

Summer 2017 NSERC Undergraduate Research Assistantships

Department of Statistical Sciences, University of Toronto

General information:

Applications are invited for Undergraduate NSERC Research Assistantships. These projects provide undergraduate students with an opportunity for research experience during the summer. Each award is for sixteen weeks during May to August 2017, 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 four projects:

Directional Testing in High-Dimensional Regression

Supervised by: Professors Nancy Reid and Don Fraser

This project will involve computation of directional tests, as defined in Fraser et al. (2014, 2016), in various regression settings. Those papers showed how to compute directional p-values, and mentioned the possibility of extending this to p-value functions for suitably defined parameters. In addition to exploring this, the project will involve studying how well the methods work as the dimension of the parameter increases, and whether any links can be established between directional tests and regularization methods. Time permitting, some aspects of the power of directional tests will be investigated.

The applicant should be familiar with likelihood-based inference and linear regression, and have facility programming in R. Experience with generalized linear models is an asset but not required.

Algorithmic Trading with Latent Information

Supervised by: Associate Professor Sebastian Jaimungal

Financial markets as a whole are driven by a huge number of factors, many of which are latent. Intraday markets typically run through phases of mean-reversion, momentum, and random walks, however, which of these phases the market is in is not an observable, rather it must be filtered from the observed prices and order book information. This project aims to make use of machine learning techniques combined with stochastic control of partially observed systems to making optimal trading decisions in a variety of environments.

The successful candidate must have command of programming in Matlab, and C++ or C#, as well as an understanding of statistical machine learning techniques. Knowledge of financial markets, particular electronic trading is an asset. The project will involve working with real data, developing and implementing cutting edge research.

Loss Reserving and Ruin Probabilities

Supervised by: Associate Professor Andrei Badescu

Loss reserving is of paramount importance for Property and Casualty insurance since it is a cornerstone for ratemaking and solvency evaluation. Among the many categories of reserves, Incurred But Not yet Reported (IBNR) claim reserve is an important and rather unique one. For lines of business featuring a long reporting lag, it is highly possible that a large proportion of claims incurred during the evaluation period are reported long after the evaluation date. Failing to recognize the IBNR claims will undermine the validity of the subsequent product pricing and even threaten the soundness of solvency management of the insurance company.

While "macro-level" models were designed to tackle with relatively coarse data before the advent of powerful computers, nowadays more exquisite (both mathematically and statistically) models are required to extract more information from the complex datasets (or big data) available in practice.

The current project proposes to dig into "micro-level" models and analyze certain dependencies that occur among reporting lags, settlement legs and claim sizes. On top of this, we plan to incorporate some of these quantities in a closely related insurance area, in ruin theory. One object that we try to investigate here is how to calculate ruin probabilities under various scenarios when the IBNR and the RBNS reserve is taken into consideration.

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. Students should be 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. If a student already holds a bachelor's degree and is studying towards a second bachelor's degree in the natural sciences or engineering, they are also eligible. Interested students should submit their application(s) to Gillis Aning, Department of Statistical Sciences Room 6018 in person or email it as an attachment to gillis.aning@utoronto.ca.

How to submit your application(s):

1. Submit the 1st page of NSERC USRA form, an unofficial transcript from ROSI and a cover letter stating why you want a summer research award, and also state which project you would like to apply for. Students may apply for more than one project. If you are applying for more than one project, please prepare a separate application for each project.
2. **Student applications are due to the department by Monday, February 27th.** The supervisors have one week to decide whether or not to interview the prospective student(s). 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. Unsuccessful students will be contacted by email regarding the decision.

***Please Note:** 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 be submitted online and then be printed for submission to Research Services. Those prepared by any other means (e.g., handwritten or manually typewritten) will **NOT** be accepted.

Completed applications are due by Friday, March 3rd (Supervisors due date to the department.)