Regression for Doubly Inflated Multivariate Poisson Distributions

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Abstract : Dependent multivariate count data occur in several research studies. These data can be modeled by a multivariate Poisson or Negative binomial distribution constructed using copulas. However, when some of the counts are inflated, that is, the number of observations in some cells are much larger than other cells, then the copula based multivariate Poisson (or Negative binomial) distribution may not fit well and it is not an appropriate statistical model for the data. There is a need to modify or adjust the multivariate distribution to account for the inflated frequencies. In this article, we consider the situation where the frequencies of two cells are higher compared to the other cells, and develop a doubly inflated multivariate Poisson distribution function using multivariate Gaussian copula. We also discuss procedures for regression on covariates for the doubly inflated multivariate count data. For illustrating the proposed methodologies, we present a real data containing bivariate count observations with inflations in two cells. Several models and linear predictors with log link functions are considered, and we discuss maximum likelihood estimation to estimate unknown parameters of the models.

Keywords : copula, Gaussian copula, multivariate distributions, inflated distributios
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