CUMMING SCHOOL OF MEDICINE
GRADUATE COURSE OUTLINE

COURSE TITLE: Machine Learning for Health Data Science			
Course	DATA 622		
Pre/Co-Requisites	DATA 601, 602, 603, 604 and admission to the Graduate Diploma in Data Science and Analytics OR Proficiency in Python programming and successful completion of at least one mathematics course at either the undergraduate or graduate level		
Faculty	Cumming School of Medicine, Graduate Science Education		
Instructor Name(s)	Dr. Joon Lee	**Email**	joonwu.lee@ucalgary.ca
Office Location	TRW 5E17	**Office Hours**	Thursday 3:00 – 4:30pm
Instructor Email Policy	Responds to @ucalgary emails within 24 hours on weekdays		
Telephone No.	403-220-2968		
TA Name, if applicable	Steven Dykstra	**Email**	dykstras@ucalgary.ca
Class Term, Days	Winter 2020, Thursday		
Class Times	5:00 – 8:00pm		
Class Location	TRW 5E16 (Gosling Room, Centre for Health Informatics)		

COURSE INFORMATION/DESCRIPTION OF THE COURSE

This course is an introduction to machine learning with a focus on health applications. While the theoretical foundation behind each machine learning method will be covered, emphasis will be on hands-on skills and practical applications. Students will individually work on in-class quizzes and computer assignments to learn basic knowledge and hands-on skills, respectively. Students will also engage in interactive class discussions and teamwork in the form of a hackathon.

LEARNING RESOURCES/REQUIRED READING

There is no textbook in this course. All lecture slides, Jupyter notebooks, references, assignments, quizzes, and hackathon materials will be posted on D2L.

Technology Requirements

A shell in D2L is set up for this course. A laptop, desktop, or mobile device is required for D2L access.

COURSE OBJECTIVES/LEARNING OUTCOMES

At the end of this course, students will be able to:

1. Inspect and prepare health data sets for machine learning

2. Explain the frameworks, utilities, and limitations of different machine learning methods

3. Apply appropriate machine learning methods to a given health problem and data set

4. Evaluate trained machine learning models with a particular focus on ethics and explainability

5. Work in a multidisciplinary team to create a machine learning solution for a health problem

CUT POINTS FOR GRADES

This course adheres to the grading system outlined in the University of Calgary, Faculty of Graduate Studies Calendar. Grades of A+ and A are not distinguished in the calculation of GPAs. Percentage/letter grade conversion used for this course is as follows

Grade	Grade Point Value	Percentage Conversion	Graduate Description
A+	4.00	95-100	Outstanding
A	4.00	90-94	Excellent – superior performance showing comprehensive understanding of the subject matter
A-	3.70	85-89	Very Good Performance
B+	3.30	77-84	Good Performance
B	3.00	72-76	Satisfactory Performance
B-	2.70	68-71	Minimum Pass for Students in the Faculty of Graduate Studies
C+	2.30	63-67	All grades below 'B-" are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements

Assessment Components: The University policy on grading related matters is outlined in the 2019-2020 Calendar.

Assessment Methods	Description	Weight %	Due Date and Time
In-class Quizzes	A total of 10 quizzes, worth 2% each, will be done in class. Each quiz will consist of 5 multiple choice or short answer questions, and will be closed book. The purpose of each quiz will be to test students' general knowledge and understanding of the topics covered in previous class. The answers and corresponding explanations will be given immediately following each quiz. All quizzes will be delivered in D2L.	20%	First 10 minutes of each class except the first two classes
Assignments	A total of 10 assignments, worth 5% each, will help students acquire and practice computer skills related to the implementation of the machine learning methods they learn in each class. D2L will be used for accessing assignment materials, submission, and grading.	50%	Due at the start of each class (i.e., 5pm) except the first two classes
Hackathon	Students will participate in a hackathon in groups of 3 or 4 where the goal is to apply machine learning to a given data set to solve a health problem. The last class will be devoted to kick-off the hackathon; by the end of the class each group will present their proposed solution. Subsequently, each group will have one week to implement and submit their solution. The presentation and submitted solution will be worth 10% and 20%, respectively.	30%	Presentation during the last hour of the class on Apr 9 Implemented solution due 11:55pm on Apr 19

ASSESSMENT AND EVALUATION INFORMATION

ATTENDANCE AND PARTICIPATION EXPECTATIONS:
Students are expected to attend every class in person and actively participate in all components of each class including the quiz, lecture, discussion, and tutorial.

GUIDELINES FOR SUBMITTING ASSIGNMENTS AND HACKATHON SOLUTIONS:

All submissions must be uploaded to the corresponding Dropbox on D2L. All assignments must be submitted by the start of the class (i.e., 5pm) on the date that they are due. Hackathon solutions must be submitted by 11:55pm on the due date.
Note: It is the student's responsibility to keep a copy of each submission and to ensure that the proper version is submitted. Including a version date in your file name may be useful.

FINAL EXAMINATIONS:
There is no final exam in this course.

EXPECTATIONS FOR WRITING:
Writing should be understandable and typo-free.

LATE AND/OR MISSING ASSIGNMENTS:
Late submissions will receive a 5% penalty per day. Any submission late for 14 calendar days or more will receive a grade of zero. Valid reasons for late submission (e.g., medical, family emergency) should be brought to the instructor's attention as soon as possible, preferably before the deadline if possible.

