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Robust Shrinkage Principal Component Parameter Estimator for Combating Multicollinearity and Outliers' Problems in a Poisson Regression Model

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Abstract : The Poisson regression model (PRM) is a nonlinear model that belongs to the exponential family of distribution. PRM is suitable for studying count variables using appropriate covariates and sometimes experiences the problem of multicollinearity in the explanatory variables and outliers on the response variable. This study aims to address the problem of multicollinearity and outliers jointly in a Poisson regression model. We developed an estimator called the robust modified jackknife PCKL parameter estimator by combining the principal component estimator, modified jackknife KL and transformed M-estimator estimator to address both problems in a PRM. The superiority conditions for this estimator were established, and the properties of the estimator were also derived. The estimator inherits the characteristics of the combined estimators, thereby making it efficient in addressing both problems. And will also be of immediate interest to the research community and advance this study in terms of novelty compared to other studies undertaken in this area. The performance of the estimator (robust modified jackknife PCKL) with other existing estimators was compared using mean squared error (MSE) as a performance evaluation criterion through a Monte Carlo simulation study and the use of real-life data. The results of the analytical study show that the estimator outperformed other existing estimators compared with by having the smallest MSE across all sample sizes, different levels of correlation, percentages of outliers and different numbers of explanatory variables.

Keywords : jackknife modified KL, outliers, multicollinearity, principal component, transformed M-estimator.
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