



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Informatics

1920-1-E0201Q046

Aims

The course will introduce the basic concepts of computer science and statistics, with a particular focus on biotechnology applications. The course will also introduce the students to the relationships between computer science and biology by considering, on the one hand, topics like biological databases and problems in bioinformatics or computational biology; on the other hand, basic notions about biology-inspired computational methods and their application for the solution of computational biology problems will be treated.

Knowledge and understanding. The student will gain knowledge about:

- "computational thinking", in order to critically use concepts and tools of computer science (algorithms, computational methods, software) for the solution of a given problem;
- the choice of the proper sampling and statistical methods, and the interpretation of outcomes in the analysis of biological/clinical data.

Applying knowledge and understanding. The student will be able to apply "computational thinking" and statistical methods for the solution of computational and statistical problems:

- organizing and handling biological data in automatic ways (practical skills on the use of spreadsheets);
- development of basic algorithms using Python and R programming languages (through computer laboratory practicals).

Making judgements. The student will be able to process the acquired knowledge and choose the proper computational/statistical methods for different applications.

Communication skills. Students are expected to acquire an appropriate scientific vocabulary and ability in oral/written reports

Learning skills. Skills in literature reading and understanding, as well as in the elaboration, analysis and application of the acquired knowledge in other courses related to the application of computational and statistical methods for data analysis.

Contents

Informatics

- 1) Introduction to computer science
- 2) Computational thinking and basics of structured programming
- 3) Notions of bioinformatics and computational biology
- 4) Data management and database

Statistics

- 1) Descriptive statistics
- 2) Inferential statistics

Laboratory

Spreadsheets

Basic notions of programming in Python and R languages

Detailed program

Informatics

- 1) Introduction to computer science
 - Principles of computer operations
 - Von Neumann architecture
 - Computer hardware and software
 - Data (number, text, multimedia) representation
- 2) Computational thinking and basics of structured programming
 - Definition of algorithm
 - From algorithms to programs
 - Structured programming and pseudo-code
 - Notions of computational complexity
- 3) Notions of bioinformatics and computational biology
 - Biological databases
 - Sequence alignment algorithms
 - Protein folding, molecular docking
 - Bio-inspired computational methods
- 4) Data management and databases
 - Database management systems
 - Relational databases

Statistics

- 1) Descriptive statistics
 - Introduction to statistics (types of data, collecting sample data)
 - Summarizing and graphing data (frequency distributions, histograms, boxplots)
 - Statistics for describing, exploring and comparing data (measures of center, measures of variation, measures of relative standing)
- 2) Inferential statistics
 - Basic concepts of probability
 - Probability distributions (uniform, binomial, normal, Poisson)
 - Sampling distributions and estimators
 - Hypothesis testing
 - Correlation and regression

Laboratory
Spreadsheets
Basic notions of programming in Python and R languages

Prerequisites

Background: none
Prerequisites: none

Teaching form

Classroom lectures (40 h, 5 ECTS) supported by PowerPoint slides, and computer lab practicals (30 h, 3 ECTS).
Teaching language: italian.

Textbook and teaching resource

Learning material is available at the e-learning platform of the course.

Recommended textbooks:

- L. Snyder, A. Amoroso, Fluency - Conoscere e usare l'informatica, Pearson, 2015
- M.M. Triola, M.F. Triola, Fondamenti di statistica per le discipline biomediche, Pearson, 2017
- M.C. Whitlock, D. Schluter, Analisi statistica dei dati biologici, Zanichelli, 2010

Semester

First semester

Assessment method

Written examination (2 hours), with 9 multiple-choice questions and one open question, about the topics presented during both classroom and practical lectures.

Office hours

Contact: on demand, upon request by mail to lecturer.