Is a passing grade on a particular component essential to pass the course as a whole? No

COURSE TIMETABLE		
Course Schedule Date	**Topic**	**Assignments/Due Dates & Times**
Jan 16	Unit 1: Course Introduction & Groundwork	
Jan 23	Unit 2: Supervised Learning Part 1 – Classification	Assignment 1 due 5pm on Jan 30 In-class Quiz 1 on Jan 30
Jan 30	Unit 2: Supervised Learning Part 2 – Regression	Assignment 2 due 5pm on Feb 6 In-class Quiz 2 on Feb 6
Feb 6	Unit 3: Unsupervised Learning Part 1 – Clustering	Assignment 3 due 5pm on Feb 13 In-class Quiz 3 on Feb 13
Feb 13	Unit 3: Unsupervised Learning Part 2 – Dimensionality Reduction	Assignment 4 due 5pm on Feb 27 In-class Quiz 4 on Feb 27
Feb 20	No Class – Reading Week	

Feb 27	Unit 4: Ensemble Modeling	Assignment 5 due 5pm on Mar 5 In-class Quiz 5 on Mar 5
Mar 5	Unit 5: Deep Learning Part 1 – Basic Neural Networks	Assignment 6 due 5pm on Mar 12 In-class Quiz 6 on Mar 12
Mar 12	Unit 5: Deep Learning Part 2 – Advanced Neural Networks	Assignment 7 due 5pm on Mar 19 In-class Quiz 7 on Mar 19
Mar 19	Unit 6: Sequential Data Modeling	Assignment 8 due 5pm on Mar 26 In-class Quiz 8 on Mar 26
Mar 26	Unit 7: Reinforcement Learning	Assignment 9 due 5pm on Apr 2 In-class Quiz 9 on Apr 2
Apr 2	Unit 8: Ethical & Explainable Machine Learning	Assignment 10 due 5pm on Apr 9 In-class Quiz 10 on Apr 9
Apr 9	Hackathon	In-class proposed solution presentation Solution submission due 11:55pm on Apr 19

INTERNET AND ELECTRONIC COMMUNICATION DEVICE INFORMATION

Cell phones must be turned off in class unless otherwise arranged with the instructor.

The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. Students are to refrain from accessing websites that may be distracting for fellow learners (e.g. personal emails, Facebook, YouTube). Students are responsible for being aware of the University's Internet and email use policy, which can be found at https://www.ucalgary.ca/policies/files/policies/electronic-communicationspolicy.pdf.

MEDIA AND RECORDING IN LEARNING ENVIRONMENTS

Media recording for lesson capture

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

Media recording for assessment of student learning

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

Media recording for self-assessment of teaching practices

The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

Student Recording of Lectures

Audio or video recording of lectures is prohibited except where explicit permission has been received from the instructor.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

ACADEMIC ACCOMMODATIONS

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/. Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf

IMPORTANT INFORMATION

Any research in which students are invited to participate will be explained in class and approved by the appropriate University Research Ethics Board

COPYRIGHT

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University's Fair Dealing Guidance for Students (library.ucalgary.ca/files/library/guidance_for_students.pdf). Further information for students is available on the Copyright Office web page (https://library.ucalgary.ca/copyright)

A NOTE REGARDING INSTRUCTOR INTELLECTUAL PROPERTY
Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor (s). These materials may NOT be reproduced, redistributed or copied without the explicit consent of the professor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course *at the same time* may be allowed under fair dealing

ACADEMIC INTEGRITY
The Cumming School of Medicine expects intellectual honesty from its students. Course participants should be aware of University policies relating to Principles of Conduct, Plagiarism and Academic Integrity. These are found in the printed Faculty of Graduate Studies Calendar, or online under Academic Regulations in the Faculty of Graduate Studies Calendar, available at **Faculty of Graduate Studies Academic Regulations**

ACADEMIC MISCONDUCT
For information on academic misconduct and its consequences, please see the University of Calgary Calendar at http://www.ucalgary.ca/pubs/calendar/current/k.html

EMERGENCY EVACUATION AND ASSEMBLY POINTS
Assembly points for emergencies have been identified across campus. The primary assembly points for South Campus (Health Science Centre (HSC); Health & Research Innovation Centre (HRIC); Heritage Medical Research Building (HMRB) and Teaching, Research and Wellness (TRW)) are:

- HSC and HMRB: HRIC Atrium (alternate assembly point is Parking Lot 6)
- HRIC: HMRB Atrium (alternate assembly point is Parking Lot 6)
- TRW: McCaig Tower (alternate assembly point is HMRB – Atrium)

APPEALS
If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section N of the Faculty of Graduate Studies Calendar. Students must follow the official process and should contact the Student Ombuds Office (http://www.ucalgary.ca/provost/students/ombuds) for assistance with this and with any other academic concerns, including academic and non-academic misconduct

THE FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY (FOIP) ACT
This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP) and students should identify themselves on written assignments (exams and term work.) by their name and ID number on the front page and ID on each subsequent page. Assignments given by you to your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission

WELLNESS AND MENTAL HEALTH RESOURCES

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre), https://www.ucalgary.ca/wellnesscentre/services/mental-health-services and the Campus Mental Health Strategy website https://www.ucalgary.ca/mentalhealth/"

SUPPORTS FOR STUDENT LEARNING, SUCCESS, AND SAFETY

Student Ombudsman: The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union: The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; Information about the SU, including elected Faculty Representatives can be found here: https://www.su.ucalgary.ca

Graduate Student's Association: The GSA Vice-President Academic can be reached at (403) 220- 5997 or gsa.vpa@ucalgary.ca; Information about the GSA can be found here: https://gsa.ucalgary.ca

SAFEWALK

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit http://www.ucalgary.ca/security/safewalk. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.