CMPUT 267 - Machine Learning I
Fall 2024

Lecture Room & Time: Tue & Thu 12:30pm - 1:50pm (CCIS 1-440 & Virtual)
Tutorial (Optional): Thu 4:00pm - 5:00pm (CCIS 1-160 & Virtual)
Instructor: Vlad Tkachuk (email: vtkachuk@ualberta.ca)
Office Hours: Thu 2:15pm - 3:30pm (CSC 2-15)
TA E-mail: cmput267@ualberta.ca
Course Web Page: Link
eClass: Link
Piazza: Link
Recordings: Link
Course Notes: Link

TAs and Office Hours: There will be TA office hours both in-person and virtual. You can sign up for 10-minute slots, using this Sheet.

Name	Day and Time	Location
Bahar Boroomand Ghahnavieh	Monday 9:00am - 10:00am	Virtual
Abdelrahman Elaraby	Monday 12:00pm - 1:00pm	CAB 313
Mehrshad Tavana	Monday 1:00pm - 2:00pm	CAB 313
Alireza Masoumian	Tuesday 9:00am - 10:00am	CAB 313
Aidan Bush	Tuesday 3:00pm - 4:00pm	Virtual
Guoqing Luo	Wednesday 9:00am - 10:00am	Virtual
Thang Duc Chu	Wednesday 2:00pm - 3:00pm	Virtual
Jai Riley	Wednesday 3:00pm - 4:00pm	CAB 313
Vlad Tkachuk (Instructor)	Thursday 2:15pm - 3:30pm	CSC 2-15
Alex Ayoub	Friday 9:00am - 10:00am	CSC 2-18
Rohini Das	Friday 1:00 - 2:00pm	Virtual
Kushagra Chandak	Friday 4:00pm - 5:00pm	Virtual

COURSE CONTENT

Course Description:
This course introduces the fundamental statistical, mathematical, and computational concepts in analyzing data. The goal for this introductory course is to provide a solid foundation in the mathematics of machine learning, in preparation for more advanced machine learning concepts. The course focuses on univariate models, to simplify some of the mathematics and emphasize some of the underlying concepts in machine learning, including how should one think about data; how can data be summarized; how models can be estimated from data; what sound estimation principles look like; how generalization is achieved; and how to evaluate the performance of learned models.

Course Prerequisites:
Prerequisites: CMPUT 174 or 274; one of MATH 100, 114, 117, 134, 144, or 154.
Corequisites: CMPUT 175 or 275; CMPUT 272; MATH 102, 125 or 127; one of STAT 151, 161, 181, 235, 265, SCI 151, or MATH 181.
In this course, we will cover some basics in probability and optimization that you will need for the course. However, you will be applying these concepts for machine learning, and so it is important that (a) you have been exposed to some of the concepts before, and (b) are at least enforcing some of the mathematical knowledge in parallel. You must have taken calculus before this course, and have some programming experience. Background in probability and a first course in programming is recommended to be taken before this course, but can be taken as a co-requisite. An excitement to understand the math underlying machine learning is a must.

The course CMPUT 272 is included as a co-requisite, as that course helps you become more comfortable with mathematical formalization. This co-requisite is particularly pertinent to those in CS, where CMPUT 272 is a requirement. For other departments, other math classes might provide that background, and can be used in place of CMPUT 272. In this case, you can email the instructor for permission to take the course without 272.

Course Objectives and Expected Learning Outcomes:
By the end of the course, you should understand:

- The regression and classification problems
- How to solve the problems using closed form solutions and iterative methods like gradient descent
- How to evaluate your solutions

By the end of the course, you will have improved your skills in:

- Implementing basic estimation approaches (e.g., stochastic gradient descent for linear regression) in Python
- Applying concepts from calculus and probability to solve real data problems

- Problem solving, by facing open-ended data analysis problems and needing to both formulate the problem and identifying appropriate algorithms to solve the problem

Course Schedule & Assigned Readings:

The course schedule will be available on eClass and the course website, along with assigned readings.

Tutorial (Optional):

There will be a weekly tutorial session on Thursdays at 4:00pm - 5:00pm (CCIS 1-160) led by the instructor or a TA. The tutorials will go over practice problems and assignments. The tutorial is optional (i.e. no course marks are given for attendance). The tutorials will also be streamed virtually and recorded.

