

Advanced Course: Experimental Design and Analysis of Multivariate Data

Date: 22 – 26 January 2024

Type of course: Theoretical/Practical (35 hours contact)

Venue: University of Aveiro (UA), on-line course

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

Description

The course is delivered on-line, using Zoom sessions. The course follows a problem-solving approach, exploiting teaching and learning case studies. The teaching case studies present the baseline theoretical concepts and the software (PRIMER v7 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, should find enough time to exploit it and discuss the methods.

Syllabus

1. Introduction. 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. Advantages and limitations. The panoply of methods. Agglomerative and divisive methods. Agglomerative hierarchical clustering: single, complete, average and flexible algorithms. Construction and interpretation of dendrograms.
4. Ordination. Advantages and limitations. 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 using analysis of similarities (ANOSIM) and permutation multivariate analysis of variance (PERMANOVA).

Learning outcomes

Understand the theoretical background of multivariate data analysis and experimental design concepts and the practical use of appropriate software. The development of the following skills is expected:

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

Who can participate and course assessment

The course is primarily devoted for students attending UA doctoral programs but can accommodate other participants. Assessment is restricted to participants attending UA doctoral programs and includes group work rendered at the end of the course (6 ECTS advanced course). To register, e-mail Prof. Victor Quintino (victor.quintino@ua.pt), no later than January 17, 2024.