

Statistics and Spatial Analysis (GEOG 202)



Fall 2021
Department of Geography
McGill University

Schedule (Except October 12, 13 and 15 for Fall reading break)

Lectures: Wednesday and Friday 13:05- 14:25pm

Labs: Tuesdays 08:35- 11:25am

Course location: Burnside Hall 511

First day of class: Wednesday, September 1

Last day of class: Friday, December 3

Instructor:

Bidhya Sharma
Office hours: Mondays 10:00 am-12:00pm. At other times by appointment only
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Course Objectives & Outline

This course is intended to introduce you to basic statistical concepts of spatial and non-spatial analysis. The emphasis is on understanding how to select an appropriate descriptive tool or analytical test for different types of data, how to manage particularly spatial problems in statistical analysis, how to conduct basic analyses using statistical software, and how to interpret the output of analyses.

The course aims to enable you to acquire

- a knowledge and understanding of basic statistical concepts
- analytical methodological skills, to apply basic spatial and non-spatial analysis
- analytical writing skills, to produce, read and interpret analytical reports
- an introductory understanding of the software packages
- confidence in dealing with numeric and spatial analysis
- be familiar in using RStudio for statistical analysis

Mode of Delivery

The course follows the usual lecture approach. This means you should read the required texts for each week before class starts. Additionally, we will have labs. We will have two one and half hour lectures every week. We will also have lab sessions where we will focus on using R for statistical analysis.

The classes for this course are planned in-person, but the mode of instruction might change depending upon McGill's public health regulation regarding the COVID situation. This could mean that all the lectures and lab sessions will be moved online. When online, all lectures and lab will be recorded and made available on MyCourses.

Required Reading

- Diez, D., Çetinkaya-Rundel, M. and Barr, C.D. (2019): OpenIntro Statistics. 4th edition. Also online available at openintro.org/os
- O'Sullivan, D. and Unwin, D.J. (2010): Geographic Information Analysis. 2nd edition. Wiley.

Further Reading Suggestions

- McGrew, J. Chapman Jr. et. al. (2014): An Introduction to Statistical Problem Solving in Geography. 3rd edition. Waveland Press.
- McCarroll, D (2016): Simple Statistical Tests for Geography. CRC Press / Chapman and Hall.

– Ismay, C and Kim, A.Y. (2020): Statistical Inference via Data Science. A ModernDive into R and the Tidyverse. CRC Press. Also online available at <https://moderndive.com>

The first textbook is readily available online for free (although you can contribute, which the authors, as you can imagine, would appreciate). The second textbook is available for free at the library (as E-book as well as PDF). Additionally, some sessions contain assigned readings which can be accessed on-line via MyCourses at least one week prior to the session in question.

The required readings represent the foundation of the course content. The obvious assumption is that you have read these texts to be able to understand the concepts, contribute to classroom discussions and pose questions. Not every aspect of these readings may be discussed during course sessions; however, all aspects of these texts may be part of a course assignments or exams.

Course Evaluation and Assignment Details

Your final marks will be composed of:

1. Quizzes (approximately 5 quizzes): 20% of the final mark (not equally weighted)
2. Lab assignments (5 lab assignments): 50% of the final mark
3. Project (Proposal, presentation and final report): 30% of the final mark

Quizzes will be spread out throughout the term but only the ones after add/drop date will count towards your final mark. Roughly there will be a quiz after a major concept is completed. Questions for quizzes will be from the lectures and the required readings assigned to the class. They must be completed by the beginning of the class (Wednesday before 1:05pm). You will always have up to two attempts during a 60 minutes' duration maximum for each quiz. Request for additional attempts will not be considered.

Academic Integrity

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see <http://www.mcgill.ca/students/srr/honest> for more information). (Approved by Senate on 29 January 2003)

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir

de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/).

Language of Evaluation

“In accord with McGill University’s Charter of Students’ Rights, students in this course have the right to submit in English or in French any written work that is to be graded.” (approved by Senate on 21 January 2009) “Conformément à la Charte des droits de l’étudiant de l’Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l’un des objets est la maîtrise d’une langue).”

