Career and Professional Development
Non-Credit Programs

Course Outline

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Course Title	**Computational Applied Statistics**
Course Number	YCBS 255
Continuing Education Units:	4 CEUs
Instructor(s)	Dr. Vahid Partovi Nia
Contact Information	**Email:** vahid.partovinia@mcgill.ca
	Office hours: Upon request
Course Description	This course is designed for adult students with background in introductory probability statistics, and computer programming. The course objective is to equip students with basic statistical machine learning tools. Each lecture is followed with several exercises on data analysis, and computational exercises to complete the lecture.
	The assignments must be submitted within a week. Send your questions to vahid.partovinia@mcgill.ca
	Students must check the online website of the course (MyCourses) regularly for updates and participate in forum, discussions, etc. Evaluation of the course is based on assignments and quizzes. The passing grade for this course is 65% or more. A 75% attendance is required in this course. If your attendance is <75% it will mean an automatic fail. Exercises are individual, more than 50% resemblance of assignment between students is subject to plagiarism, only online submitted *.pdf assignments are accepted.
Learning Outcomes	• Use python 3.6 to visualize and execute a predictive model • Install, load, and use conventional libraries related to machine learning and statistical modeling • Combine different algorithms to execute a predictive task

- Implement parameter estimation and regularization
- Perform model selection and model inference
- Improve predictive performance by combining different algorithms
- Interpret results of applied statistical methods

Course Material

Required:
The course is built on the famous textbook "Introduction to Statistical Learning with Applications in R" by James, Witten, Hastie, and Tibshirani. This book is adapted for python 3.6 through the lecture materials.
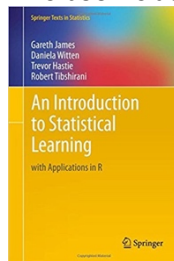
The PDF of the book is freely available from
http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Fourth%20Printing.pdf
The printed version can be ordered online from amazon.ca

The datasets of the book are available from
http://www-bcf.usc.edu/~gareth/ISL/

Jupyter Notebook of the lectures are available from
https://github.com/vahidpartovinia/ycbs255

Instructional Methods

Teaching and learning approach is experiential, collaborative, and problem-based.

EVALUATION

Item	%	Explanation
Active participation	10 %	- This course consists of a community of learners of which you are an integral member; your active participation is therefore essential to its success. This means: attending class; visiting *myCourses*, doing the assigned readings/exercises before class; and engaging in class discussions/activities. **A minimum attendance of 75% is required in order to pass the course.**
Assignment	80%	4 assignments will be given in the following dates on myCourses. - Assignment 1: 30 October 2018 (20%) - Assignment 2: 13 November2018 (20%) - Assignment 3: 20 November 2018 (20%) - Assignment 4: 4 December 2018 (20%)
Quiz	10%	4 quizzes, will be given at the beginning of the following classes - Quiz 1: 30 October 2018 (2.5%) - Quiz 2: 13 November 2018 (2.5%) - Quiz 3: 20 November 2018 (2.5%) - Quiz 4: 4 December 2018 (2.5%)
Total	**100%**	

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

UNIVERSITY POLICIES

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 *www.mcgill.ca/integrity* for more information).

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/integrity*).

Right to submit in English or French
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.

In cases where language acquisition is part of the assessment objectives, the work must be submitted in the language evaluated.

Email Policy
E-mail is one of the official means of communication between McGill University and its students. As with all official University communications, it is the student's responsibility to ensure that time-critical e-mail is assessed, read, and acted upon in a timely fashion. If a student chooses to forward University e-mail to another e-mail mailbox, it is that student's responsibility to ensure that the alternate account is viable. Please note that to protect the privacy of students, the University will only reply to students on their McGill e-mail account.

RESOURCES

Student Services
Various services such as Walksafe, McGill Libraries, the Writing Centre, the bookstore, etc., are available to Continuing Education students:
www.mcgill.ca/continuingstudies/current-students/student-services-and-resources

Students with Disabilities
Students who have a documented disability and require academic accommodations and services should contact the Office of Students with Disabilities (http://www.mcgill.ca/osd or 514-398-6009) early in the term.

Computer Labs
Free access to computer labs is available at 688 Sherbrooke (12th floor), MACES, the McLennan Library and other locations on campus.

Athena and Online Resources
Access your personal student information online with Athena
(https://continuingstudies.mcgill.ca/portal/logon.do?method=load).

 Information regarding online resources such as email, VPN, myCourses, etc. can be found at
(www.mcgill.ca/it).

MACES
The McGill Association of Continuing Education Students, MACES (www.maces.ca), is located at
3437 Peel, 2nd floor, tel. (514) 398-4974.

GRADING SCHEME

The following grading scheme applies to Non-Credit Transcript Professional Development
Certificate programs.

Professional Development Certificates		Grade
Pass	(85-100%)	A
	(80-84%)	A-
	(75-79%)	B+
	(70-74%)	B
	(65-69%)	B-
Failure	(0-64%)	F

A minimum attendance of 75% is required in order to pass the course.

COURSE CONTENT

Class / Day/ Date	Topics / Assignments / Readings
1 **Tuesday** **October 23** **6-9pm**	Session 1: Introduction: python, descriptive statistics, important statistical distributions, random number generation, and basic data visualization.
2 **Tuesday** **October 30** **6-9pm**	Quiz 1. Session 2: Linear regression: simple linear regression, and multiple linear regression. Assignment 1.
3 **Tuesday** **November 6** **6pm-9pm**	Session 3: Basic classification: logistic regression, linear discriminant, and quadratic discriminant.
4 **Tuesday** **November 13** **6-9pm**	Quiz 2. Session 4: Error estimation: cross-validation, and bias-variance trade-off. Assignment 2.
5 **Saturday** **November 17** **9am-4pm**	Session 5: Shrinkage methods: subset selection, ridge shrinkage, and lasso shrinkage. Session 6: Dimension reduction: principal components, and partial least squares.
6 **Tuesday** **November 20** **6pm-9pm**	Quiz 3. Session 7: Beyond linearity: smoothing splines, local regression, and additive models. Assignment 3.
7 **Tuesday** **November 27** **6-9pm**	Session 8: Tree and ensemble methods: regression trees, classification trees, bagging, and boosting.
8 **Tuesday** **December 4** **6pm-9pm**	Quiz 4. Session 9: Powerful classifiers: support vector machines, and random forest. Assignment 4.

9 **Tuesday** **December 11** **6pm-9pm**	Session 10: Unsupervised learning: k-means, and hierarchical clustering.