QUANTITATIVE ANALYSIS FOR GEOGRAPHICAL RESEARCH GEOG 5002 - Winter 2017

Instructor:	M. Richardson; B355 Loeb Building 520-2600 ex. 2574; murray.richardson@carleton.ca
Office Hours:	TBD
Meetings:	Mondays and Wednesdays 11:35-13:25 in A220 Loeb Building

Recommended Textbooks:

There is no required textbook. Recommended reference materials will be introduced at the beginning of the course.

Objectives: This course will cover topics in quantitative geographic analysis using the popular open source software R. The course will begin with an introduction to the R programming language including data structures, syntax, descriptive and inferential statistics, and basic programming techniques. Once these foundations are in place, students will apply advanced quantitative analysis techniques to a wide range of environmental and geographic data sets. Students will develop critical understanding and technical knowledge of the broad field of environmental modelling through readings, workshops and problem sets. The course will culminate in individual research projects focused on a suitable environmental modelling problem, ideally chosen with input from each student's graduate supervisor.

Course topics: Statistical computing with R programming language

Multiple regression Classification and regression trees Machine learning with Random Forest Model selection and cross-validation Time series analysis Model simulation and optimization Uncertainty and error Equifinality and model parsimony Model calibration and validation Spatial autocorrelation and variography

Program:	Workshops as per schedule			
	Readings as assigned			
	Problem sets as assigned			
	Modelling project proposal and presentation			
	Online quizzes (self-paced)			
	Final project presentation			
	Final project report			
Evaluation :	Problem Sets	25%		
	Modelling project proposal	10%		
	Modelling project report	40%		
	Online statistics quizzes	10%		
	Presentations	15%		
		100%		

Assignments

1) Problem sets: You will be assigned several problem sets throughout the semester. These are designed to help you understand apply key concepts and develop hands-on experience solving quantitative research problems with R.

2) Modelling Project Proposal and Report: The purpose of the modelling project is to develop a more in-depth and working knowledge of statistics with R, with application to a problem of relevance to your research topic. You should focus on either analysis of a dataset using methods learned in class, or on implementation of a new technique not learned in the course. You are expected to discuss the topic of this project with your supervisor and may wish to request a suitable dataset from them. You will write a project proposal at the half-way point in the course, to be submitted for evaluation. The project report should follow the format of a journal article, with allowance for appendices and additional figures.

3) Presentations: You will deliver two short (~15 minute) oral presentations to the class throughout the semester. The first will provide an overview of your proposed modelling project proposal. In the second presentation during the last week of classes, you will present your findings.

4) Quizzes – a series of short (~10 question) online quizzes must be completed by all students in order to demonstrate that you have a solid grasp of fundamental statistical concepts, as expected at the graduate level in our program. You will be directed towards appropriate readings to help you prepare for and succeed in these quizzes.

4) You will be assigned journal article readings throughout the course and some meetings may be devoted to discussion of key concepts introduced in the course. All students must come prepared to discuss the readings and individuals may be asked to lead discussions without prior notice.

Week	Date/Week of	Topics
1	Jan 9	Course Introduction Introduction to R and RStudio Review of elementary statistics (e.g. description, probabilities of the normal distribution)
2	Jan 16	Central Limit Theorem, Confidence Intervals (PS1)
3	Jan 23	Inference Power Analysis Correlation and Regression
4	Jan 30	Regression DiagnosticsMultiple Linear Regression(PS2)
5	Feb 6	Model Selection CART and Random Forest
6	Feb 13	Bootstrapping and Cross-Validation (PS3)
	Feb 20	Reading Week No Class
7	Feb 27	PCA
8	March 6	Project Proposal Presentations
9	March 13	Time Series Analysis (PS4)
10	March 20	Model optimization and parameter uncertainty
11	March 27	Murray away this week
12	April 3	Time Series Analysis Spatial Data Handling in R
13	Wed Dec 3	Final Project Presentations