Importing, summarizing and visualizing data

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Introduction to the course

The material in these slides is strongly based on [1]. When other materials are going to be used, they will be cited accordingly.

Python as the programming languange to learn

- Easy to learn and powerful
- High-level efficient data structures
- Effective approach to object-orineted programming
- Interpreted
- Elegant syntax and dynamic typing

The choice for rapid application development in many areas on most platforms:

- Official Python tutorial
- Interactive Python tutorial at LearnPython.org

Learning Python through Jupyter notebook and JupyterLab

https://jupyter.org

- Jupyter Notebook:
  - web application
  - creating and sharing computational documents
  - several programming languages, including Python
  - interactive output
- JupyterLab
  - interactive development environment (IDE) for notebooks, code and data
  - flexible interface
  - modularity

Installing Jupyter

```
conda install jupyter
jupyter notebook
```

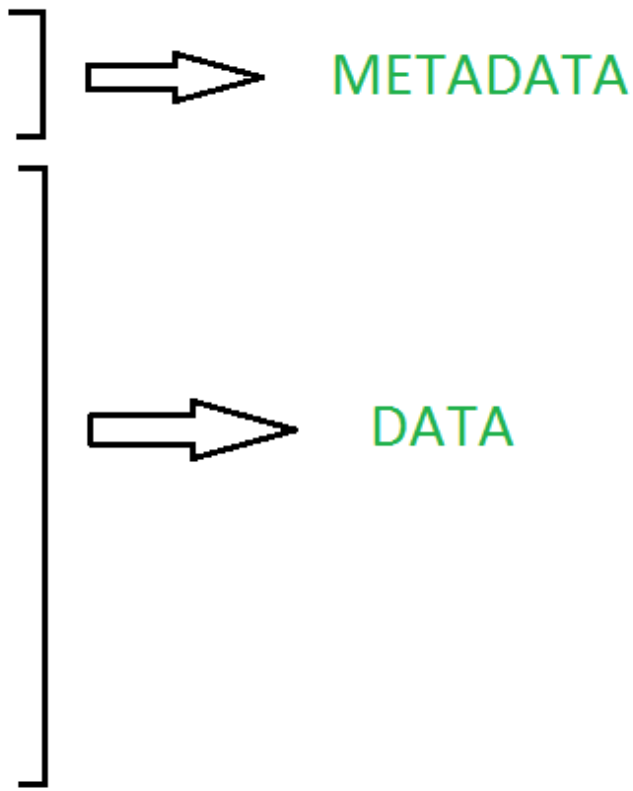
Code 1: installing and executing Jupyter notebook

How is data stored?

- Data can be thought of as being the result of some random experiment.
- We are interested in analysing such data.
- The format is typically a set of variables or *features* as **columns** while the different items are given as **rows**.
- Typically the first columns represents a unique identifier or index.
- Some columns refer to the experimental settings and others are real variables.
- Many times variables and experimental designs are stored in two different files. The we call the experimental desgins file as the **metadata** file, describing the details of the different experiments (or columns).

Data vs Metadata

NAME	AGE	GENDER	HEIGHT (CM)
A	20	MALE	172
B	21	MALE	168
C	19	FEMALE	160
D	20	MALE	163



Training datasets

There exist several datasets repositories that one can use to test the methods that are being developed. Some of them are going to be used in this course:

- Machine Learning Repository at University of California (https://archive.ics.uci.edu)
- Vincent Arel-Bundock repository (https://vincentarelbundock.github.io/Rdatasets/)
- Data from Pierre Lafaye de Micheaux and collaborators in their book "The R Software. Fundamentals of Programming and Statistical Analysis" [2]

EX 1 I

Exercise 1 Data visualization

Import the *EuStockMarkets* dataset from the Vincent Arel-Bundock repository. The data set contains the daily closing prices of four European stock indices during the 1990s, for 260 working days per year.

1. Create a vector of times (working days) for the stock prices, between 1991.496 and 1998.646 with increments of 1/260.
2. Reproduce Figure 1.10. [Hint: Use a dictionary to map column names (stock indices) to colors.]

