

Summer 2020 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 2020, and pays between \$1,500 and \$2,000 per month, depending on qualifications.

Projects

Case-Crossover Models for Daily Mortality and Air Pollution

Supervised by: Professor Patrick Brown

This project will involve developing models and creating software for quantifying the relationship between daily mortality and air quality in Canadian cities using case-crossover models. The research group at the Centre for Global Health Research has, under contract from Health Canada, been analyzing 30 years of daily cause-specific mortality and morbidity data from 25 cities and relating it to air quality monitoring data from ground stations in a semi-parametric Bayesian analysis. In the first stage of this project the models and methods have been developed and an R package for fitting data from a single city has been written. The next stage will be to extend the model to accommodate data from multiple cities, allowing for possible variation in the effect of air pollution between them. The goals of the larger research project are to 1) create a comprehensive statistical modelling framework for modelling daily mortality data from multiple cities, accounting for uncertainty in air pollution measurements, non-linear response curves, and variation amongst cities; 2) use these methods to undertake the definitive analysis of daily mortality and air quality in Canada since 1990, for publication in a high-impact health journal; and 3) disseminate a suite of R packages implementing the methodology, suitable for use by epidemiologists and environmental scientists.

The tasks which the summer student will be responsible for are as follows.

1. become familiar with case-crossover models, non-parametric modelling with random walks, and software able to fit these models using Bayesian inference
2. modify the software to fit a hierarchical version of the model for data from different cities and regions
3. create an R interface for the model and incorporate it into the existing R package
4. write help files, examples, and a vignette demonstrating the methodology for the R package

The summer project will be supervised by Patrick Brown and will involve close collaboration with PhD student Alex Stringer, postdoc Guowen Huang, and several epidemiologists and geographers at the Centre for Global Health Research.

Sensitivity Analysis of a Life Insurance Portfolio Using SWIM

Supervised by: Professor Silvana Pesenti

In this project, we perform sensitivity analyses of a life insurance portfolio using the R package SWIM. SWIM (which I developed with my co-authors) provides a novel methodology to perform analysis sensitivity to risk factors in a numerically efficient way. In an insurance and regulatory context, sensitivity analysis is of central importance and answers questions such as: What is the impact of a pandemic, such as the

Coronavirus, on a life insurance company's loss? For further information about SWIM, see the article in The Actuary, the British journal of insurance practitioners, <https://www.theactuary.com/features/2020/03/sensitivity-analysis-swimming-lessons/>.

Modelling the Cascading of Defaults in a Financial Market

Supervised by: Professor Silvana Pesenti

In this project we model how the default of a financial institution propagates through a financial market model. Specifically, in a financial market model consisting of a network of banking institutions, we investigate which institution is systemically important and/or causes other banks to become distressed, using the cascade sensitivity measure. Further, we aim to analysis the impact the interconnectedness of the financial institutions has on the propagation of defaults in the market.

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 SS 6024 in person or email it as an attachment to ug.statistics@utstat.utoronto.ca

How to submit your application(s):

1. Submit the 1st page of NSERC USRA form(https://ebiz.nserc.ca/nserc_web/nserc_login_e.htm), 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, March 23rd**. 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. Those prepared by any other means (e.g., handwritten or manually typewritten) will **NOT** be accepted.

Completed applications are due by Monday, March 23rd