Advanced Course: Experimental Design and Analysis of Multivariate Data

Date: 28 January – 1 February 2019

Type of course: Theoretical/Practical (35 hours)

Venue: University of Aveiro, Department of Biology, computer room 1.1.49.

Coordinator: Victor Quintino, CESAM & Department of Biology, University of Aveiro

Description

The course is lectured in a computer room, using a problem-solving approach and exploiting teaching and learning case studies. The teaching case studies present the baseline theoretical concepts and the software (PRIMER v6 with the add-on PERMANOVA+). The learning case studies use real datasets and allow participants to apply the theoretical concepts and acquire autonomy in the choice and workflow of the methods. PhD students that already have their own data sets should find enough time to exploit their data and discuss the methods.

Syllabus

1. Introduction. Samples, variables and measurement scales. From univariate to multivariate data collection and analysis.
2. Resemblance. Resemblance functions for the analysis of variables – association and correlation coefficients – and samples – similarity and distance functions. Appropriateness of the resemblance functions to the dataset. Choosing a resemblance function.
3. Clustering. Principle, advantages and disadvantages. The panoply of methods. Agglomerative and divisive methods. Agglomerative hierarchical clustering: single, complete, average and flexible algorithms. Construction and interpretation of dendrograms.
4. Ordination. Principle, advantages and disadvantages. The panoply of methods. Principle coordinate and component analysis (PCO and PCA), correspondence analysis (CA) and non-metric multi-dimensional scaling (MDS). Biplots and interpretation of factorial axes.
5. Multivariate hypothesis testing. Fixed and casual factors, orthogonal and hierarchical designs. Implications on the estimation of variance components. Hypothesis testing with multivariate data: the methods analysis of similarities (ANOSIM) and permutation multivariate analysis of variance (PERMANOVA).

Learning outcomes

Develop skills to understand the theoretical background of experimental design and data analysis concepts and the practical use of software involved in the analysis of multivariate data. The development of the following skills is expected:

1. ability to produce an experimental design to answer a given question, to identify the factors involved and their relationship, as well as adequate controls;
2. build skills in the exploitation and analysis of multivariate data, namely in the choice of adequate resemblance functions to analyse the variables and the samples;
3. build skills in the use of clustering and ordination methods as well as hypothesis testing using multivariate approaches;
4. build skills in the use of software to achieve the above-mentioned objectives.

Assessment

Assessment is restricted to the participants attending doctoral programs and includes group work rendered at the end of the course.

The course is lectured in a computer room with the appropriate software installed (PRIMER v6 with the add-on PERMANOVA+), with a maximum of 30 participants (up to two per computer).

To register, send an e-mail to Prof. Victor Quintino (victor.quintino@ua.pt)