Canadian Statistical Sciences Institute
Institut canadien des sciences statistiques

Simon Fraser University
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CANSSI Quebec Recruitment Scholarship

List of Potential Supervisors (2024)

1. **Cédric Beaulac**
   (beaulac.cedric@uqam.ca)
   Professor, Université du Québec à Montréal (UQAM) Mathematics
   Research Interests: I am developing novel models for image analysis by integrating tools from functional data analysis. The main idea behind the models I am developing is to study shapes in images rather than simply rely on pixels. There are multiple potential projets ranging from edge dectection to shape generation.

2. **Jean-François Renaud**
   (renaud.jf@uqam.ca)
   Professor, Université du Québec à Montréal (UQAM) Mathematics
   Research Interests: My research interests fall under the (large) umbrella of stochastic optimization and dynamic decision-making. More specifically, I'm interested in stochastic control problems in which withdrawals (e.g., dividend payments) and injections (e.g., issuance of equity) are possible to alter the evolution of a stochastic system (e.g., cash fund). My approach is rather probabilistic and thus based on stochastic processes, such as diffusion processes or Lévy processes.

3. **Yang Lu**
   (yang.lu@concordia.ca)
   Associate Professor, Concordia University, Department of Mathematics and Statistics
   Research Interests: I am interested in statistical applications in insurance and finance.

4. **Masoud Asgharian**
   (masoud.asgharian2@mcgill.ca)
   Member of the Faculty of Science (Full Professor), McGill University, Mathematics and Statistics
   Research Interests: I have diverse interests and have supervised in the following areas: Survival analysis, Causal inference, Large p Small n problems, Learning theory and OR/Optimization. My current research is mostly focused on causality and learning on selection bias.

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5. **Léo Belzile**
   (leo.belzile@hec.ca)
   Associate Professor, HEC Montréal, Decision Sciences
   Research Interests: Modeling of rare events and extreme values: multidimensional and spatio-temporal extremes, Bayesian and likelihood-based inference. Detection and attribution. Applications in hydrology, environment, demography, and climate sciences. *Potential Projects:* 1. Semiparametric models for extremes in survival data, 2. Stochastic generators for extreme precipitation, 3. Extremes based on the geometric approach: estimators and asymptotic theory, 4. Multidimensional spatial extreme models.

6. **Johanna Neslehova**
   (johanna.neslehova@mcgill.ca)
   Full Professor, McGill University, Department of Mathematics and Statistics
   Research Interests: Extreme-value theory: multivariate modeling, spatio-temporal extremes and causal inference for extremes, extremes of dependent sequences. Multivariate analysis: dependence modeling, rank-based inference for copula models, models for data with ties. Applications of these models in the environmental sciences, health and risk management.

7. **Alexandre Bureau**
   (alexandre.bureau@fmed.ulaval.ca)
   Professor, Université Laval, Social and Preventive Medicine
   Research Interests: Developing statistical methods to infer gene expression regulation mechanisms from 3D genomic contact data obtained using technologies such as single-cell Hi-C. This research is motivated by studies of schizophrenia and bipolar disorder conducted at the CERVO Brain Research Centre and focuses on brain tissues.

8. **Denis Talbot**
   (denis.talbot@fmed.ulaval.ca)
   Professor, Université Laval, Social and Preventive Medicine
   Research Interests: My research focuses broadly on the development, adaptation, and evaluation of statistical methods for causal inference from epidemiological health data. Causal inference aims to determine the impact of an intervention, such as a medical treatment or public policy, on an outcome. The research project for which I seek to recruit a PhD student aims to develop new methods for causal inference in personalized medicine when the outcome of interest is time-to-event data (i.e.,

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survival data). Personalized medicine seeks to identify decision rules that consider individuals' characteristics to optimize their health outcomes. Although several methods have been developed in recent years, significant challenges remain for survival data. For example, many methods require strong assumptions regarding the censoring mechanism and do not handle competing risks in a statistically valid and clinically relevant way. The project's objective is to develop new methods better suited for survival data. We will use semiparametric or nonparametric efficiency theory to develop estimators that integrate machine learning while maintaining desirable theoretical properties (e.g., root-n convergence). This project is motivated by the need to better personalize hormone therapy recommendations for women with breast cancer. This treatment is currently recommended for most women with non-metastatic hormone-dependent breast cancer but does not always produce the desired effects. To avoid unnecessary side effects for women who will not benefit, it is essential to better identify these women. The project will be carried out in close collaboration with epidemiology experts and a patient partner. The project is funded by the Canadian Institutes of Health Research.

9. **Melina Mailhot**
   (melina.mailhot@concordia.ca)
   Associate Professor, Concordia Unversity, Mathematics and Statistics
   Research Interests: My research interests are related to spatio-temporal models related to insurable risks affected by natural catastrophes. The potential projects are related to dependence models and multivariate risk measures and risk uncertainty.

10. **Lisa Kakinami**
    (lisa.kakinami@concordia.ca)
    Associate Professor, Concordia University, Mathematics and Statistics
    Research Interests: From the perspective of epidemiology and applied (bio)statistics, my research falls into one of four domains within a broad overview of obesity and cardiovascular disease risk:
    (1) health methodologies (validation)
    (2) the environment (social and built) and health
    (3) socioeconomic determinants of health
    (4) health behaviours and chronic disease
    Potential projects include:
    - Longitudinal association between neighbourhood socioeconomic position and the built environment on future health
    - Measurement uncertainty of the built environment

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-Statistical learning approaches to body composition measurements on predicting health
-Health consequences of weight intentions and weight history
-The use of compensatory behaviours, and their health implications

11. Juliana Schulz

(juliana.schulz@hec.ca)
Associate Professor, HEC Montréal, Department of Decision Sciences
Research Interests: My work primarily focuses on dependence modelling, with the goal of developing novel multivariate statistical models appropriate for various types of data, including multi-dimensional discrete and mixed outcomes. With a background in actuarial mathematics, I am particularly interested in developing statistical methods appropriate for the analysis of multivariate claims data stemming from non-life insurance. I am also interested in biostatistical approaches for precision medicine wherein the objective is to develop statistical methods for estimating optimal personalized treatment strategies.

