Faculty of Business, Management and Economics,
Faculty of Computing,
and
Laboratory for Perceptual and Cognitive Systems at the Faculty of Computing

invite to
Lectures and Seminars

Advances in Combined Permutation Tests

by

Prof. Stefano Bonnini

Department of Economics and Management
University of Ferrara
Italy

Keywords: permutation test, multivariate statistics, nonparametric combination, finite sample consistency.

In several application problems, the phenomena under study are multidimensional. Therefore, these phenomena are represented by multivariate variables. In multivariate inferential problems, such as tests of hypotheses for comparing two or more populations, where data are assumed to be determinations of random variables, standard parametric methods (e.g. likelihood ratio test, Hotelling T^2 test, ...), when applicable, require stringent assumptions that make them non robust and often inappropriate.
The main limits of these methods are:
1) the assumed underlying distribution is not always plausible or cannot be tested (especially for small sample sizes);
2) the dependence structure (apart from the infrequent case of independent variables) must be formally defined and estimated. For example, in the case of normal multivariate distributions, it is necessary to estimate the covariance matrix or correlation matrix.
The proposed combined nonparametric test, is based on the breakdown of the problem into as many sub-problems as many variables, and on the application of a univariate permutation test for each sub-problem. The combination of the permutation significance level functions of each test provides a unique test statistic (and a unique p-value) to solve the multivariate problem.
The test is therefore distribution-free and the dependence of partial tests doesn't need to be explicitly defined and estimated, because it is implicitly considered in the permutation strategy and in the combination method. Hence, the test can be applied even in the case of nonlinear dependence, when covariances or correlations do not exhaustively describe the dependence.
Another important propriety of this method consists in the "finite sample consistency". Keeping the sample sizes fixed, under the alternative hypothesis, the greater the number q of variables the greater the power of the multivariate test. When q diverges, the power tends to one.

Reference:
Bonnini S, Corain L, Marozzi M, Salmaso L (2014). Nonparametric Hypothesis Testing. Rank and Permutation Methods with Applications in R. Wiley: Chichester.

Timetable

Thursday, May 17, 180 min, seminar
(for participants with minor or no background in R)
Friday, May 18, 90 min, seminar

First two seminars: introduction to basic notions on test of statistical hypothesis and permutation tests (from the methodological side) and R (from the software point of view).

Tuesday, May 22, 90 min, lecture
Wednesday, May 23, 180 min, seminar
Thursday, May 24, 90 min, seminar

Monday, May 28, 90 min, lecture

In seminars testing methods will be presented in using R codes.
Participants are encouraged to take their own computers.

All seminars and lectures will take place in Room 322, Faculty of Business, Management and Economics, Aspazijas blvd. 5. Time: 16 15.