# Statistical Inference and Applications 2

Chair: Zhou Zhou (University of Toronto)

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**SHIRIN GOLCHI**, Simon Fraser University

*Sequentially-constrained Monte Carlo*

Imposition of constraints can be a source of challenge in Bayesian modelling. Constraint can be interpreted in a broad sense as any kind of explicit restriction over the model such as positivity of parameters or monotonicity of functions, adherence of the model to a deterministic system or a conservative selection criteria in approximate Bayesian computation. We propose a variant of sequential Monte Carlo algorithm for posterior sampling in presence of constraints. The specific parametrization of the constraints in the model is used to define a filtering sequence of distributions. Particles generated from an unconstrained or mildly constrained distribution are filtered and moved through sampling and re-sampling steps to obtain a sample from the fully constrained target distribution.

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**AVIK HALDER**, Queen's University

*On Simulation of the Beta-Dirichlet Process*

The beta-Dirichlet process was introduced by Kim, James and Weissbach (2012). They have used this process as a prior for Bayesian analysis of cumulative hazard functions associated with any multistate event history data analysis. We will propose two new methods for simulation from beta-Dirichlet process and use them for estimation of the cumulative hazard functions associated with multistate event history data analysis. The first method is based on the Indian Buffet Process and the second method is based on an approximation proposed by Al Labadi (2012). We will compare these two simulation schemes with one proposed by Kim, James and Weissbach (2012). The first method based on the Indian Buffet Process produces exact samples while the other methods produce approximate samples.

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**WAN-CHEN LEE**, University of Manitoba

*On Curved Exponential Imbedding and its Applications*

In the regression model, the mean and variance of the response variable may be a function of the parameter such as $E(Y \mid X) = X\theta$ and $Var(Y \mid X) = \gamma(\theta)$. Under this case, the usual weighted least squares estimator is often an inconsistent estimator. The quasi likelihood estimator is an inefficient estimator, however, may be a consistent estimator. We propose an estimator based on curved exponential imbedding procedure. The estimator derived by this procedure has several optimal properties such as consistency and exponential rate of convergence. An example will be given to illustrate the procedure and results.

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**FRANCOIS PERRON**, University of Montreal

*On the Extensions of Subcopulas*

The Sklar theorem says that it is always possible to extend a subcopula to a copula. Particular extensions are known. We want to find all of the possible extensions. The solutions to this problem are known for the subcopula associated to discrete random variables. In the most general setting some solutions have been proposed but we found major errors in the proposed solutions. In this talk we will present our solution and we will explain why the other solutions are not fully general. We will also discuss the problem of finding the maximal copula extending a subcopula. The standard results, for copula related to discrete random variables involve series expansions. We will derive a fairly simple formula.

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**SERGE PROVOST**, The University of Western Ontario

*Improved Saddlepoint Density Approximations through Polynomial Adjustments*

Improved density approximations are obtained by means of moment-based polynomial adjustments applied to the widely used saddlepoint approximation, the initial distributional support being determined from the Lugannani-Rice formula. Approximate percentiles, as evaluated from the original saddlepoint formula and its adjusted counterpart, are compared both numerically and graphically to their exact values in several illustrative examples. The bivariate case is addressed by applying a polynomial adjustment to the product of the approximated marginal densities of the standardized variables. Furthermore, extensions to the context of density estimation are formulated and applied to several univariate and bivariate data sets. Interestingly, the proposed methodology for approximating bivariate distributions gives rise to copula density functions that prove much more flexible than the conventional functional type.

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**AARON SPRINGFORD**, Queen's University at Kingston

*Analysis of Time series with Unknown Times Using a Hierarchical Chronology Model*

Time series analysis is well developed when sampling times are known, but latent times pose an additional challenge. For example, paleoenvironmental core data consist of samples collected at sequential depths in an extracted core (e.g. sediment, ice). The age of samples is unknown partly due to variation in deposition rate of the core material. A chronology model that relates depth to age is required in order for time series analysis to proceed. Early approaches included curve fitting and piecewise linear chronology models. More recent approaches model the deposition process but allow unrealistic deposition rates. I present a Bayesian hierarchical approach that regularises deposition rates at the prior level. The model is then incorporated into the overall time series analysis framework.