THE UNIVERSITY OF BRITISH COLUMBIA

Irving K. Barber Faculty of Science
Okanagan Campus

Department of Computer Science, Mathematics, Physics and Statistics

DATA 311
Machine Learning (3)
2020W1
Online, Thursday 11:00-12:30

Instructor:

Name: Jeffrey L. Andrews
Office: SCI 111 (in theory)
Phone: 250-807-9931 (in theory)
Email: jeff.andrews@ubc.ca --- NOTE: unless privacy needed, use forums on Canvas
Website: canvas.ubc.ca

Office Hours:

Calendar lecture hours (Th 11-12:30) are office hours except for midterm weeks as content is posted asynchronously. Zoom link will be posted on Canvas. TAs will also hold 'office hours' during posted lab times.

Course Description:

DATA 311 (3) Machine Learning

Regression, classification, resampling, model selection and validation, fundamental properties of matrices, dimension reduction, tree-based methods, unsupervised learning. Credit will be granted for only one of STAT 311 or DATA 311. [3-2-0]
Prerequisite: Either (a) STAT 230 or (b) a score more than 75% in one of APSC 254, BIOL 202, PSYO 373; and one of COSC 111, APSC 177.

Course Format:

Intended format:

Canvas will have 'apps' embedded for each lecture that will include several elements, including: text, lecture videos, interactive simulations, questions (multiple choice and otherwise). These will guide you through the material, hopefully providing insight on the topics we will be covering. Students are expected to keep up with the course material as it is released (more on this shortly).

FYI: This is an experimental approach for this course which normally would be given in a traditional whiteboard-and-slides style. Additionally, given that these apps include interactive elements, they are hosted on a UBCO server which is somewhat untested for this application…

Backup format:

If things go horribly, horribly wrong, we will revert to fairly traditional lectures with whiteboard and slides posted as videos to Canvas.

Learning Outcomes:
By the end of this course, students should be able to:

- build a model and validate it
- understand fundamental proofs for techniques that rely on matrix algebra
- compute linear regression and apply hypothesis testing
- perform logistic regression and discriminant analysis
- apply the K-fold cross-validation methods
- apply the LASSO and ridge regression methods
- apply bagging and boosting on tree-based methods
- apply some methods of unsupervised learning (e.g. principal components, or k-means clustering).
- manipulate data sets in R including applying the above methods

Passing Criteria:
50% or higher as a final computed grade in the course with at least one test (midterm or exam) graded at or above 50% are required to pass the course.

Required Materials:
Primarily…
An Introduction to Statistical Learning with Applications in R, James, Witten, Hastie, and Tibshirani, Springer 2013.
Available (free) online at http://faculty.marshall.usc.edu/gareth-james/ISL/ or through the UBC library.

Some additional content coverage in…
The Elements of Statistical Learning: data mining, inference, and prediction, Hastie, Tibshirani, Friedman. Springer 2009.
Available (free) online at https://web.stanford.edu/~hastie/ElemStatLearn/ or through the UBC library.

Course Evaluation:

Participation	5%	See details below
Midterms	40%	Dates: October 8, November 19
Assignments	15%	
Final Exam	40%	3 hours during exam period (TBA)
Total	100%	

Details:

Participation	This is essentially a "keeping pace" grade. Each lecture 'app' will conclude with a "Download" button which will output a Rdata object. This object will include your timings, answers to in-app questions, etc. Uploading this file to Canvas within the prescribed timeframe (generally within a week of material being posted) will result in full marks. Timings/etc are simply used to monitor for academic integrity issues and will not affect grades in any manner. Each app will be equally weighted, number of apps still TBD, but probably in the range of 20-25.
Midterms	Midterms will be held as timed tests within Canvas during regular classroom hours (Thursday 11-12:30)
Assignments	Expect 4 or more assignments. For each assignment you will be given at least a week from posting to complete it. Late assignments will not be accepted.
Final Exam	Will be scheduled by the university during the regular exam period. 3 hour timed exam in Canvas.

Missed Assignments and Exams (if applicable)

Missed assignments or midterms will have their weight shifted to the final exam IF and ONLY IF its missingness is justified to the instructor's satisfaction in advance or within 24 hours of the time the item was due.
Given the amount of time provided for all items, I expect to grant very few shifts.

There will be no leniency on "Keeping Pace" grade item except in extreme circumstances pre-cleared well in advance with the instructor.

Final exam concessions are handled through the Faculty of Science Dean's Office.
See: https://science.ok.ubc.ca/student-resources/undergrad/student-forms/
Email: fos.students.ubco@ubc.ca

Late Policy
Late items will not be accepted. In other words, "late" is considered "missed", see above.

Lecture Outline
The following table provides a tentative schedule for the term and may be adjusted dependent on the class needs.

