by scikit-learn, so for those, we use other APIs.

Chapter 11, Environments Outside the Python Ecosystem and Cloud Computing, gives various examples on how to integrate existing code not written in Python. Also, setup in the Cloud will be demonstrated.

Chapter 12, Performance Tuning, Profiling, and Concurrency, gives hints on improving performance with profiling and Cythoning as key techniques. For multicore, distributed systems, we discuss the relevant frameworks too.

Appendix A, Key Concepts, serves as a glossary containing short descriptions of key concepts found throughout the book.

Appendix B, Useful Functions, gives an overview of functions used in the book.

Appendix C, Online Resources, lists links to documentation, forums, articles, and other important information.

What you need for this book

The code examples in this book should work on most modern operating systems. For all chapters, Python 2 and pip is required. To install Python, go to <https://wiki.python.org/moin/BeginnersGuide/Download>. To install pip, go to <http://pip.readthedocs.org/en/latest/installing.html>. Instructions to install software are given throughout the chapters. Most of the time, we need to run the following command with admin privileges:

```
$ pip install <some software>
```

The following is a list of software used for the examples and versions used for testing purposes:

- NumPy 1.8.1
- SciPy 0.14.0
- matplotlib 1.3.1
- IPython 2.0.0
- pandas Version 0.13.1
- tables 3.1.1
- numexpr 2.4
- openpyxl 2.0.3
- XlsxWriter 0.5.5
- xlrd 0.9.3
- feedparser 5.1.3
- BeautifulSoup 4.3.2
- StatsModels 0.6.0
- SQLAlchemy 0.9.6