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Designing an offset poisson-gamma mixture regression model

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The Negative Binomial distribution is a mixture of a family of Poisson distributions with Gamma mixing weights. In this case, the Poisson parameter is a random variable which is distributed as Gamma. Modeling the probability of success for a single Bernoulli trial with the Negative Binomial distribution as an underlying distribution requires in most application the mean of proportional response for each sub population and not the mean of the actual response. In this paper, a modified Poisson-Gamma mixture regression model is designed to accommodate the option of using proportional mean response. To achieve this, the joint density link of the Poisson– Gamma mixture distribution is modified by introducing an offset term into the Negative Binomial canonical link function. This model is applied in modeling the probability of HIV AIDS infection when over-dispersion, proportion of affected population, individual sex frequency per specified period and number of contacts with infected persons are of interest. Several illustrative examples are used to show that this modification has an advantage over the existing Poisson- Gamma-mixture model.

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