Department of Biology Course Outline

BIOL5081 BIOSTATISTICS
FALL 2019

Course Description

This course examines common statistical methods used in biology. Data science and statistical workflows are developed. Descriptive statistics, generalized linear models, regression, nonparametric tests, bootstrapping, randomization tests, tree-based analysis, multivariate statistics, and time-series analysis are considered. The R programming language and RStudio will be used for data analysis

Prerequisites (strictly enforced)

BIOL 2060, previously numbered BIOL 3090 or an undergraduate course in Statistics. Students who have not taken a statistics course within the last three years are required to audit BIOL 2060 lectures.

Course Instructor(s) and Contact Information

Dr. Christopher J. Lortie
218A Lumbers
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e-mail: lortie@yorku.ca

Dr. Sapna Sharma
326 Lumbers
Telephone: 416-736-2100 ext. 33761
e-mail: sharma11@yorku.ca

Schedule

Date and Time: W: 8:30-11:30 a.m.
Location: DB 2114
Course Session: FALL 2018 - Start date: September 4, 2019.
Course ID.: F62E01

Evaluation

Evaluation Components of Final Grade and related information.
Final course grades may be adjusted to conform to Program or Faculty grades distribution profiles.

Module 1.
The first 6 weeks are administered by Dr. Lortie
Fundamental stats review   25%
Take-home statistical test/report   25%

Module 2.
The remaining 6 weeks are administered by Dr. Sharma
Lab Assignments   20%
Poster   30%

Important Dates

Part A. Fundamental statistics and data
Oct 2nd, 2019: Review due to Dr. Lortie using https://www.turnitin.com
October 16th, 2019: Take-home practical test/reports due to Dr. Lortie by 830am using https://www.turnitin.com

Part B. Advanced topics in biostatistics
October 30, 2019: Regression assignment due to Dr. Sharma by 8:30 am
November 20, 2019: Multivariate Statistics assignment due to Dr. Sharma by 8:30 am
November 29, 2019: Poster due to Dr. Sharma by 11:59 pm

Drop Deadline: Fri. Nov. 8, 2019 (last day to drop without course on transcript)
Course Withdrawal: Sat. Nov. 19 to Dec. 3, 2019 (course still appears on transcript with 'W")

Resources

The New Statistics with R: An Introduction for Biologists by Andy Hector.
Print ISBN-13: 9780198729051

Numerical Ecology by P. and V. Legendre.

Readings and other online resources including peer-reviewed publications provided in class.

R and RStudio

Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Build a data model for a graduate-level dataset.
2. Develop a reproducible data and statistical workflow.
3. Design and complete intermediate-level data visualizations appropriate for a graduate-level simple dataset.
4. Identify a range of suitable univariate and multivariate statistical approaches that could be applied to any dataset
5. Interpret statistical output to quantify statistical model performance
6. Complete fundamental exploratory data analysis on any dataset.
7. Appreciate the strengths and limitations of open science, data science, and evidence-based collaboration models.

Professional Skills

The following skills will be developed in this course.

1. Critical thinking skills for quantitative evidence.
2. The capacity to manage and manipulate diverse forms of data.
3. Data visualization skills and competency with contemporary statistical tools including the tidyverse in the R programming language.
4. Fundamental biostatistical analysis skills in R including distribution assessment, generalized linear mixed models, regression analyses, tree-based models, and multivariate analyses.
5. Effective communication skills of quantitative challenges in the biosciences in written, oral, and graphical modalities.

Course Content

Module 1: Dr. Christopher Lortie
Sept 4:   Data preparation, data visualization, and t-tests.
Sept 11: Data workflows and missing data.
Sept 18: Advanced data visualization to explore statistical patterns including correlation analyses.
Sept 25: General linear models and generalized linear mixed models.
Oct 2:   *Review due at start of class 830am via turnitin;* Hackathon to explore GLMs and GLMMs
Oct 9:   Statistical models and prediction in the biosciences practical exercise.

Oct 16: **Reading Week – No class;** *Take home practical test due by midnight via turnitin*

Module 2: Dr. Sapna Sharma
Oct 23: Linear regression models
Oct 30: Tree-based models; *Regression Assignment Due*
Nov 6: Data Collection; No in-class meeting
Nov 13: Multivariate Statistics; Present data & potential analytical techniques to Dr. Sharma
Nov 20: Multivariate Statistics II and Spatial Statistics; Data Analysis Tutorial; *Multivariate Statistics Assignment Due*
Nov 27: Time Series Analysis; Data Analysis Tutorial
Nov 29: *Poster Due*

Experiential Education and E-Learning
GitHub, R studio, and R will be used to share code, wrangle data, and do statistics.

Other Information
EXPECTATIONS
Attendance is mandatory because the lectures will provide an opportunity for the students not only to listen to summary lectures of the by the professor of statistics but to also engage in the analyses. In the lectures, we will work together to actively handle data and do statistics. All information presented in class is testable. For module 1 with Dr. Lortie, both assignments must be submitted to turnitin.com.
Class ID: 18910126
Key: rstats4bio

Course Policies
Alternative dates for assignments/evaluations are not available in this course. If documentation is provided for valid absences on test dates, accommodation will be granted in mutual discussion with the professors. To promote fairness and student responsibility, all in class exercises are due on the dates specified herein. A 20% penalty will be applied for the first day the exercise is late and 5% every day thereafter. Students who anticipate being unable to submit the exercises on the due date are encouraged to submit early. Grades on exercises and exams are not negotiable. Every reasonable action is made to ensure advance reminders are provided and instruction. Thus, the course director should only be contacted if there is calculation or clerical error present. The Document Submission System must be used to submit all documentation associated with absences.
https://science.apps01.yorku.ca/machform/view.php?id=84113

Students are not allowed to record lectures or lab tutorials using their own devices.

University Policies
Academic Honesty and Integrity
York students are required to maintain the highest standards of academic honesty and they are subject to the Senate Policy on Academic Honesty (http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/). The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards.
There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to help improve students' research and writing skills, and cope with University life. Students are expected to review the materials on the Academic Integrity website at - http://www.yorku.ca/academicintegrity/

Important A note from the Faculty of Science Committee on Examinations and Academic Standards: Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be wilfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero or One Class, the submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that exams, tests, and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not).

Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

Access/Disability

York University is committed to principles of respect, inclusion and equality of all persons with disabilities across campus. The University provides services for students with disabilities (including physical, medical, learning and psychiatric disabilities) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

Student's in need of these services are asked to register with disability services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with disabilities services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Counselling & Disability Services - http://cds.info.yorku.ca/

Counselling & Disability Services at Glendon - https://www.glendon.yorku.ca/counselling/

York Accessibility Hub - http://accessibilityhub.info.yorku.ca/

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. Similarly, should an assignment to be completed in a lab, practicum placement, workshop, etc., scheduled later in the term pose such a conflict, contact the Course director immediately. Please note that to arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an Examination Accommodation Form at least 3 weeks before the exam period begins. The form can be obtained from Student Client Services, Student Services Centre or online at http://www.registrar.yorku.ca/pdf/exam_accommodation.pdf

Student Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at - http://secretariat-policies.info.yorku.ca/policies/disruptive-andor-harassing-behaviour-in-academic-situations-senate-policy/