

MDSC 523
AI Applications in Health

Instructor:

Connie Li, PhD (she/her)
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Office Hours/Policy on Answering Student Emails

Please note that all course communications must occur through your @ucalgary email.

Instructor office hours: Thursday 2:00pm – 4:00pm

Students are welcome to drop-in during office hours. For alternative timings, contact the instructor/TAs to schedule an in-person or Zoom meeting.

I will respond to emails sent via student's @ucalgary emails within 48 hours.

Teaching Assistants:

Paula Brandt (paula.brandt1@ucalgary.ca)
Afarinesh Panahy (afarinesh.panahy@ucalgary.ca)

Time:

Tuesdays from 3:00pm – 5:45pm

Prerequisite/Co-Requisite:

Medical Sciences 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

Data is a driving force in today's world. Our ability to model high-dimensional data and extract meaningful insights have dramatically accelerated advancements across all domains of knowledge, including health. Applications of Artificial intelligence (AI) and machine learning (ML) in health are improving our understanding of health systems and guiding our health decisions. In this course, we will introduce the statistical foundations of AI/ML approaches, discuss how they are used in health research, and practice their applications in real-world health data.

We will learn how to explore the AI/ML potential in a dataset and how to develop biological questions suitable for AI/ML analysis. We'll use statistical programming to create visualizations, train AI/ML models, and assess model performance. You'll practice these skills in a team-based AI/ML analysis of health data.

In teams, you'll design and execute your analysis, present your work orally, and create a final written report. You'll also get experience with coding platforms that are frequently used in academia and industry.

The Bachelor of Health Sciences program is a research-intensive program, and much research is now data-driven. This course aims to help you understand when and how to appropriately apply AI/ML methods to data. You'll develop data analysis, literature review, and collaboration skills that are key to succeeding in a research environment.

Global Objectives

- To identify opportunities for the application of AI/ML in health and
- To collaboratively execute an AI/ML analysis of health data in a setting reflecting real-world practices

Course Learning Outcomes

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

1. Define “artificial intelligence” and “machine learning” in the context of health-related analyses
2. Describe and differentiate between different AI/ML methods
3. Describe and implement machine learning best practices
4. Identify and discuss limitations of AI/ML from multiple perspectives
5. Critically evaluate published studies that apply AI tools in the health sciences
6. Execute AI/ML analyses on a health dataset of their choosing using publicly available platforms
7. Develop a codebase for AI/ML analyses and discuss the code
8. Effectively present the results of AI/ML analyses in 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

An Introduction to Statistical Learning with Applications in Python/R by Gareth James *et al.* is accessible from <https://www.statlearning.com/>

Other required readings will be outlined on D2L and links and documents will be made available.

A Note regarding readings

Required readings have been chosen carefully to inform you and enhance the lecture material.

Students are REQUIRED to complete assigned readings BEFORE each lecture. Instructors will proceed in class on the assumption that students have read the assigned readings. Students should be aware that many of the readings they will be assigned may be of an unfamiliar nature and style. Students should plan sufficient time to allow for the possibility of several reads of the assigned material.

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.

A laptop, desktop, tablet or mobile device is required for D2L access. If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: <http://elearn.ucalgary.ca/d2l-student/>.

Evaluation

The University policy on grading and related matters is described in Section F of the 2025-2026 Calendar.

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

| Assessment | Weight (% of Grade) | Due Date and Time | Alignment with course Learning Objectives |
|---|--|--|---|
| Written quizzes <ul style="list-style-type: none">- Individual- In-class | 10%, Lowest quiz mark will be dropped | In-class on these dates: Sept 16, Sept 23, Oct 7, Oct 14, Oct 21, Oct 28, Nov 4, Nov 25 | CLOs 1, 2, 3 |
| Journal club engagement <ul style="list-style-type: none">- Individual- In-class | 20% | In-class on these dates: Sept 16, Oct 14, Oct 21, Oct 28, Nov 18 | CLOs 1, 2, 3, 4, 5 |
| Reflection #1 <ul style="list-style-type: none">- Individual- Submit on D2L | 7% | Oct 3 @11:59pm | CLOs 1, 2, 3, 4, 5 |
| Problem Statement & Analysis Plan (Final project component) <ul style="list-style-type: none">- Group- Submit on D2L | 10% | Oct 10 @11:59pm | CLOs 1, 2, 3 |
| WIP Presentation & Question Period (Final project component) <ul style="list-style-type: none">- Group- In-class | 15% | Nov 4 in-class | CLOs 2, 3, 8 |
| Ethics workshop <ul style="list-style-type: none">- Individual- In-class | 9% | Nov 25 in-class | CLOs 2, 4, 5 |
| Reflection #2 <ul style="list-style-type: none">- Individual- Submit on D2L | 4% | Nov 28 @11:59pm | CLOs 2, 4, 5 |
| Code Review (Final project component) <ul style="list-style-type: none">- Individual- Scheduled with instructor | 10% | Bookings open from Nov 17 - Dec 4 | CLO 7 |
| Final Report (Final project component) <ul style="list-style-type: none">- Group- Submit on D2L | 15% | Dec 4 @11:59pm | CLO 2, 3, 6, 7, 8 |

