Syllabus

Term 2020 Winter 1: Sep 08 - Dec 03 2020

Course info

Instructor:
Daniel McDonald
Office: Earth Sciences Building
Website: https://dajmcdon.github.io/
Email: daniel@stat.ubc.ca

Office hours:
TBA

Course webpage:
WWW: https://ubc-stat.github.io/stat-406/
See also Canvas

Lectures:
Tue/Thu 1600h - 1700h UTC-7 Vancouver local time (class ends at 1645h)

Repeated
Tue/Thu 2000h - 2100h UTC-7 Vancouver local time (class ends at 2045h)

All students should plan to attend the following dates during the standard time (1530h-1700h) for exams: * 10 September (no exam, first day of class) * 29 September * 15 October * 3 November * 19 November * UBC scheduled Final Exam Period (TBA)

Textbooks:
[ISLR]
[ESL]

Prerequisite:
STAT 306 or CPSC 340

Course objectives

This is a course in statistical learning methods. Based on the theory of linear models covered in Stat 306, this course will focus on applying many techniques of data analysis methods to interesting datasets.

The course combines analysis with methodology and computational aspects. It treats both the "art" of understanding unfamiliar data and the "science" of analyzing that data in terms of statistical properties. The focus will be on practical aspects of methodology and intuition to help students develop tools for selecting appropriate methods and approaches to problems in their own lives.

Learning outcomes

1. assess the prediction properties of the supervised learning methods covered in class;
2. correctly use regularization to improve predictions from linear models, and also to identify important explanatory variables;
3. explain the practical difference between predictions obtained with parametric and non-parametric methods, and decide in specific applications which approach should be used;
4. select and construct appropriate ensembles to obtain improved predictions in different contexts;
5. select sensible clustering methods and correctly interpret their output;
6. correctly utilize and interpret principal components and other dimension reduction techniques;
7. employ reasonable coding practices and understand basic R syntax and function.

Textbooks

Required:

An Introduction to Statistical Learning, James, Witten, Hastie, Tibshirani, 2013, Springer, New York. (denoted [ISLR])

Available **free** online: http://faculty.marshall.usc.edu/gareth-james/ISL/index.html

The Elements of Statistical Learning, Hastie, Tibshirani, Friedman, 2009, Second Edition, Springer, New York. (denoted [ESL])

Also available **free** online: https://web.stanford.edu/~hastie/ElemStatLearn/

This second book is a more advanced treatment of a superset of the topics we will cover. If you want to learn more and understand the material more deeply, this is the book for you. With the exception of Chapter 10, all readings from [ESL] are optional.

Course assesssment opportunities

Default synchronous syllabus

1 Mini pre quiz (1%)
5 In-class mini quizzes (1% each)
5 In-class group quizzes (1% each)
5 Peer evaluations (1% each)
5 Midterm exams (14% each)
1 Comprehensive final exam (14%)
1 Discussion opportunity (+/- 1%)

Alternative asynchronous syllabus
If for any reason, you wish to complete the course asynchronously, you may email my by midnight on 30 September to request to complete the course "asynchronously". The intention behind this option is to accomodate internet connectivity, family, work, life, mental health, or other issues which may arise. In this case, the grading scale will be modified. Note that all exams must still be taken during the scheduled time (1530h-1700h Vancouver local time) through Canvas. Changes requested after this date will be made at the discretion of the instructor.

1 Mini pre quiz (1%)
5 In-class mini quizzes (2% each)
5 Midterm exams (15% each)
1 Comprehensive final exam (14%)
1 Discussion opportunity (+/- 1%)

Missed assessment policy
Missed or late peer evaluations result in the student receiving no credit. All other missed opportunities will have their weight added to the comprehensive final exam. There are no other makeup opportunities. If you miss more than 2 midterm exams, you must request an academic concession through your academic advising office.

Group synchronous sessions

Synchronous class periods will be spent working on and discussing group coding exercises, similar to lab sessions. They will also be used for individual and group quizzes and individual exams.

Each student will be assigned a group for the entirety of the semester. Your group assignment will be determined by your selected Lecture time (1600h or 2000h) as well as other factors. You must attend your selected Lecture time each session. If you cannot attend, missed quizzes (or exams0 will have their weight added to the comprehensive final exam. But students should be aware

that their groups are counting on them. If you miss a session, your peers may give you lower peer evaluation scores.

It's important here to recognize just how important active participation in these activities is. You learn by doing, and this is your opportunity to learn in a low-stakes, moderated environment. One thing you'll learn, for example, is that all animals urinate in 21 seconds.[1]

Important considerations

University policies UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here.

Academic honesty and standards UBC Vancouver Statement

Academic honesty is essential to the continued functioning of the University of British Columbia as an institution of higher learning and research. All UBC students are expected to behave as honest and responsible members of an academic community. Breach of those expectations or failure to follow the appropriate policies, principles, rules, and guidelines of the University with respect to academic honesty may result in disciplinary action.

For the full statement, please see the 2020/21 Vancouver Academic Calendar

Course specific

Several commercial services have approached students regarding selling class notes/study guides to their classmates. Please be advised that selling a faculty member's notes/study guides individually or on behalf of one of these services using UBC email or Canvas, violates both UBC information technology and UBC intellectual property policy. Selling the faculty member's notes/study guides to fellow students in this course is not permitted. Violations of this policy will be considered violations of UBC Academic Honesty and Standards and will be

[1] A careful reading of the linked paper with the provocative title "Law of Urination: all mammals empty their bladders over the same duration" reveals that the authors actually mean something far less precise. In fact, their claim is more accurately stated as "mammals over 3kg in body weight urinate in 21 seconds with a standard deviation of 13 seconds". But the accurate charactization is far less publicity-worthy.

reported to the Dean of Science as a violation of course rules. Sanctions for academic misconduct may include a failing grade on the assignment for which the notes/study guides are being sold, a reduction in your final course grade, a failing grade in the course, among other possibilities. Similarly, contracting with any service that results in an individual other than the enrolled student providing assistance on quizzes or exams or posing as an enrolled student is considered a violation of UBC's academic honesty standards.

Some of the problems that are assigned are similar or identical to those assigned in previous years by me or other instructors for this or other courses. Using proofs or code from anywhere other than the textbooks (with attribution), this year's course notes (with attribution), or the course website is not only considered cheating (as described above), it is easily detectable cheating. Such behavior is strictly forbidden.

In previous years, I have caught students cheating on the exams. I did not enforce any penalty because the action did not help. Cheating, in my experience, occurs because students don't understand the material, so the result is usually a failing grade even before I impose any penalty and report the incident to the Dean's office. I carefully structure exams to make it so that I can catch these issues. I **will** catch you, and it does not help. Do your own work, and use the TA and me as resources. If you are struggling, we are here to help.

If I suspect cheating, your case will be forwarded to the Dean's office. No questions asked.

Academic Concessions These are handled according to UBC policy. Please see * UBC student services * UBC Vancouver Academic Calendar * Faculty of Science Concessions

Missed final exam Students who miss the final exam must report to their Faculty advising office within 72 hours of the missed exam, and must supply supporting documentation. Only your Faculty Advising office can grant deferred standing in a course. You must also notify your instructor prior to (if possible) or immediately after the exam. Your instructor will let you know when you are expected to write your deferred exam. Deferred exams will ONLY be provided to students who have applied for and received deferred standing from their Faculty.

Censorship During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local

jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit this link for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses. For further information and support, please visit this link.