A Nonparametric Multivariate Scatter-Based Ranking Method with Applications to Biomedical Research and Industrial Quality Management

Stefano Bonnini*
Department of Economics and Management, University of Ferrara, Ferrara, Italy – bmsfn@unife.it

Rosa Arboretti
Department of Land, Environment, Agriculture and Forestry, Legnaro (PD), Italy – rosa.arboretti@unipd.it

Livio Corain
Department of Management and Engineering, University of Padova, Vicenza, Italy – livio.corain@unipd.it

Bruno Cozzi
Department of Comparative Biomedicine and Food Science, University of Padova, Legnaro (PD), Italy – bruno.cozzi@unipd.it

Stefano Montelli
Department of Comparative Biomedicine and Food Science, University of Padova, Legnaro (PD), Italy – stefano.montelli@unipd.it

Antonella Peruffo
Department of Comparative Biomedicine and Food Science, University of Padova, Legnaro (PD), Italy – antonella.peruffo@unipd.it

Luigi Salmaso
Department of Management and Engineering, University of Padova, Vicenza, Italy – luigi.salmaso@unipd.it

Abstract

As an extension of the multivariate location-based ranking approach proposed by Arboretti et al. (2014), we present in this work a novel nonparametric and permutation-based method for ranking of multivariate populations concerning with the scatter aspect. Besides the methodological novelty of the approach, it has a practical relevance given that there are many real problems where the need of ranking several multivariate treatments/conditions/etc. regarding an overall variability criterion is the natural goal. Finally, two real case studies in the fields of biomedical research and industrial quality management are introduced, i.e. a cytoarchitectonic study of the cerebral cortex and a search for the best storing condition in the leather industry.

Keywords: multivariate ranking problem; nonparametric combination; permutation tests.