Some generalizations of bivariate discrete distributions and their applications

by

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Abstract

In this paper, we develop a general class of bivariate discrete distributions following the approach of Kundu (2020). Kundu takes each marginal as the random geometric sum of a baseline distribution. We replace the geometric with the logseries distribution as well as the more versatile Hurwitz-Lerch-Zeta (HLZ) distribution, which includes many well-known distributions such as the logseries and Reimann Zeta as special cases (see Gupta et al. (2008) for more details). Two specific stopped-sum models are developed: the bivariate Poisson stopped-sum logseries and the bivariate negative binomial stopped-sum logseries distributions. For these models, the joint probability function (pf), the joint moment generating function (mgf), cross moments, method of moment estimators, maximum likelihood estimators, and Fisher information matrices are obtained. Additionally, we identify whether the families are over-dispersed or under-dispersed and develop a result for the distribution of the sum of the components of these bivariate distributions. In order to compare the performance of the MME with the MLE, we obtain asymptotic relative efficiencies for the models considered. Finally, we present a numerical example from the literature and compare our model's results with those of the past.

Key words: Bivariate discrete distribution, generalized Hurwitz-Lerch zeta, method of moments, method of maximum likelihood, information matrix, asymptotic relative efficiency