Descriptions and rubrics/marketing guidelines of each assessment item are posted in D2L.

There will be no final exam for this course.

A student's final grade for the course is the sum of the separate assignments. It is not necessary to pass each assignment separately in order to pass the course.

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 2025-26 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 to complete each assessment must be properly documented, unless otherwise noted by the instructor. 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 students will lose 5% per day late past the deadline for all assignments. 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.

As per University Calendar Section G.2.3 **students who are absent from an in-class assessment will receive a mark of zero on the missed component.** Students who are absent are responsible for contacting their instructor to discuss the impact of their missed assessment. Alternative opportunities for completing missed assessments or shifting of the assessment weight **may** be possible but are not guaranteed. Students who are identified as falsifying information related to missed assessments will be subject to investigation for academic misconduct.

Extensions will NOT be granted on any assignment or quizzes in MDSC 523. The only exceptions to this are those in keeping with the University Calendar (debilitating illness, religious conviction, or severe domestic affliction) that are received in writing and with supporting documentation. Traffic jams and late or full buses are common events in Calgary and are NOT acceptable reasons for late arrivals to class, meetings and examinations. 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://calendar.ucalgary.ca/pages/02ffccb6b1a541db880fe4223d122b5e>

Course Evaluations and Student Feedback

Student feedback will be sought at the end of the course through the new UCalgary Course Experience Survey 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. Fabiola Aparicio-Ting, Associate Dean (Undergraduate Health and Science Education) in the Cumming School of Medicine (feapartic@ucalgary.ca).

Attendance

Regular attendance is advised in order to succeed in MDSC 523. Students are expected to take notes during class and should not rely solely on material supplied by the instructors. Instructors may or may not post lectures notes to D2L, at their individual discretion. In-class discussion and all content presented in class, including concepts and examples, can constitute substantial learning and can be considered for assessment.

Note that in-class quizzes and discussions make up a significant portion of the grades for MDSC 523. You must be present to participate in these components.

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://ucalgary.ca/student-services/student-conduct/policy>

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/legal-services/university-policies-procedures/acceptable-use-electronic-resources-and-information-policy>

Use of Artificial Intelligence Tools

Generative Artificial Intelligence (AI), and specifically foundational models that can create writing, computer code, and /or images using minimal human prompting includes not only GPT-4 (and its siblings ChatGPT and Bing), but many writing assistants that are built on this or similar AI technologies.

Students may use artificial intelligence tools, including generative AI, to assist in learning course material and assist in coding in **MDSC 523**. Other AI use is prohibited unless explicitly stated otherwise by the instructor. All submitted writing and presentation materials must be the work of the student. **Students are ultimately accountable for the work they submit.** Students may choose to use generative artificial intelligence tools as they work through the assignments in this course; this use must be documented in an appendix for each assignment. The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work. **Failure to cite the use of AI generated content in an assignment/assessment will be considered a breach of academic integrity and subject to Academic Misconduct procedures.** Please see this library guide for how to cite the use of AI tools: <https://libguides.ucalgary.ca/c.php?g=733971&p=5302331>

Students *are not allowed* to upload class slides, assignment instructions, or other course materials to AI tools or platforms. These are the intellectual property of the course instructor (IP); uploading these to and AI platform may breach IP rules since some of these sites may use these as training/output data.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

Copyright

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (<https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy>) 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/legal-services/university-policies-procedures/student-non-academic-misconduct-policy>

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/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>).

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. Fabiola Aparicio-Ting (feaparc@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://www.ucalgary.ca/legal-services/university-policies-procedures/student-academic-misconduct-policy>.

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) by students 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/student-services/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://calendar.ucalgary.ca/pages/e31a7115dca740ec83579e946d4a4193>

Media Recording

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.

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/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy>

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/student-services/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/risk/emergency-management/drills/assembly-points-and-evacuation-maps>

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.