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Interactive graphical modeling methods for regression

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Abstract: Identification of curvature in regression models is an important aspect of data analysis. Partial residual plots have played a major role. Recently a new class of plots has been developed. They are called CERES plots and include partial residual plots as a special case. Implementation of these plots necessitates modeling the relationships between certain covariates. If these relationships are linear, a partial residual plot is obtained. However, if the relationships are nonlinear, the more general CERES plot is obtained. Generalized additive models (GAM) are another method for identifying and estimating curvature. Again, implementation of a GAM requires modeling the relationships between covariates and the response. Here, we motivate and describe key features of interactive, graphical methods which construct CERES plots and/or GAMs.

Key words: Partial residual plots, CERES plots, Generalized Additive Models, XLISP-STAT, S-PLUS.

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1 Introduction

Conditional expectation residual plots (CERES plots, see Cook, 1993) and Generalized Additive Models (GAMs, see Hastie and Tibshirani, 1990) have been developed in the literature as diagnostic and modeling tools for regression analysis. These methods are designed to detect curvilinear relationships between selected covariates and the response variate in regression. When used interactively, these methods can help detect outliers, give information about possible heteroscedasticity.

In this paper, we outline the basic theory and assumptions underlying CERES plots and GAMs. Using simulated data, we then illustrate how