12. Taoufik Bouezmarni

(Taoufik.Bouezmarni@Usherbrooke.ca)
Full Professor, Université de Sherbrooke, Mathematics
Research Interests: Survival Analysis; Kernel smoothing for semi and nonparametric methods; Econometrics (Causality and inequality); Dependence modelling: estimation and inference; Independence and conditional independence tests.

13. Maciej Augustyniak

(maciej.augustyniak@umontreal.ca)
Associate Professor, Université de Montréal, Mathematics and Statistics
Research Interests: I am a researcher in actuarial science and quantitative risk management. My research aims to develop new models and methods to quantify and manage long-term risks in actuarial and financial applications. This research program involves multidisciplinary expertise, and therefore, I have research interests in various disciplines. *Econometrics and Computational Statistics:* I seek to contribute methodologically and in modeling within the class of hidden Markov chain processes applied to financial time series. *Keywords in English: hidden Markov models, regime-switching models, GARCH models, state space models, filtering techniques, particle filters, Kalman filter, EM algorithm*. *Quantitative Finance:* My goal is to study and develop techniques for more effective management of long-term financial risks. *Keywords in English: quadratic hedging, variance-optimal hedging, mean-variance*

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hedging, local risk-minimization, dynamic programming. *Actuarial Science:* I aim to analyze and improve the efficiency of hedging strategies used in the context of financial products sold with investment guarantees, known as segregated funds. *Keywords in English: risk management, dynamic hedging, variable annuities, equity-linked life insurance, segregated funds, model risk, lapse risk, stochastic volatility, stochastic interest rates*.

14. Karim Oualkacha

(oualkacha.karim@uqam.ca)
Professor, Université du Québec à Montréal, Mathematics
Research Interests: My research deals with developing multivariate statistical models for analyses of high-dimensional and dependent data, with applications to genomics studies. In many genetic studies, clinically-relevant multiple phenotypes (outcomes) are measured. Understanding their relationship with recent high-throughput genomic data is of primary interest to many practitioners. I have developed several methods to maximize the utility of multiple correlated, e.g., principal components of heritability. This is known as phenotype optimization problem. Modelling the dependence of multiple phenotypes via copulas is another aspect to tackle the phenotype optimization problem, and is also a research area that I am interested in. I have developed several copula-based association models for familial data and both continuous (non-normally distributed), dichotomous and mixed phenotypes. Penalized (robust) regression methods are also another important component in my research given that genomics data are high dimensional, noisy, and heterogeneity prone. I have developed several penalized quantile/expectile regression methods, and penalized generalized linear mixed models, with most appealing penalties.

Potential project: with my PhD student, Julien St-Pierre (U McGill), who is graduating in October 2024, I have developed a penalized GLMM framework (pGLMM) for high-dimensional setting (St-Pierre et al., Bioinformatics, 2023, btad063). pGLMM accounts for the familial dependency structure between subjects from the same family using a random effect. The model parameters are estimated through a loss function based on the penalized quasi-likelihood (PQL). pGLMM uses block coordinate descent techniques to solve the underlying optimization problem to estimate both fixed and random effects parameters of the model in presence of high-dimensional genetic data. This makes it computationally efficient and allows it to scale to large biobank genomics data. Through both simulation study and analysis of data from UKBiobank cohort study, pGLMM demonstrates its superiority compared to existing penalized models that are dealing with familial structure. The proposed PhD project aims to

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extend pGLMM to penalized Lp-quantile framework, including both penalized quantile and expectile regression methods, in presence of related subjects and/or hidden relatedness. This aim will be achieved by adding random effects into the Lp-quantile regression model to control for familial (or hidden relatedness) dependency. In fact, if one assumes that a (continuous) outcome of interest is generated from the skewed power exponential distribution (Nelson (1991), Econometrica, 59, 347-370), some simple calculation can show that the Lp-quanitle loss function estimation is equivalent to the maximum likelihood estimation. Thus, we will assume that, conditionally on the covariates and the random effects, the outcome follows skewed power exponential distribution. This allows us to write the conditional likelihood as the integral of the Lp quantile loss. To get rid of the integral and obtain the marginal likelihood, Laplace approximation technique, similar to what we did in pGLMM, can be used. To allow for variable selection, a penalty term, in a same way as in pGLMM, will be added to the Lp-quantile model to perform variable selection in the context of genetic association studies. We will hold regular meetings to discuss the progress of the research, address challenges, and plan next steps. These meetings will provide the opportunity for feedback and guidance. We will identify technical skills and theoretical knowledge needed for the research. Recommend courses, workshops, or seminars that will help the student acquire these skills.

15. **Kirill Neklyudov**
    (kirill.nekliudov@umontreal.ca)
    Assistant Professor, Université de Montréal, Mathematics and Statistics
    Research Interests: My studies include Artificial Intelligence for applications in natural sciences, Optimal Transport, Differential Geometry of probability spaces, and Monte Carlo methods.

16. **Abbas Khalili**
    (abbas.khalili@mcgill.ca)
    Professor of Statistics, McGill University, Mathematics and Statistics
    Research Interests: The main theme of my research is:
    1. High-dimensional statistics
    2. Distributed learning in big data problems
    3. Neural Networks: theory and applications in latent variable models
    4. Post-model selection inference

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