Theory and Applications of Copulas

Chair: Johanna Nešlehová (McGill University)

ELIF FIDAN ACAR, McGill University
Statistical Testing for Conditional Copulas

In conditional copula models, the copula parameter is deterministically linked to a covariate via the calibration function. The latter is of central interest for inference and is usually estimated nonparametrically. However, when a parametric model for the calibration function is appropriate, the resulting estimator exhibits significant gains in statistical efficiency. We develop methodology for testing a parametric formulation of the calibration function against a general alternative and propose a generalized likelihood ratio-type test that enables conditional copula model diagnostics. We derive the asymptotic null distribution of the proposed test and study its finite sample performance using simulations.

TOUNKARA FODE, Université Laval
A Copula-based Estimator for the Intracluster Correlation Coefficient

Exchangeable copulas are used to model an extra-binomial variation in Bernoulli experiments with a variable number of trials. Maximum likelihood inference procedures for the intra-cluster correlation coefficient are proposed. Profile confidence intervals are constructed for several specifications of the copula family. Alternative models where the probability of success depends on the number of trials are investigated. The sensitivity of the inference to the specification of the copula family is investigated in a simulation study. Numerical examples are presented.

HÉLA ROMDHANI, Université Laval
Measuring and Testing the Intraclass Dependence for Non-normally Distributed Clustered Data

We are interested in measuring the intraclass dependence for non-normal clustered data. We first propose a generalization of the one way random effect ANOVA model valid for the larger family of elliptical distributions. Under this model, we give the asymptotic properties of the moment estimator of the intraclass correlation coefficient. Then we propose an estimator of Kendall's tau adapted to exchangeable data. Under a copula model, we derive its asymptotic distribution and give an estimator for its variance. We also give an alternative estimator of the intraclass correlation coefficient for the class of elliptical distributions and derive its asymptotic properties.

BIN DONG, NCIC Clinical Trials Group, Queen's University
Copula Estimation for Censored Data via Empirical Likelihood: NCIC CTG MA.27 and MA.14 Endocrine Breast Cancer Trials

In multivariate survival analysis, copulas have become a popular tool for modeling the dependence in a vector of continuous time-to-event random variables subject to censoring. Many authors have investigated goodness-of-fit (gof) tests for copulas. In the presence of censoring, most of the established work is restricted to a particular class of copulas. In order to develop a gof test procedure that can used in more general situations, I use an empirical likelihood (EL) approach to estimate copula non-parametrically. With this EL-based estimator of a copula, I can derive a gof test for assessing a specific parametric copula model for censored data.

BEILEI WU, University of Calgary
Flexible Random Effects Copula Models for Clustered Mixed Outcomes – Application in Toxicology

We employ random effects models to analyze clustered mixed-outcomes and account for associations between discrete and continuous outcomes within clusters. The regression parameters in models for both outcomes are marginally meaningful; in

addition, by assuming a latent variable framework to describe discrete outcomes, complications of copulas to discrete variables are avoided. The marginal distributions can be chosen from any distributions. Maximum likelihood estimation is implemented using SAS. Results of simulations concerning the bias and efficiency of the estimates are reported. The proposed methodology is motivated by and illustrated using a developmental toxicity study of ethylene glycol in mice.