

Multidimensional Analysis of Rankings Permutations

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Keywords: Principal Component Analysis, Mtring Scaling, Latent Constructs.

Abstract.

In this paper we illustrate an original approach to factorial analysis of rankings data. The proposed technique is based on the decomposition of the Spearman's rank correlation matrix defined on a whole set of permutation. The properties of such correlation matrix will be discussed. The complete set of permutation is defined univocally from the size, n , of the ordering task. Indeed, dealing with the class of untied ordinal data, the dataset to reduce is provided, for any given n , by all the possible permutations of the first n integer numbers. The analysis we propose is performed in two steps: firstly aimed at reducing a complete set of permutation data into a few number of orthogonal factors, we define the rank correlation matrix of the permutation set. The factorial decomposition of such matrix by means of Principal Component Analysis allows to transform the huge data set in a reduced number of factors, each of them representing a fixed, *ex-ante*, latent ordering system. It is referred as an *ex-ante* because, at this step, there are no actual observed data in its definition. It will act as a reference system for *ex-post* real data.

In the second step, the *ex-post* ordinal data (empirical observation) can be attribute to one, or more, of the *ex-ante* conceptual partitions according to a statistical measure of membership. The *ex-ante* structure works as a reference representation for all next actual realizations of a measurement process defined on ordinal scale. Once real data are collected, their analysis consists in an analytical and graphical exploration onto the reference structure. The analysis take advantage of traditional tools of multidimensional data analysis and graphical representations.

This approach applies to a wide range of application field where the measurement process can be defined onto a finite countable set of values. A typical example is given by judgments. The properties of the proposed approach and its advantage will be discussed trough a comparison with classical Principal Component Analysis carried out on ordinal preference data.

References

- Hand D.J. (1996) Statistics and the theory of measurement, *Journal of the Royal Statistical Society*, Series A, 159, 445-492.
- Suppes, P., Krantz, D. H., Luce, R. D., Tversky, A. (1989) *Foundations of Measurement: Geometrical, Threshold, and Probabilistic Representations*, San Diego: Academic Press.