MDSC 523
AI Applications in Health

Instructors:

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Office Hours/Policy on Answering Student Emails
All student meetings will be scheduled individually and conducted either in person or by Zoom.

Please note that all course communications must occur through your @ucalgary email, and a response to emails sent via student's @ucalgary emails can be expected within 48 hours.

Teaching Assistants:

Kalum Ost: kalum.ost@ucalgary.ca
Imam Asad: mohammadimamhasanbin@ucalgary.ca

Time and Location:
2022/09/06-2022/12/07

HS 1501
Tuesdays 3:00pm-5:25pm

This course will utilize Desire2Learn (D2L). To best succeed in the course, students are encouraged to participate in the asynchronous learning tasks using the D2L learning environment, as well as during synchronous in-person and Zoom sessions. When unable to participate live due to unforeseen circumstances, inform the instructor in advance and propose and implement propose an alternative participation activity (e.g., watch recorded lectures, submit a brief reflection, and actively contribute to the follow-up online discussion).

Prerequisite/Co-Requisite:
Medical Science 301 or 401; and 3 units from Computer Science 217, 219, 231 or 233.

Course Description:
A focus on concepts and ideas in artificial intelligence (AI) and machine learning, including statistical approaches, visualization, and human-computer interactions. An exploration of current research in AI and machine learning with a specific focus on applications to health.

Overarching Theme

This course will focus on concepts and ideas in artificial intelligence (AI) and machine learning -- including statistical approaches, visualization, and human-computer interactions. Applications of AI techniques and software tools. This will be a discussion-fueled course that involves reading recent literature and discussing ideas with faculty members involved in research in Artificial Intelligence and Machine Learning with a specific focus on applications to health, and will include the execution of an original analysis that must be presented in both written and oral formats.

Global Objectives

- Engage with the use of AI tools in the analysis of health/biological datasets, and to effectively communicate the results of such analyses.

Course Learning Outcomes

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

- Define "AI" in the context of health-related analyses; describe and differentiate between different "AI" methods;
- Select an AI-based analysis method taking into consideration the goals, type(s) of data, and other relevant factors;
- Perform AI analyses on a dataset of their choosing using one of several publicly available toolkits;
- Critically evaluate published studies that utilize AI tools in the health sciences;
- Effectively present the results of AI analysis in both written and oral formats.

Transferable Skill Development:

Many of the skills and abilities that you are developing in your coursework are transferable to the workforce, graduate and professional studies and other facets of life. Employers seek applicants with transferable skills because they can be an asset in the workplace, regardless of industry or sector. Transferable skills are core skills for your success in building your future career.

The work that you will do in MDSC 523 will help you build the following transferable skills:

- **Collaboration**: Work respectfully with others from different backgrounds, cultures, and countries.
- **Verbal Communication**: Learn and share information by presenting, listening, and interacting with others.
- **Creativity and Innovation**: Find different and better ways to do things, being curious, thinking imaginatively.
- **Critical Thinking**: Actively and skillfully conceptualize, apply, analyze, synthesize, and/or evaluate information (data, facts, observable phenomena, and research findings) to make a reasoned judgement or draw a reasonable conclusion.
- **Digital Skills**: Use digital technologies like computers, social media, virtual meeting platforms, and the internet.
- **Information Literacy**: Find, understand, and use information presented through words, symbols, and images
- **Numeracy**: Use mathematical information such as numbers, symbols, words, and graphics to do tasks.
- **Problem solving**: Identify an issue, find and implement a solution, and assess whether the situation has improved.

- **Project Management:** Conceptualize, initiate, plan and execute a plan to achieve a predetermined goal (project) by effectively prioritizing activities and meeting deadlines.
- **Written Communication**: Share ideas and information by using words, images, and symbols.

Learning Resources
Pytorch: https://pytorch.org/

Recommended Textbooks/Readings
Google-AI: https://ai.google/tools/

Weka: https://www.cs.waikato.ac.nz/ml/weka/

Learning Technology Requirements
Brightspace (by D2L) is located on the University of Calgary server and will be used extensively for communication with students. **It is the student's responsibility to ensure that they receive all posted communications and documents and that they receive emails sent by instructors or fellow students through D2L.** Only your @ucalgary.ca email address may be linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account.

Evaluation
The University policy on grading and related matters is described in section F of the 2022-2023 Calendar.

In determining the overall grade in the course, the following weights will be used:

10% -   Weekly reading of papers and summary report

15% -   "Journal club" discussion sessions (10% presentation, 5% participation)

15% -   Tutorial assignments

15% -   Written assessment of machine learning and data analytics tools

25% -   Proposal of an Artificial Intelligence project (using identified software tools) related to health care research, delivery, or other related issue. Must include some preliminary analysis.

