

## Experimental Design and Analysis of Multivariate Data

University of Aveiro, Department of Biology, January 29 - February 2, 2018

**Introduction.** Samples, variables and measurement scales. Going from univariate to multivariate data collection and analysis.

**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 data.

**Clustering.** Principle, advantages and disadvantages. The panoply of methods. Agglomerative hierarchical clustering: single, complete, average and flexible algorithms. Construction and interpretation of dendrograms.

**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.

**Multivariate hypothesis testing.** Fixed and casual factors, orthogonal and hierarchical designs. Implications on the estimation of the variance components. Hypothesis testing with multivariate data: the methods analysis of similarities (ANOSIM) and permutation multivariate analysis of variance (PERMANOVA)

The course is primary meant for PhD students, but others can participate, given enough seats. It is lectured in a computer room, using a problem solving approach and exploiting 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. Assessment is restricted to the participants attending doctoral programs and includes individual work rendered at the end of the course.

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