

Spline-based semiparametric estimation of a zero-inflated Poisson regression single-index model

Minggen Lu¹ · Chin-Shang Li²

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Abstract When the number of zeros in a count dataset exceeds the accommodation of the probability mass of a regular Poisson distribution at zero, the zero-inflated Poisson (ZIP) distribution is often used. To characterize the potential non-linear effects of covariates and avoid the “curse of dimensionality”, we propose a spline-based ZIP regression single-index model. *B*-splines are employed to estimate the unknown smooth function. A modified Fisher scoring method is proposed to simultaneously estimate the linear coefficients and the regression function. It is shown that the spline estimator of the nonparametric component is uniformly consistent, and achieves the optimal convergence rate under the smooth condition, and that the estimators of regression parameters are asymptotically normal and efficient. The spline-based semi-parametric likelihood ratio test is also established. Moreover, a direct and consistent variance estimation method based on least-squares estimation is proposed. Simulations are performed to evaluate the proposed method.

Keywords *B*-spline · Likelihood estimator · Single-index model · Zero-inflated Poisson regression

✉ Chin-Shang Li
cssli@ucdavis.edu
Minggen Lu
minggenl@unr.edu

¹ School of Community Health Sciences, University of Nevada, Reno, NV 89557, USA

² Division of Biostatistics, Department of Public Health Sciences, University of California, Davis, CA 95616, USA