20% -   Final oral presentation with questions from instructors and the class

A Note regarding Writing Assignments:

Writing skills are important to academic study in all disciplines. In keeping with the University of Calgary's emphasis on the importance of academic writing in student assignments (section E.2 of 2022-23 Calendar), writing is emphasized, and the grading thereof in determining a student's mark in this course. The Bachelor of Health Sciences values excellence in writing. Competence in writing entails skills in crafting logical, clear, coherent, non-redundant sentences, paragraphs and broader arguments, as well as skills with the mechanics of writing (grammar, spelling, punctuation). Sources used in research papers must be properly documented. The University of Calgary offers instructional services through the Students' Success Centre's Writing Support Services (http://www.ucalgary.ca/writingsupport/) for

students seeking feedback on assignments or seeking to improve their general writing skills. Students are **strongly encouraged** to take advantage of these programs.

Grading Scheme:

Letter Grade	Description	Percentage
A+	Outstanding performance	96-100
A	Excellent performance	90-95.99
A-	Approaching excellent performance	85-89
B+	Exceeding good performance	80-84
B	Good performance	75-79
B-	Approaching good performance	70-74
C+	Exceeding satisfactory performance	65-69
C	Satisfactory performance	60-64
C-	Approaching satisfactory performance	57-59
D+	Marginal pass	54-56
D	Minimal pass	50-53
F	Does not meet course requirements	0-49

Missed Components of Term Work:
At each instructor's discretion, late assignments will lose 5% per day late past the deadline.
Assignments will **NOT** be accepted more than 72 hours after the posted deadline and students failing to submit any assignment within this time frame will receive a mark of zero.

Course Evaluations and Student Feedback

Student feedback will be sought at the end of the course through the Universal Student Rating of Instruction (USRI) and a qualitative student evaluation. Students are welcome to discuss the process and content of the course at any time with the instructor. Students may also address any concerns they may have with Dr. Ebba Kurz, Associate Dean (Undergraduate Health and Science Education) in the Cumming School of Medicine (kurz@ucalgary.ca).

Attendance
Attendance at live lectures sessions is expected for each student at all times. Please note that while absences are permitted for religious reasons, students are responsible for providing advance notice and adhering to other guidelines on this matter, as outlined in the University Calendar (https://www.ucalgary.ca/pubs/calendar/current/e-4.html).

Conduct During Lectures
The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic. Students, employees, and academic staff are also expected to demonstrate behaviour in class that promotes and maintains a positive and productive learning environment.

As members of the University community, students, employees and academic staff are expected to demonstrate conduct that is consistent with the University of Calgary Calendar, the Code of Conduct

and Non-Academic Misconduct policy and procedures, which can be found at
https://www.ucalgary.ca/legal-services/university-policies-procedures.

Students are expected to take notes during class and should not rely solely on material supplied by the instructors.

Use of Internet and Electronic Communication Devices in Class
The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. However, research studies have found that inappropriate/off-topic use of electronic devices in the classroom negatively affects the learning of others during class time.

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-communications-policy.pdf .

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

Copyright
All students are required to reach the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright-policy.pdf) and requirements of the Copyright Act (https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html) to ensure they are aware of the consequences of unauthorized sharing of course materials (including instructor notes, electronic versions of textbooks, etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy https://www.ucalgary.ca/pubs/calendar/current/k.html.

Instructor Intellectual Property
Course materials created by instructors (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. 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 Accommodations
It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at https://ucalgary.ca/student-services/access/prospective-students/academic-accommodations. Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities.pdf). SAS will process the request and issue letters of accommodations 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 Dr. Ebba Kurz (kurz@ucalgary.ca), Associate Dean (Undergraduate Health and Science Education).

Academic Misconduct
The University of Calgary is committed to the highest standards of academic integrity and honesty. The University of Calgary has created rules to govern all its members regarding the creation of knowledge and the demonstration of knowledge having been learned.

Academic Misconduct refers to student behaviour that compromises proper assessment of a student's academic activities and includes (but is not limited to): cheating, fabrication, falsification, plagiarism, unauthorized assistance, failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses, and failure to comply with exam regulations applied by the Registrar. **It also includes using of third-party websites/services to access past/current course material, essay/assignment writing services, or real-time assistance in completing assessments, seeking answers to assessment questions and similar, whether paid, bartered or unpaid.**

For information of the Student Academic Misconduct Policy and Procedures, please visit;
https://ucalgary.ca/policies/files/policies/student-academic-misconduct-policy.pdf
https://ucalgary.ca/policies/files/policies/student-academic-misconduct-procedure.pdf

Additional information is available on the Academic Integrity website at: https://ucalgary.ca/student-services/student-success/learning/academic-integrity.