Attendance

The course consists of 13 weeks; online classes are 1.5 hours long each with a break in-between; online lab sessions last up to 3 hours, once again, with breaks in-between. During class time we will interactively discuss what you have read up on and apply the concepts to examples, in lab sessions we will cover the introduction to R and R Markdown; we may also practice applying the knowledge you acquired in class to the software used. Full and complete attendance is suggested as not all content will be covered by the textbook. However, attendance is not mandatory and all material you need to learn about the content will be made available on MyCourses. If you choose not to attend classes, please make sure you *regularly check your e-mail account registered with MyCourses as well as the MyCourses Announcement section* as I will post required organisational messages there, additionally to announcing them in class. Your participation and content-wise engagement during classes like taking part in discussions or posing questions to clarify content is highly welcome and appreciated, both by me, your instructor, and your fellow students. I assume that you are interested in the course content; therefore, I take for granted that you will respect usual customs of behaviour in a learning environment in class as well as on the software platforms used.

Grading

You can find McGill grading policies here: https://www.mcgill.ca/study/2018-2019/university_regulations_and_resources/undergraduate/gi_grading_and_grade_point_averages

Grade appeals

Instructors and teaching assistants take the marking of assignments very seriously, and we work diligently to be fair, consistent, and accurate. Nonetheless, mistakes and oversights occasionally happen. If you believe that to be the case, you must adhere to the following rules:

- If it is a mathematical error simply alert a TA of the error.
- In the case of more substantive appeals, you must:
 1. Wait at least 24 hours after receiving your mark.
 2. Carefully re-read your paper/assignment/test, all guidelines and marking schemes, and the grader's comments.
 3. If you wish to appeal, you must submit to the instructor a written explanation of why you think your mark should be altered. Please note statements such as "I need a higher grade to apply to X" are not compelling. If you need a certain grade to apply to X, try to comprehend the material well and you will perform well in the assignments. Also, please note that upon *re-grade your mark may go down, stay the same, or go up*.

Missed Assignments and late submission

In fairness to those of you who complete assignments on time, *late assignments will be penalized by 0.005 % points per minute*.

In cases of personal or academic difficulty, consideration may be given. Requests for consideration should be made well before the assignment due date, and must be accompanied by documentation with sufficient detail to describe whether a student can perform academic assignments and the duration of the problem. In this case, contact the instructor not the TA.

Excuses for missed assignments and examination will not be accepted, except in serious cases for which written proof from an appropriate authority must be provided to the instructor. Requests for consideration of late submissions should be made to the instructor and not the TA.

Queries

I am open to discuss matters related to course topics, assignments, exams or your academic interest related to the course content. Please approach me during office hours or by e-mail. In line with McGill policy, I prefer correspondence via your McGill e-mail addresses. In e-mails, please insert your full name. E-mail is a piece of formal correspondence and should be treated as a permanent record of communication. I will endeavour to respond to e-mails within 48 hours, but this may not always be possible. E-mails containing questions that can be answered by referring to this syllabus, or to administrative matters discussed in class or posted on MyCourses (e.g. specifics of assignments, instructions on how best to prepare for the exam) may not receive a response.

MyCourses Policy

Please check MyCourses regularly for updated course information, required readings or materials. All use of MyCourses, especially 'Discussions' content, must relate to the content of course material. MyCourses should not be used as a forum for evaluations about the course or other content that is unrelated to sessions or readings (You will have a chance to evaluate the course near the end of the term). All student posts are expected to be respectful in tone and content. Violations of this policy will result in restricted access and other penalties at the instructor's discretion.

Course content

This course focuses on basic spatial and non-spatial statistical analysis. We will begin the course by covering basic concepts in understanding datasets and probability distributions. The course focuses on helping students to understand the data they are working with, describe the data, select an appropriate statistical test, use common software packages to run that test, understand the output, and interpret results. The second component of the course focuses more specifically on spatial analyses. Students will have the opportunity to learn and apply common spatial statistical techniques and use the state-of-the-art free software package R available for analysis. The statistical concepts and theories introduced in this course are equivalent to standard introductory statistics course credits.

What will not be covered in this course

This is not a standard statistics course – we will not focus on detailed mathematics of statistical theory. While brief forays into the equations and math behind statistical approaches will be provided, the course focuses on application and understanding. This is not an advanced spatial statistics course either. Such courses usually require at least one prerequisite in basic statistics. GEOG202 provides such a prerequisite (including introduction to statistics) but goes a little further by introducing spatial concepts and delving into some spatial analysis.

