Longitudinal Analysis for Matched Series of Studies
Anibal Areia and Manuela M. Oliveira

1 College of Business Sciences, Setubal Polytechnic Institute, Portugal
2 Department of Mathematics and CIMA, University of Évora, Portugal

Abstract. In the first phase of the STATIS methodology the information is contained in a series of studies is first condensed into a symmetric matrix. Models based in the spectral analysis of their mean matrices were developed, see Areia et al. (2008). When their first eigenvalue is dominant a further condensation of the information into a structure vector $\theta$ with $\gamma$ the sum of the squares of its elements is carried out. This enables the joint analysis of matched series of studies associated to the treatments of a base design. Then in the longitudinal analysis of such families of series we study the action of the factors in the base design (contrasts) taken for the components of the structure vectors. An application to elections in Portugal is presented.

Keywords: ANOVA, Inference, Matched Series of Studies, STATIS.


INTRODUCTION

Escoufier (1973) developed a geometric representation for the series of studies. For the series of studies of the first type he obtained operators $X^t S X = [s_{ij}^t]$, $i, j = 1, \ldots, k$, with $s_{ij} = tr [A^t A]$ and the symmetric matrix $X^t D X$, see Areia et al. (2008), with a common structure of degree $h$, given by

$$S = \sum_{r} \lambda r o r^t + E = \sum_{r} \beta r o v^t + E$$

with $\lambda r = \lambda r_1, i = 1, \ldots, k$ and $E$ an errors matrix and presented the tests of validation of this model. In this paper, based on this model, we apply a longitudinal analysis that allows to study the action of factors on the evolution of the structure vectors. A contrast between the components of the vector $v = (v_1, v_2, \ldots, v_m)^t$ can be defined as a linear combination $\sum_{r} (c_r) v_r$, where the components have null sum, $\sum_{r} c_r = 0$. We admit $\beta_1 \sim N(0, \sigma^2)$, independent of $V(l)$, $l = 1, \ldots, m$. As we have $m$ series of studies, $V = \sum_{l=1}^{m} V(l)$ is independent of $\beta(l), l = 1, \ldots, m$.

LONGITUDINAL ANALYSIS

The longitudinal analysis allows the study of matched series of studies. We admit structure common of degree one ($h = 1$), that is, a single structure vector represented by $\beta(l)$ for the $l$ series, with $l = 1, \ldots, m$ and $V(l)$ the corresponding sum of the squares residuals. This analysis is made by using the contrasts. A contrast between the components of the vector $v = (v_1, v_2, \ldots, v_m)^t$ can be defined as a linear combination $\sum_{r=1}^{m} (c_r) v_r$, where the components have null sum, $\sum_{r=1}^{m} c_r = 0$. We admit $\beta(l) \sim N(\beta(l), \sigma^2 W(l)))$ $J = 1, \ldots, m$.

$$\sum_{l=1}^{m} V(l) \sim \sigma^2 \chi^2_m$$

independent of $V(l)$, $l = 1, \ldots, m$. As we have $m$ series of studies, $V = \sum_{l=1}^{m} V(l) \sim \sigma^2 \chi^2_m$ is independent of $\beta(l), l = 1, \ldots, m$.

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