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Summer Program on Transportation Statistics
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Lecture: *Bayesian Analysis of Multivariate Crash Counts Using Copulas*

Speaker: Eun Sug Park

Abstract:

There has been growing interest in jointly modeling correlated multivariate crash counts in road safety research over the past decade. To assess the effects of roadway characteristics or environmental factors on crash counts by severity level or by collision type, various models including multivariate Poisson regression models, multivariate negative binomial regression models, and multivariate Poisson-Lognormal regression models have been suggested. We introduce more general copula-based multivariate count regression models with correlated random effects within a Bayesian framework. Copulas provide a flexible way to construct valid multivariate distributions by decomposing any joint distribution into a copula and the marginal distributions. Our models incorporate the dependence among the multivariate crash counts by modeling multivariate random effects using copulas. Overdispersion as well as general correlation structures including both positive and negative correlations in multivariate crash counts can easily be accounted for by this approach. Our copular-based models can also encompass previously suggested multivariate negative binomial regression models and multivariate Poisson-Lognormal regression models. The proposed method is illustrated with the crash count data of five different severity levels collected from 451 three-leg unsignalized intersections in California.

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