LEARNING RESOURCES

Major Course Materials:
The course will be based on these notes (made specifically for the course). These are designed to be short, so that you can read every chapter. I recommend avoiding printing these notes, since later parts of the notes are likely to be modified.

Piazza Discussion Group:
This term we will be using Piazza for class discussion (please use your real name when signing up). The system is highly catered to getting you help fast and efficiently from classmates, TAs, and the instructor. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. You can also post your questions anonymously. You may see a prompt about contributing, but you are NOT REQUIRED to pay anything to participate.

Optional Learning Resources:
Presented in order of relevance:

- C.M. Bishop, Pattern Recognition and Machine Learning.
- Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning.
- Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Machine Learning.
- T. Hastie, R. Tibshirani, and J. Friedman, The Elements of Statistical Learning.
- David Barber, Bayesian Reasoning and Machine Learning.

Academic Success Centre:
The Academic Success Centre provides professional academic support to help students strengthen their academic skills and achieve their academic goals. Individual advising,

appointments, and group workshops are available year round in the areas of Accessibility, Communication, Learning, and Writing Resources. Modest fees apply for some services.

Faculty of Science Student Services:
The Faculty of Science Student Services office is located on the main floor of the Centennial Centre for Interdisciplinary Sciences (CCIS). This office can assist with the planning of Your Academics, and provide information related to Student Life & Engagement, Internship & Careers, and Study Abroad opportunities. Please visit Advising for more information about what Faculty Academic Advisors in the Student Services Office can assist you with.

GRADE EVALUATION

Assessment	**Weight**	**Date**
Assignments (8, top 7 counted)	30% (4.29% each)	See course website
Midterm exam 1	20%	Oct 8, 2024 in class (12:30pm - 1:45pm in CCIS 1-440)
Midterm exam 2	20%	Nov 19, 2024 in class (12:30pm - 1:45pm in CCIS 1-440)
Final exam	30%	Dec 18, 2024 at 8:30am (3 hours) (tentative)

At least 3 of the assignments will be coding assignments. We will be using Python in Google Colab. Resources to help you get started with Google Colab will be shared later in the course.

To do the assignments you will need: An internet connection, and a modern web browser (Chrome, Firefox, or Safari recommended).

Students must verify the final exam date on BearTracks when the Final Exam Schedule is posted.

Grades are unofficial until approved by the Department and/or Faculty offering the course.

Statement of Expectations for AI Use:

AI tools such as large language models (ex: ChatGPT, Gemini, and Claude) are becoming increasingly prevalent in academic settings. While they can be valuable resources for learning, it's crucial to use them ethically, transparently, and effectively. This policy outlines the guidelines for AI usage in this course.

Learning with AI:

1. Experimentation and AI Literacy: You are encouraged to experiment with AI tools throughout the course to help understand concepts and develop AI literacy, an emerging skill valuable for both students and instructors.
2. Critical Evaluation: Familiarize yourself with the strengths and weaknesses of AI tools. Be aware that they are prone to fabrication and factual inaccuracies. Always verify information provided by AI using other reliable sources.
3. Responsibility: You are responsible for identifying and resolving any errors or omissions in AI-generated content that you use.

Appropriate Use of AI:

1. Permitted Uses: You may use AI to:
    - Debug code
    - Better understand questions or concepts
    - Reason through your solutions
2. Original Work: All assignment answers must be in your own words. AI should support your learning, not replace your own critical thinking and expression.
3. Thoughtful Application: Be mindful about when and how you use AI tools. Avoid using them to shortcut the work necessary to achieve your learning goals or when it's not appropriate for the task at hand.

Transparency and Academic Integrity:

1. Mandatory Disclosure: If you use AI to assist with any part of your assignment, you must include a detailed paragraph at the end of your submission. This paragraph should:
    - Specify which questions or sections involved AI assistance
    - Explain how the AI tool was used (e.g., brainstorming, proofreading, generating initial ideas)
    - Clarify your own contributions to the final work
2. Grading Policy:
    - You will not lose marks for using AI as long as you disclose its use appropriately.
    - However, if you use AI to generate a complete solution for a question, you will receive zero marks for that specific question.
    - Honest and full disclosure of AI usage, even when used to generate complete solutions, will not result in disciplinary action beyond the zero marks for that question.

