Behaviormetrics:
Quantitative Approaches to Human Behavior 7

Giuseppe Bove
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Methods for the Analysis of Asymmetric Proximity Data

Springer

Behaviormetrics: Quantitative Approaches to Human Behavior

Volume 7

Series Editor

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This series covers in their entirety the elements of behaviormetrics, a term that encompasses all quantitative approaches of research to disclose and understand human behavior in the broadest sense. The term includes the concept, theory, model, algorithm, method, and application of quantitative approaches from theoretical or conceptual studies to empirical or practical application studies to comprehend human behavior. The Behaviormetrics series deals with a wide range of topics of data analysis and of developing new models, algorithms, and methods to analyze these data.

The characteristics featured in the series have four aspects. The first is the variety of the methods utilized in data analysis and a newly developed method that includes not only standard or general statistical methods or psychometric methods traditionally used in data analysis, but also includes cluster analysis, multidimensional scaling, machine learning, corresponding analysis, biplot, network analysis and graph theory, conjoint measurement, biclustering, visualization, and data and web mining. The second aspect is the variety of types of data including ranking, categorical, preference, functional, angle, contextual, nominal, multi-mode multi-way, contextual, continuous, discrete, high-dimensional, and sparse data. The third comprises the varied procedures by which the data are collected: by survey, experiment, sensor devices, and purchase records, and other means. The fourth aspect of the Behaviormetrics series is the diversity of fields from which the data are derived, including marketing and consumer behavior, sociology, psychology, education, archaeology, medicine, economics, political and policy science, cognitive science, public administration, pharmacy, engineering, urban planning, agriculture and forestry science, and brain science.

In essence, the purpose of this series is to describe the new horizons opening up in behaviormetrics — approaches to understanding and disclosing human behaviors both in the analyses of diverse data by a wide range of methods and in the development of new methods to analyze these data.

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To our families

Preface

This monograph originates from the long scientific collaboration between the three Authors on the subject of asymmetry in multidimensional scaling and cluster analysis, through many international meetings and workshops. An initiative of this collaboration was the Special Issue of the journal *Advances in Data Analysis and Classification* entitled *Analysis of Asymmetric Relationships*, published in the year 2018, now followed by this monograph.

The idea is not to write a second book on asymmetric structures of data analysis after the comprehensive exposition of Saito and Yadohisa (2005), but rather an agile monograph on the subject oriented to application in behavioural sciences. Many researchers in different fields collect proximity data such as brand switching or import–export data, flows and migration data and sociomatrices and need methods to explore the structure of their data. Therefore, the monograph is primarily intended as an updated overview of methods available for studying and analysing asymmetric relationships with a special focus on the practical relevance of the methods presented. Methods and results are always accompanied by illustrative graphical representations through real-life examples to be understandable to non-mathematicians and practitioners. The focus is on conceptual understanding and practical know-how rather than mathematical formalization and proofs. Specialized software is provided or referenced to in the final sections of some chapters, to help the computation of some of the models presented. The monograph can be also useful for graduate students interested in asymmetry in different fields of applications. Guidelines for reading are provided in Sect. 1.4.

We are indebted to many people we have shared time with to discuss asymmetry when preparing joint research papers or attending conferences in the last decades. Particularly useful and stimulating were the joint meetings and sessions organized between the Japanese and the Italian Groups of Classification and Data Analysis in 2012.

Special thanks go to Dr. Alessio Serafini for supporting the preparation of some R scripts and for discussing the software sections, to Prof. Tadashi Imaizumi for his help in preparing Sect. 5.5, and to Prof. Mark de Rooij who, with his careful reading, provided detailed and valuable suggestions that made the volume more understandable and accurate. The second author thanks Yosuko Hase for her help in English in Chap. 5.

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