EX 1 II

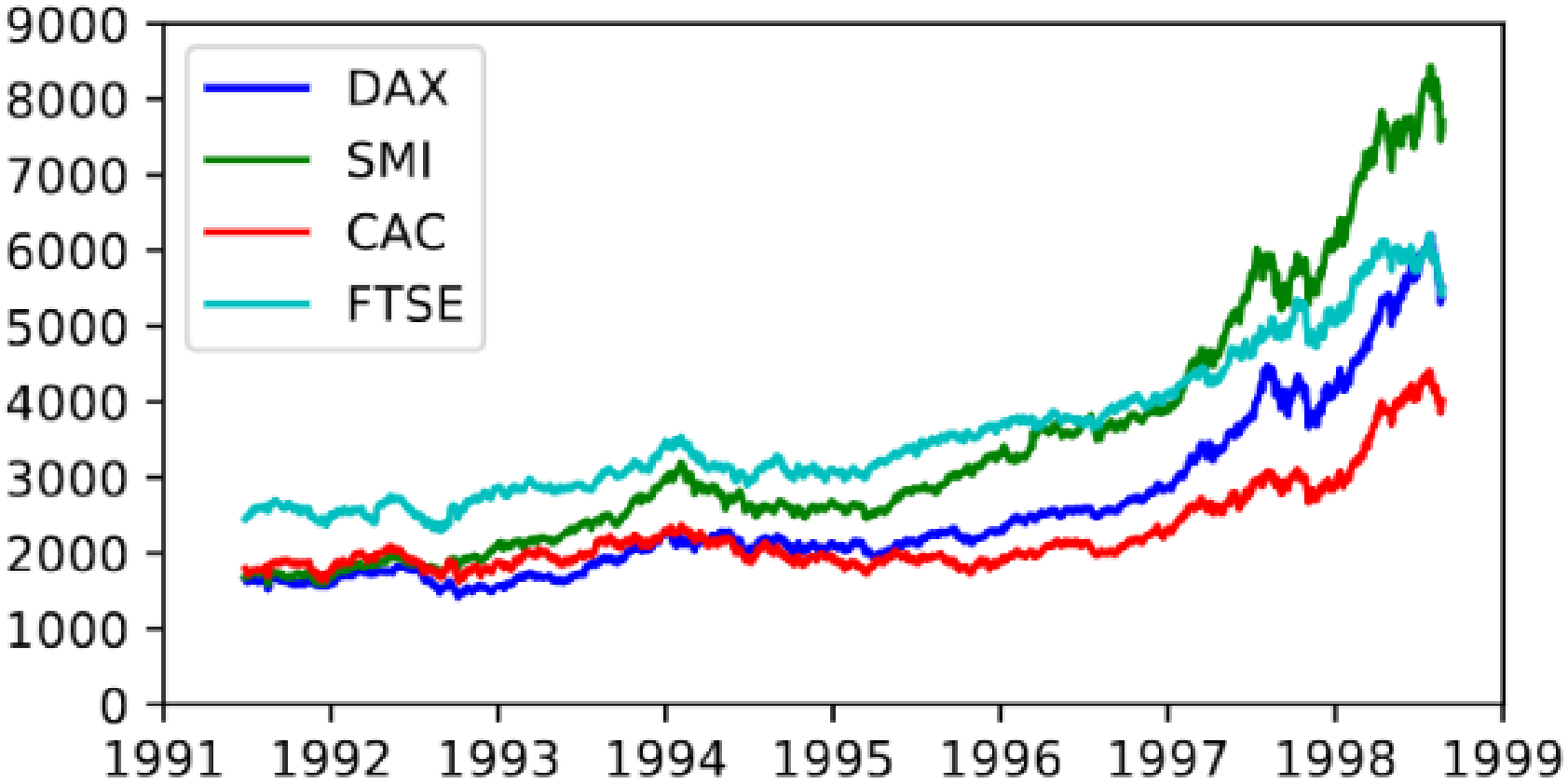


Figure 1.10: Stocks


Dirk P. Kroese, Zdravko Botev, Thomas Taimre, and Radislav: Vaisman.
Data Science and Machine Learning: Mathematical and Statistical Methods.
Machine Learning & Pattern Recognition. Chapman & Hall/CRC, 2020.


Pierre Lafaye De Micheaux, Rémy Drouilhet, and Benoit Liquet.
The R Software: Fundamentals of Programming and Statistical Analysis, volume 40 of *Statistics and Computing*.
Springer, New York, NY, 2013.