3. Academic Integrity: Failure to disclose AI usage is considered a form of cheating and a violation of the University of Alberta Student Academic Integrity Policy. Such violations may result in severe academic penalties.

By following these guidelines, you demonstrate academic integrity and develop crucial skills in ethical AI usage that will serve you well in your future academic and professional endeavors. Remember, AI is a tool to enhance your learning, not replace it. Use it responsibly to support your understanding and development of course material.

Re-evaluation of Term Work:
After receiving the mark for each assignment students may contact the TAs at cmput267@ualberta.ca if there is an error in tallying marks or a section has not been marked correctly. In either case, the students must contact the TAs within one week from the day the marks are released; any requests beyond that week will not be considered.
After receiving the mark for each midterm exam there will be three sessions (1 hour in length) offered in the following week to review your midterm exam if you think there was an error in marking. If you are unable to attend any of the three midterm exam review sessions you can email the instructor to schedule a separate session. Any requests two weeks after the midterm exam marks were released will not be considered.
There is no possibility of an extension or a re-examination for midterm exams in this course.

Re-examination:
There is no possibility of a re-examination in this course.

Past or Representative Evaluative Material:
Past or representative exam material will be provided.

POLICIES FOR LATE AND MISSED WORK

Late Policies:
We will not accept late assignments; there is no late penalty policy. The assignments must be submitted electronically via eClass on time, by 11:59 pm Mountain time on the due date.

Missed Term Work or Final Exam Due to Non-medical Protected Grounds (e.g., religious beliefs):
When a term assessment or final exam presents a conflict based on non-medical protected grounds, students must apply to the Academic Success Centre for accommodations via their Register for Accommodations website. Students can review their eligibility and choose the application process specific for *Accommodations Based on Non-medical Protected Grounds*.

It is imperative that students review the dates of all course assessments upon receipt of the course syllabus, and apply ***AS SOON AS POSSIBLE*** to ensure the timely application of the accommodation. Students who apply later in the term may experience unavoidable delays in the processing of the application, which can affect the accommodation.

Missed Term Work: Assignments

Students may email the instructor with requests for an extension at least 24 hours before an assignment deadline. Students must include two things in the email: (1) a reason for the extension (detail is not required, but at least a high level idea), and (2) the amount of time they're requesting the extension for. Note that you can miss one assignment and not incur a penalty because only the top 7 (of 8) assignments count towards the final grade. An extension is a privilege and not a right. There is no guarantee that an extension will be granted, or for the time requested. Misrepresentation of facts to gain an extension is a serious breach of the Student Academic Integrity Policy.

Missed Term Work: Midterm Exams

There is no possibility of an extension of a re-examination for midterm exams in this course. If a student cannot complete a midterm exam due to incapacitating illness, severe domestic affliction or other compelling reasons, the student must contact the instructor within two working days of missing the exam, or as soon as possible, to request an excused absence. If an excused absence is granted, then the weight of that missed exam is transferred to the final exam. An excused absence is a privilege and not a right. There is no guarantee that an absence will be excused.

Misrepresentation of facts to gain an excused absence is a serious breach of the Student Academic Integrity Policy. In all cases, instructors may request adequate documentation to substantiate the reason for the absence at their discretion.

Deferred Final Examination:

A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Such an application must be made to the student's Faculty office within two working days of the missed examination and must be supported by appropriate documentation or a Statutory Declaration (see calendar on Attendance). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. The Faculty may deny deferral requests in cases where less than 50% of term work has been completed. Misrepresentation of facts to gain a deferred examination is a serious breach of the Student Academic Integrity Policy.

Deferred final exam date: Jan 16, 2025 at 9:00am MDT

REMOTE DELIVERY CONSIDERATIONS

Virtual Delivery:
The class times and tutorials will be streamed virtually. A link to join can be found on eClass or the course website.

Recordings of Synchronous Activities:

- Please note that class times and tutorials for this course will be recorded. Recordings of this course will be used for the purposes of asynchronous learning and will be posted publicly on Youtube.
- If students choose to join class via Google Meet, they have the right to not participate in the recording and are advised to turn off their cameras and audio prior to recording; they can still participate through text-based chat. It is recommended that students remove all identifiable and personal belongings from the space in which they will be participating.
- Recordings will be made available until at least January 1, 2025 and accessible publicly on this Youtube playlist. Please direct any questions about this collection to the instructor of this course.