Recording of Lectures
Audio or video recording of lectures (or similar) is prohibited except where explicit permission has been received from the instructor.

Freedom of Information and Protection of Privacy Act
Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary

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 I of the University Calendar. Students must follow the official reappraisal/appeal process and may contact the Student Ombuds' Office (http://www.ucalgary.ca/ombuds) for assistance with this and with any other academic concerns, including academic and non-academic misconduct. Students should be aware that concerns about graded term work may only be initiated **within 10 business days** of first being notified of the grade. https://www.ucalgary.ca/pubs/calendar/current/i-2.html

MEDIA RECORDING
Please refer to the following statement on media recording of students: https://elearn.ucalgary.ca/wp-content/uploads/2020/05/Media-Recording-in-Learning-Environments-OSP_FINAL.pdf

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 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.

Media recording for the 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.

Sexual and Gender-Based Violence Policy
The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf

Resources for Support of Student Learning, Success, Safety and Wellness
Student Success Centre   http://www.ucalgary.ca/ssc/
Student Wellness Centre   http://www.ucalgary.ca/wellnesscentre/
Student Advocacy and Wellness Hub (CSM)
            https://cumming.ucalgary.ca/mdprogram/current-students/student-advising-wellness
Distress Centre   http://www.distresscentre.com/
Library Resources   http://library.ucalgary.ca

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 (https://www.ucalgary.ca/wellnesscentre/services/mental-health-services) and the Campus Mental Health Strategy (http://www.ucalgary.ca/mentalhealth/).

Student Ombuds' Office
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

BHSc Student Faculty Liaison Committee (SFLC)

The BHSc SFLC, with elected representatives from all majors, serves to raise issues of interest to BHSc students to the program administration, including items pertaining to curriculum, scheduling and events. A list of current representatives can be found on the BHSc website.

Student Union (SU) Information
The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; the SU representatives for the Cumming School of Medicine can be reached at medrep1@su.ucalgary.ca or medrep2@su.ucalgary.ca.

Student Success Centre
The Student Success Centre provides services and programs to ensure students can make the most of their time at the University of Calgary. Our advisors, learning support staff, and writing support staff assist students in enhancing their skills and achieving their academic goals. They provide tailored learning support and advising programs, as well as one-on-one services, free of charge to all undergraduate and graduate students. For more information visit: https://www.ucalgary.ca/student-services/student-success

Emergency Evacuation/Assembly Points
As part of the University of Calgary Emergency Evacuation plan, students, faculty, and staff should locate the closest Assembly Point in case of Fire Alarm. Safety signage is posted throughout the campus showing the locations and the possible route to these locations. All students, faculty, and staff are expected to promptly make their way to the nearest Assembly Point if the Fire Alarm is activated. No one is to return into campus facilities until an all clear is given to the warden in charge of the Assembly Area. For more information, see https://www.ucalgary.ca/emergencyplan/building-evacuation/assembly-points

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.

Class Schedule
The following is a list of topics for class, associated readings, and assignment / exam due dates. Please note that unforeseen circumstances may cause changes to the schedule with respect to the timing of topics and readings. Students will be notified of all changes in a timely manner by way of email and D2L announcements.

Date	Module / Topics	Instructor/Guest Lecturer	Tutorial
Sept 6	Course Outline; General Introduction to AI	Dr. Anderson	Imam
Sept 13	Dimensionality Reduction	Dr. Anderson	Kalum
Sept 20	Data transformation; Linear/log regression; model assessment; Model complexity	Dr. Anderson	Kalum
Sept 27	Linear models and regularization	Dr. Long (Dr. Ovens?)	Kalum
Oct 4	Support Vector Machines and kernel-based methods	Dr. Long	Kalum
Oct 11	Neural networks	Dr. Long	Imam
Oct 18	Deep Learning	Dr. Long	Imam
Oct 25	Clinical perspectives on AI in health	Dr. Cadotte	
Nov 1	CNNs; Image Analysis	Dr. Forkert	Imam
Nov 8	Reading Break (no class)		
Nov 15	(Work/informal presentation session)		
Nov 22	Future Directions; Explainable AI; Common pitfalls and challenges	Kalum Ost	Kalum
Nov 29	Project Presentations		
Dec 6	Project Presentations		

Fall 2022