General information

Applications are invited for Undergraduate NSERC Research Assistantships. These projects provide undergraduate students, an opportunity for research experience during the summer. Each award is for sixteen weeks during May to August 2014, and pays between $1,500 and $2,000 per month, depending on qualifications.

Projects

In this proposal the student will be able to opt for one of the following six projects:

Assessing Spatial Models through ROC curves

This project is supervised by Associate Professor Patrick Brown: This involves 1) establishing a general framework for comparing spatial models via simulation studies and ROC curves; 2) creating and documenting R code for carrying out such comparisons; and 3) using this code and methodology to address a number of current problems. Specific questions to be addressed include comparing continuously defined geostatistical models to discretely valued Markov random field models; assessing the adequacy of fixing a Matern shape parameter at 1 or 2 vs estimating this parameter; and evaluating the performance of the Markov Random Field approximation to the Matern in practical situations. Each of this questions will involve: first, specifying a true model to simulate from; second, performing inference on the simulated data using a number of different models; and third, using repeated simulations to calculate false positive and false negative rates. ROC curves are obtained by graphing these true rates for different significance levels.

High Frequency Financial Data Analysis and Algorithmic Trading

This project is supervised by Associate Professor Sebastian Jaimungal: Computerized trading has revolutionized the way in which financial markets work. Nowadays, all major exchanges operate on electronic platforms where market participants’ trade using powerful hardware and customized software built on sophisticated stochastic models. Now, with the availability of high frequency financial data, new areas of research in stochastic modeling and stochastic control have opened up. In this research project, the successful candidate will gain an understanding of the basic concepts, questions and methods that arise in this domain. He/she will assist in analyzing high frequency financial data using discrete time-series and continuous time stochastic models. Furthermore, they will assist in determining the proper stochastic control problem to pose. The solution of these control problems result in analyzing Hamilton-Jacobi-Bellman type equations and the successful candidate will implement numerical schemes for solving the various non-linear PDEs that arise. The successful candidate must have a solid command of: ODEs, PDEs, Probability, Time-Series Models, Stochastic Processes and have computing experience (preferably in Matlab). Familiarity with finance is a plus but not required.
Fitting Erlang-Based Models to Insurance Loss Data

This project is supervised by Professor Sheldon Lin: The project deals with fitting Erlang-based mixture models to insurance loss data and operational risk loss data. The main objective of the project is to focus on the design of the Expectation-Maximization (EM) algorithm for parameter estimation multivariate Erlang mixtures and multivariate Negative Binomial mixtures. The student will work on the improvement of the algorithms we have developed, as well as testing the efficiency of the algorithms and applying them to real insurance data.

Adjusted profile log-likelihoods in semi-parametric models

This project is supervised by Professor Nancy Reid: Many semi-parametric regression models involve introducing a relatively large number of nuisance parameters, usually as coefficients for a regression on basis functions. In parametric models profile log-likelihoods can lead to misleading inference when there are a lot of nuisance parameters, and a number of adjusted profile log-likelihoods have been suggested to address this problem. This project will experiment with the application of these adjustments to semi-parametric logistic regression, using various data sets from the field of machine learning, and a number of simulations.

Familiarity with likelihood inference and experience with the R programming language are required.

High Dimensional Data Analysis

This project is supervised by Professor Muni Srivastava: Recent Advances in technology to obtain DNA microarrays have made it possible to measure quantitatively the expression of thousands of genes. These observations are, however, correlated to each other as the genes are from the same subject. Since the number of subjects available for taking the observations are so few as compared to the gene expressions, high dimensional multivariate theory and analysis is required to analyze the data. In this project recent available theory will be applied to analyze the available data.

A Survey of Hypothesis Testing for Functional Data

This project is supervised by Associate Professor Fang Yao: In this project we begin with comparing several existing hypothesis testing procedures for two-sample and multi-sample functional data under dense observational schemes. This is essential to provide insight towards seeking more effective and efficient methods for such testing problems. One of the key challenges lie in the infinite dimensionality of functional data, while existing methods only considered finite-dimensional approximating models. Furthermore, the functional data we eventually deal with can be observed sparsely over the time domain and corrupted with measurement error. None of the existing approaches have treated test procedures for such challenging situations. The purpose of the proposed project is to carefully survey the strength and weakness of some previously proposed test procedures. The background on statistical computing using R or Matlab is required, and students with basic understanding of nonparametric regression and functional data are especially encouraged to apply.
How to apply

Applicants should be undergraduate students in mathematics, statistics or actuarial science with a "B" standing. In accordance with NSERC regulations, applicants must hold Canadian citizen or permanent resident of Canada. Registered (at the time of application), in a bachelor’s degree program (and not holding higher degrees) at an eligible university in the term immediately before holding the award. Already holds a bachelor’s degree and is studying towards a second bachelor’s degree in the natural sciences or engineering. Interested applicants should contact Andrea Carter, Department of Statistical Sciences Room 6022 as soon as possible.

How to submit your application(s):

1. Submit: 1st page of NSERC USRA form, an unofficial transcript from ROSI and cover letter stating why you want a summer research award, and an indication of which project(s) you would like to apply for. You can apply for more than one project by indicating it in your cover letter.

2. This is due within 5 days to the department which is Friday, February 14th. The supervisors have one week to decide whether or not to interview the prospective student(s) or not. When the supervisor decides, the student(s) will be contacted to order an official transcript and have it sent directly to the department or deliver in person. Please do not open the transcript if delivered in person.

3. The unsuccessful students will be contacted by email regarding the decision.

Please Note: New – Starting this competition, USRA application information will be captured from the NSERC On-line System. Therefore, all applications MUST be completed by students and their supervisors online (https://ebiz.nserc.ca/nserc_web/nserc_login_e.htm). Applications must then be printed and signed manually. Those prepared by any other means (e.g., handwritten or manually typewritten) will NOT be accepted.

Completed applications are due by Friday, February 21, 2014. This due date is for the department only.