STUDENT RESPONSIBILITIES

Academic Integrity and Student Conduct:

The University of Alberta is committed to the highest standards of academic integrity and honesty, as well as maintaining a learning environment that fosters the safety, security, and the inherent dignity of each member of the community, ensuring students conduct themselves accordingly. Students are expected to be familiar with the standards of academic honesty and appropriate student conduct, and to uphold the policies of the University in this respect.

Students are particularly urged to familiarize themselves with the provisions of the Student Academic Integrity Policy and the Student Conduct Policy, and avoid any behaviour that could potentially result in suspicions of academic misconduct (e.g., cheating, plagiarism, misrepresentation of facts, participation in an offence) and non-academic misconduct (e.g., discrimination, harassment, physical assault). Academic and non-academic misconduct are taken very seriously and can result in suspension or expulsion from the University.

All students are expected to consult the Academic Integrity website for clarification on the various academic offences. All forms of academic dishonesty are unacceptable at the University. Unfamiliarity of the rules, procrastination or personal pressures are not acceptable

excuses for committing an offence. Listen to your instructor, be a good person, ask for help when you need it, and do your own work -- this will lead you toward a path to success. Any academic integrity concern in this course will be reported to the College of Natural and Applied Sciences. Suspected cases of non-academic misconduct will be reported to the Dean of Students. The College, the Faculty, and the Dean of Students are committed to student rights and responsibilities, and adhere to due process and administrative fairness, as outlined in the Student Academic Integrity Policy and the Student Conduct Policy. Please refer to the policy websites for details on inappropriate behaviours and possible sanctions.

The College of Natural and Applied Sciences (CNAS) has created an Academic Integrity for CNAS Students eClass site. Students can self enroll and review the various resources provided, including the importance of academic integrity, examples of academic misconduct & possible sanctions, and the academic misconduct & appeal process. They can also complete assessments to test their knowledge and earn a completion certificate.

"Integrity is doing the right thing, even when no one is watching." -- C.S. Lewis

Contract Cheating and Misuse of University Academic Materials or Other Assets:

Contract cheating describes the form of academic dishonesty where students get academic work completed on their behalf, which they then submit for academic credit as if they had created it themselves.

Contract cheating may or may not involve the payment of a fee to a third party, who then creates the work for the student.

Examples include:
1) Getting someone to write an essay or research paper for you.
2) Getting someone to complete your assignment or exam for you.
3) Posting an essay, assignment or exam question to a tutorial or study website; the question is answered by a “content expert”, then you copy it and submit it as your own answer.
4) Posting your solutions to a tutorial/study website, public server or group chat and/or copying solutions that were posted to a tutorial/study website public server or group chat.
5) Sharing your login credentials to the course management system (e.g. eClass) and allowing someone else to complete your assignment or exam remotely.
6) Using an artificial intelligence bot or text generator tool to complete your essay, research paper, assignment or exam solutions for you (without the instructor’s permission).
7) Using an online grammar checker to “fix” your essay, research paper, assignment or exam solutions for you (without the instructor’s permission).

Contract cheating companies thrive on making students believe that they cannot succeed without their help; they attempt to convince students that cheating is the only way to succeed.

Uploading the instructor's teaching materials (e.g. course outlines, lecture slides, assignment or exam questions, etc.) to tutorial, study or note-sharing websites or public servers is a copyright infringement and constitutes the misuse of University academic materials or other assets.

Receiving assignment solutions or answers to exam questions from an unauthorised source puts you at risk of receiving inaccurate information.

Appropriate Collaboration:

Students need to be able to recognize when they've crossed the line between appropriate collaboration and inappropriate collaboration. If students are unsure, they need to ask the instructors to clarify what's allowed and what's not allowed.

Here are some tips to avoid copying on assessments:
1) Do not write down something that you cannot explain to your instructor.
2) When you are helping other students, avoid showing them your work directly. Instead, explain your solution verbally. Allowing your work to be copied is also considered inappropriate collaboration.
3) It is possible that verbally discussing the solution in too much detail may result in written responses that are too similar. Try to keep discussions at a general or high level.
4) If you find yourself reading another student's solution, do not write anything down. Once you understand how to solve the problem, remove the other person's work from your sight and then write up the solution to the question yourself. Looking back and forth between someone else's paper and your own paper is almost certainly copying and considered inappropriate collaboration.
5) If the instructor or TA writes down part of a solution in order to help explain it to you or the class, you cannot copy it and hand it in for credit. Treat it the same way you would treat another student's work with respect to copying, that is, remove the explanation from your sight and then write up the solution yourself.
6) There is often more than one way to solve a problem. Choose the method that makes the most sense to you rather than the method that other students happen to use. If none of the ideas in your solution are your own, there is a good chance it will be flagged as copying.