This course will not cover basic GIS techniques, and we will not use standard GIS software (e.g., ArcGIS) during labs. For students particularly interested in the spatial aspects of analysis, a GIS course would be an excellent complement to GEOG202.

Lecture schedule:

Week	Lecture	Date	Topic	Related Assignment/ Project	Assignment due date
1	1	1 September	Introduction and overview of course		
1	2	3 September	Basic terms and concepts		
2	3	8 September	Descriptive statistics: Measures of central tendency & variability		
2	4	10 September	Probability distributions	Assignment 1	17 September
3	5	15 September	Probability distributions		
3	6	17 September	Sampling and estimation		
4	7	22 September	Probability and estimation wrap up	Assignment 2	1 October
4	8	24 September	Inferential Statistics I: Assessing normality, overview of hypothesis testing		
5	9	29 September	Inferential Statistics II: Test for continuous and categorical variable: chi-squared, t-test	Proposal	7 October
5	10	1 October	Inferential statistics III: ANOVA, repeated measures		
6	11	6 October	Inferential statistics wrap up	Assignment 3	27 October
6	12	8 October	Project proposals: Student presentations		

8	13	20 October	Correlation		
8	14	22 October	Introduction to Regression		
9	15	27 October	Multivariate Regression I	Assignment 4	12 November
9	16	29 October	Multivariate Regression II		
10	17	3 November	Multivariate Regression III		
10	18	5 November	Introduction to Spatial Statistics I		
11	19	10 November	Introduction to Spatial Statistics II		
11	20	12 November	Spatial analysis: point data I		
12	21	17 November	Spatial analysis: point data II		
12	22	19 November	Spatial analysis: area data I	Assignment 5	3 December
13	23	24 November	Spatial analysis: area data II		
13	24	26 November	Spatial data wrap up		
14	25	1 December	Project presentations		
14	26	3 December	Project presentations	Project report	16 December

Lab sessions:

Week	Lab	Date	Topic
2	1	7 September	Introduction to R
3	2	14 September	Summary statistics in R
4	3	21 September	Visualization and R markdown
5	4	28 September	Distribution and probability
7	5	19 October	Hypothesis testing
8	6	26 October	Correlation and linear regression
10	8	2 November	Multivariate regression
11	9	9 November	Spatial analysis
12	10	16 November	Spatial analysis: Point data
13	11	23 November	Spatial analysis: Area data

NOTE: This course schedule may change based on class progress or extraordinary circumstances beyond my control.

More policies

Disability

If you have a disability, please contact the instructor to arrange a time to discuss your situation. It would be helpful if you contact the *Office for Students with Disabilities* at 398-6009 before you do this.

Student Rights & Responsibilities

Policies governing academic issues which affect students can be found in the Handbook on Student Rights and Responsibilities, Charter of Students' Right: <https://www.mcgill.ca/apo/new-tsas-guide/student-life-learning>

Policy Concerning the Rights of Students with Disabilities

If you need any accommodation, please contact the Office for Students with Disabilities (<http://www.mcgill.ca/osd> or 514-398-6009). You may also contact me directly. I will make every reasonable effort to accommodate you.

Copyright of course material

Instructor generated course materials (e.g. Power Point slides, handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University

under the Code of Student Conduct and Disciplinary Procedures. Recording and distributing recordings of lectures is prohibited unless the instructor gives written consent.

I remind everyone of their responsibility in ensuring that this video and associated material are not reproduced or placed in the public domain. This means that each of you can use it for your educational (and research) purposes, but you cannot allow others to use it, by putting it up on the Internet or by giving it or selling it to others who may also copy it and make it available. Please refer to McGill's Guidelines for Instructors and Students on Remote Teaching and Learning for further information. Thank you very much for your help with this.

Course Changes in Extraordinary Circumstances

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Indigenous Land Statement

McGill University is on land which has long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg nations. We acknowledge and thank the diverse Indigenous people whose footsteps have marked this territory on which peoples of the world now gather. L'Université McGill est sur un emplacement qui a longtemps servi de lieu de rencontre et d'échange entre les peuples autochtones, y compris les nations Haudenosaunee et Anishinabeg. Nous reconnaissons et remercions les divers peuples autochtones dont les pas ont marqué ce territoire sur lequel les peuples du monde entier se réunissent maintenant.