L_1-*Statistical Procedures and Related Topics*
IMS Lecture Notes – Monograph Series (1997) Volume 31

Regression rank statistics

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Abstract: This article deals with a family of implicitly defined rank statistics, which are designed to make inference on general linear hypotheses in a large class of nonparametric extensions of the classical linear model. The new rank statistics are defined via the solutions of a continuous family of minimization problems. For simple designs, the procedure leads to the classical rank statistics.

Key words: Rank regression, logistic regression, robust estimation, transformation models, linear models.

AMS subject classification: Primary 62G05, 62G10, 62G20; secondary 62G30, 62J02.

1 Introduction

For a given known c.d.f. F_0 with continuous positive density f_0 and finite second moment, let us first consider the classical parametric linear model

$$M^{\text{Par}}(F_0) : Y_i \ \sim \ F_0(t - \mu_i), \quad \mu_i = \boldsymbol{\beta}'\mathbf{x}_i \tag{1}$$

where Y_i, $1 \le i \le n$ are independent responses and the vectors $\mathbf{x}_i$ represent design conditions and covariables (we assume that the first component x_{i1} of the $\mathbf{x}_i$ is 1 corresponding to the intercept and denote with $\mathbf{X} = (\mathbf{x}_1', \ldots, \mathbf{x}_n')'$ the design matrix). Usually, in such models one is interested in linear hypotheses of the form

$$H_0^{\text{Par}}(F_0) : \mathbf{C}\boldsymbol{\beta} = \mathbf{0}. \tag{2}$$

It is well known, that this model is not *invariant* w.r.t. nonlinear increasing transformations of the response, that is, if $m(t)$ is a nonlinear increasing function, then the transformed responses $m(Y_i)$ in general do not follow