An additional link that may be useful is "How to Avoid Inappropriate Collaboration":

https://www.ualberta.ca/campus-life/academic-success/academic-integrity/collaboration.html

Exam Conduct:

- Your student photo I.D. is required at exams to verify your identity.
- Students must arrive at the specified time to take the exam. Once the exam has started, students must remain in the physical in-person or remote environment for at least 30 minutes. Students who arrive more than 30 minutes late for an in-person exam will not be permitted to take the exam. Students who arrive more than 30 minutes late for an online exam may have their exam attempt removed or disqualified by the instructor. In both cases students may apply for a deferred examination.
- All cell phones must be turned off and stored in your bags.

Students Eligible for Accessibility-Related Accommodations:
In accordance with the University of Alberta's Discrimination, Harassment,and Duty to Accommodate policy, accommodation support is available to eligible students who encounter limitations or restrictions to their ability to perform the daily activities necessary to pursue studies at a post-secondary level due to medical conditions and/or non-medical protected grounds. Accommodations are coordinated through the Academic Success Centre, and students can learn more about eligibility on the Register for Accommodations website.

It is recommended that students apply ***AS SOON AS POSSIBLE*** in order to ensure sufficient time to complete accommodation registration and coordination. Students are advised to review and adhere to published deadlines for accommodation approval and for specific accommodation requests (e.g., exam registration submission deadlines). Students who request accommodations less than a month in advance of the academic term for which they require accommodations may experience unavoidable delays or consequences in their academic programs, and may need to consider alternative academic schedules.

Recording and/or Distribution of Course Materials:
Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Learning and Working Environment:
The Faculty of Science is committed to ensuring that all students, faculty and staff are able to work and study in an environment that is safe and free from discrimination, harassment, and violence of any kind. It does not tolerate behaviour that undermines that environment. This includes virtual environments and platforms.

If you are experiencing harassment, discrimination, fraud, theft or any other issue and would like to get confidential advice, please contact any of these campus services:

- Office of Safe Disclosure & Human Rights*: A safe, neutral and confidential space to disclose concerns about how the University of Alberta policies, procedures or ethical standards are being applied. They provide strategic advice and referral on matters such as discrimination, harassment, duty to accommodate and wrong-doings. Disclosures can be made in person or online using the Online Reporting Tool*.
- University of Alberta Protective Services: *Peace officers dedicated to ensuring the safety and security of U of A campuses and community. Staff or students can contact UAPS to make a report if they feel unsafe, threatened, or targeted on campus or by another member of the university community.*
- Office of the Student Ombuds*: A confidential and free service that strives to ensure that university processes related to students operate as fairly as possible. They offer information, advice, and support to students, faculty, and staff as they deal with academic, discipline, interpersonal, and financial issues related to student programs.*
- Office of the Dean of Students*: They can assist students in navigating services to ensure they receive appropriate and timely resources. For students who are unsure of the support they may need, are concerned about how to access services on campus, or feel like they may need interim support while you wait to access a service, the Dean of Students office is here to help.*

Feeling Stressed, Anxious, or Upset?
It's normal for us to have different mental health experiences throughout the year. Know that there are people who want to help. You can reach out to your friends and access a variety of supports available on and off campus at the Need Help Now webpage or by calling the 24-hour Distress Line: 780-482-4357 (HELP).

Student Self-Care Guide:
This Self-Care Guide, originally designed by the Faculty of Native Studies, has broader application for use during students' learning. It provides some ideas and strategies to consider that can help navigate emotionally challenging or triggering material.

Policy about course outlines can be found in Course Requirements, Evaluations Procedures and Grading of the University Calendar.

Land Acknowledgement:
The University of Alberta respectfully acknowledges that we are situated on Treaty 6 territory, traditional lands of First Nations and Métis people.

To learn more about the significance of this land acknowledgement, please read this useful article and associated links to more information.

Disclaimer:
Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this syllabus.