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Title:
Covariance modelling and inference for multivariate discrete data in ecology

Abstract:
We propose an algorithm that generalises to discrete data any covariance modelling algorithm originally intended for Gaussian responses, via a Gaussian copula approach. This allows us to explore relationships between discrete variables and to build a plausible and parsimonious model for their covariance that can be estimated even when the number of observations is not large compared to the number of response variables. In the context of ecology, this problem arises when modelling a community of species, where there are large number of species, and therefore potential species interactions, relative to the sample size. Modelling these covariances not only gives insight into how species interact with one another, but also allows us to build models that take these interactions into account when making inferences about associations between a community and the environment. Our covariance modelling algorithm is more flexible than alternate methods, takes advantage of existing algorithms for Gaussian data, and simulations suggest that it outperforms specialised graphical modelling and factor analysis procedures for count and binomial data.

As copulas specify a fully parametric model for the data, they also enable likelihood-based inference about both covariance models and the effects of predictors. This is in contrast to marginal modelling approaches based on generalised estimating equations (GEEs). For example, likelihood ratio tests have better properties than Wald and Score tests based on GEEs; and standard information criteria can be used to choose between competing models for covariance.

About the Speaker:
During her PhD, Gordana explored the use of copulas to model multivariate discrete data in ecology. She then joined Stats Central, the statistical consulting unit at UNSW, where she worked on a great variety or projects, from analysis of longitudinal health data, to modelling river flows to exploring trust using twitter interactions. In her current position as a research associate in the School of Mathematics and Statistics at UNSW she is interested in clustering multivariate data using shrinkage, as well as fast methods for likelihood estimation, particularly for point process models.