	Topics
Week 1	Introduction, Notation, Terminology
Week 2	Simple regression, model assessment, non-linearity
Week 3	Multiple linear regression, variable selection, categorical predictors, interactions
Week 4	Classification via logistic regression
Week 5	Discriminant analysis, classification performance, distance measures
Week 6	Clustering
Week 7	Cross validation, bootstrap
Week 8	Tree based methods, tuning parameters
Week 9	Neural nets, shrinkage methods (LASSO and ridge regression)
Week 10	Dimensionality reduction via PCA, NMF
Week 11	Unsupervised learning with mixture models
Week 12	Carry over and course review

****Following sections must appear as written in every Lecture Course Outline****

Copyright Disclaimer Diagrams and figures included in lecture presentations adhere to Copyright Guidelines for UBC Faculty, Staff and Students http://copyright.ubc.ca/requirements/copyright-guidelines/ and UBC Fair Dealing Requirements for Faculty and Staff http://copyright.ubc.ca/requirements/fair-dealing/. Some of these figures and images are subject to copyright and will not be posted to ***Canvas***. All material uploaded to ***Canvas*** that contain diagrams and figures are used with permission of the publisher; are in the public domain; are licensed by Creative Commons; meet the permitted terms of use of UBC's library license agreements for electronic items; and/or adhere to the UBC Fair Dealing Requirements for Faculty and Staff. Access to the ***Canvas*** course site is limited to students currently registered in this course. Under no circumstance are students permitted to provide any other person with means to access this material. Anyone violating these restrictions may be subject to legal action. Permission to electronically record any course materials must be granted by the instructor. Distribution of this material to a third party is forbidden.

Grievances and Complaints Procedures

A student who has a complaint related to this course should follow the procedures summarized below:

- The student should attempt to resolve the matter with the instructor first. Students may talk first to someone other than the instructor if they do not feel, for whatever reason, that they can directly approach the instructor.
- If the complaint is not resolved to the student's satisfaction, the student should go to the departmental chair John Braun at SCI 388, 807-8032 or e-mail him at john.braun@ubc.ca.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic
integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. **For example, incidences of plagiarism or cheating usually result in a failing grade or mark of zero on the assignment or in the course.** Careful records are kept to monitor and prevent recidivism.
A more detailed description of academic integrity, including the policies and procedures, may be found:

http://okanagan.students.ubc.ca/calendar/index.cfm?tree=3,54,111,0

If you have any questions about how academic integrity applies to this course, please consult with your professor.

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record. http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,41,90,1014 If you have any questions about how academic integrity applies to this course, please consult with your professor.

Disability Assistance

The Disability Resource Centre ensures educational equity for students with disabilities, injuries or illness. If you are disabled, have an injury or illness and require academic accommodations to meet the course objectives, visit our website for more information: http://students.ok.ubc.ca/drc/welcome.html or contact the DRC at: drc.questions@ubc.ca

Equity, Human Rights, Discrimination and Harassment

UBC Okanagan is a place where every student, staff and faculty member should be able to study and work in an environment that is free from human rights based discrimination and harassment. If you require assistance related to an issue of equity, discrimination or harassment, please contact the Equity Office, your administrative head of unit, and/or your unit's equity representative.

UBC Okanagan Equity Advisor: ph. 250-807-9291;
E-mail: equity.ubco@ubc.ca **Web:** https://equity.ok.ubc.ca/

Health & Wellness

At UBC Okanagan health services to students are provided by Health and Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Health and Wellness for more information or to book an appointment.

UNC 337

Email: *healthwellness.okanagan@ubc.ca* Web: www.students.ok.ubc.ca/health-wellness

Sexual Violence Prevention and Response Office (SVPRO)

A safe and confidential place for UBC students, staff and faculty who have experienced sexual

violence regardless of when or where it took place. Just want to talk? We are here to listen and help you explore your options. We can help you find a safe place to stay, explain your reporting options (UBC or police), accompany you to the hospital, or support you with academic accommodations. You have the right to choose what happens next. We support your decision, whatever you decide. Visit svpro.ok.ubc.ca or call us at 250.807.9640

Independent Investigations Office (IIO)

If you or someone you know has experienced sexual assault or some other form of sexual misconduct by a UBC community member and you want the Independent Investigations Office (IIO) at UBC to investigate, please contact the ***IIO***. *Investigations are conducted in a trauma informed, confidential* and respectful manner in accordance with the principles of procedural fairness. You can report your *experience directly to the **IIO** via email: director.of.investigations@ubc.ca or by calling 604.827.2060* or online by visiting investigationsoffice.ubc.ca

The Hub

The Student Learning Hub (LIB 237) is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with study skills and learning strategies**. For more information, please visit the Hub's website (https://students.ok.ubc.ca/student-learning-hub/) or call 250-807-9185.

SAFEWALK

Don't want to walk alone at night? Not too sure how to get somewhere on campus?

Call Safewalk at 250-807-8076.

For more information: https://security.ok.ubc.ca/safewalk/ or download the UBC SAFE – Okanagan app.