Universidad Zaragoza

Academic Year/course: 2023/24

68460 - Biostatistics & Bioinformatics

Syllabus Information

Academic year: 2023/24
Subject: 68460 - Biostatistics & Bioinformatics
Faculty / School: 100 - Facultad de Ciencias
Degree: 626 - Máster Universitario en Biofísica y Biotecnología Cuantitativa / Master in Biophysics and Quantitative Biotechnology
ECTS: 6.0
Year: 01
Semester: Second semester
Subject type: Optional
Module:

1. General information

The general objectives are:

To know the theoretical basis of different tools for statistical modeling of biological data. To know when they can be applied and the types of problems that can be solved by each technique.
To know how to apply statistical tools to the analysis of biological data using adequate software and to program basic analysis.
To know how to interpret the results of statistical analysis.
To know the bioinformatic tools for the study of genomes, genes and proteins with relevant applications in Biotechnology and Biomedicine.
To be trained in the use of basic programming techniques applied to Biology

2. Learning results

This course introduces some fundamental concepts of statistical modelling for biological data and algorithms of computational biology and bioinformatics, from a practical point of view.
The student should learn the following skills:
1: To be able to select the appropriate statistical tool or technique to model different types of biological data and to implement the analysis and modelling of biological data using R.
2: To be able to use fundamental computational tools for the study of genomes, genes and proteins, and their applications in biotechnology and biomedicine.
3: To perform simple programming tasks in the context of biological data.

3. Syllabus

Section 1. Biostatistics:
Advanced probabilistic results for statistical inference. Central limit theorem and others.
Statistical Inference. Parametric and non parametric tests. Multiple testing and error control.
Bayesian methods.
Supervised methods: Prediction models (linear regression models, generalised linear models). Model validation and goodness of fit measures.
Unsupervised methods: Classification techniques and dimension reduction techniques. Markov chains and hidden models.

Section 2. Bioinformatics
Computational tools for data processing in bioinformatics: reading, manipulation and writing of files
Common formats in bioinformatics: nucleic acid and protein sequences and their alignments (FASTA), molecular structures (PDB) and phylogenetic trees (Newick).
Algorithms of the dynamic programming for local and global alignments. Search for similar sequences in local databases by means of alignments. Multiple alignments of DNA and protein sequences and biological sequence-based phylogenetic analysis
Alignments of protein structures and calculation of RMSD.
Design, development and fundamentals of analysis of RNAseq experiments. Gene functional and structural annotation.

4. Academic activities

The course is taught throughout the second semester, from February to June:

- The first 30h correspond to Biostatistics
- The following 30h correspond to Bioinformatics

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the "Facultad de Ciencias" website and the department website (https://ciencias.unizar.es)

5. Assessment system

The final mark is obtained as $0.5*BS+0.5*BI$, where BS and BI are the marks obtained in the Biostatistic and Bioinfomratics assessments, respectively. Each of these marks, BS and BI, can be obtained as the weighted sum of the marks of the following activities:

A. Solving of problems and practical cases, both individually and in team work (75% of the mark). Students must submit a report at the end of each chapter following the guidelines and presentation format.

B. Quizzes which include both theoretical and applied questions at the end of each chapter (25% of the mark).

Alternatively, the students can opt for taking a final exam including problems, practical cases and theoretical questions at the end of the semester.