

University of Alberta  
CMPUT 267 Basics of Machine Learning  
Winter 2024

**Lecture Room and Time**

TEL 150 Tuesdays and Thursday 2:00 pm – 3:20 pm

**Instructor:** Nidhi Hegde

**Office:** ATH 3-04

**E-mail:** [cmput267@ualberta.ca](mailto:cmput267@ualberta.ca)

For emails related to this course, you must use the above email address. Please include your full name (what you like to be called and your full name according to BearTracks) and student ID in each email.

Instructor's e-mail: [nidhih@ualberta.ca](mailto:nidhih@ualberta.ca)

**Course web page:** <https://nidhihegde.github.io/mlbasics>

**Course eClass page:** <https://eclass.srv.ualberta.ca/course/view.php?id=95783>

**Office Hours: Fridays 1:00pm – 2:00pm at ATH 3-04**

**TAs**

Duc Thang Chu

Vedd Kuknur

Guoqing Luo

Olya Mastikhina

Yongchang Hao

Shreya Pekhale

Kailash Seshadri

Aniket Sharma

Vlad Tkachuk

TA Office hours and location: please check course website or eclass for updated information.

## COURSE CONTENT

### Course Description

The field of machine learning involves the development of statistical algorithms that can learn from data, and make predictions on data. These algorithms and concepts are used in a range of computing disciplines, including artificial intelligence, robotics, computer vision, natural language processing, data mining, information retrieval, bioinformatics, etc. 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 125 or 127; one of STAT 141, 151, 235, or 265, or SCI 151.

Knowledge prerequisites. 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 mathematics 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

### Overview

- Basic probability concepts, covering both discrete and continuous cases
- Basic optimization concepts, needed for estimating models
- Analyzing scalar data
- Analyzing paired data
- Assessing model (prediction) performance

### Learning Outcomes

By the end of the course, you should understand:

- The design process for solving a data analysis problem:
  - properties of the data
  - choosing a model
  - defining a computational problem (e.g. an optimization problem)
- Basic estimation algorithms, including maximum likelihood and linear regression and different optimization approaches for those problems
- Generalization, including the concept of over-fitting
- Evaluation of learned models

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 Julia
- 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 and Assigned Readings

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

## LEARNING RESOURCES

### Required Textbook and/or Other Major Course Materials

You are expected to read the corresponding sections about a class's topic from notes before class as each class will discuss each topic in more detail and address questions about the material.

All readings are from these [machine learning notes](#). It is not recommended to print these notes, since some parts may be modified during the term.

### 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.

## GRADE EVALUATION

Term marks are computed as a weighted sum of the components listed below:

Component	Weight	Date/Time
Participation and Reading Questions	10%	per eClass
Assignments (8, top 7 counted)	30%	per eClass
Midterm Exams (2, 15% each)	30%	per eClass
Final Exam	30%	per eClass

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

### Re-evaluation of Term Work

Assignments and exams are carefully marked. After receiving the mark for each submitted work, students may contact the TAs at [cmput267@ualberta.ca](mailto:cmput267@ualberta.ca) if there is an error in tally 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. If the request is about re-marking a section, then the entire submission (assignment or exam) will be marked again.

There is no possibility of a re-examination for midterm exams in this course.

## **Past or Representative Evaluative Material**

Past or representative test material will be provided.

## **POLICIES FOR LATE AND MISSED WORK**

### **Late Policies**

Participation and reading questions are given a 36 hour window and must be completed in that time. No late submissions will be accepted.

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. There is a grace period of 48 hours when assignments will be accepted. No submissions will be accepted after 48 hours after the deadline, and the assignment will be considered as incomplete if not submitted.

### **Missed Term Work Due to Non-medical Protected Grounds (e.g., religious beliefs)**

When an assignment or test 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**

Assignments must be completed in the time provided. The assignments must be submitted electronically via eClass on time, by 11:59 pm Mountain time on the due date. There is a grace period of 48 hours when assignments will be accepted. No submissions will be accepted after 48 hours after the deadline, and the assignment will be considered as incomplete if not submitted. Outside of the late policy, students may email the instructor with requests for an extension at least 24 hours before a 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 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 Code of Student Behaviour.

### **Missed Term Work: Midterm Exams**

There are no extensions or re-examinations for midterm exams. If a student cannot complete an 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 Code of Student Behaviour. In all cases, instructors may request adequate documentation to substantiate the reason for the absence at their discretion.

## 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 [Code of Student Behaviour](#) 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) 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. Any suspected academic offence 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 of Science, and the Dean of Students are committed to student rights and responsibilities, and adhere to due process and administrative fairness, as outlined in the Code of Student Behaviour and the Student Conduct Policy. Anyone who is found in violation is likely to receive a sanction. Typical sanctions for academic misconduct include conduct probation, a mark reduction or a mark of 0 on an assessment, a grade reduction or a grade of F in a course, a remark on the transcript, and a recommendation for suspension or expulsion. Sanctions for non-academic misconduct include conduct conditions, fines, suspension of essential or non-essential University services and resources, and suspension or expulsion from the University.

The College of Natural and Applied Sciences (CNAS) has created an [Academic Integrity for CNAS Students](#) eClass site. Students can enroll and review the various resources provided, including the importance of academic integrity, examples of academic misconduct and possible sanctions, the academic misconduct and appeal process, and a *Test yourself: Academic integrity quiz*.

### Appropriate Collaboration

All tests are individual work (“solo effort”) with no collaboration allowed. You must fully understand and be able to explain your solution in any amount of detail as requested by the instructor and/or the TAs. Anything that you use in your work and that is not your own creation must be properly cited by listing the original source. Failing to cite others’ work is plagiarism and will be dealt with as an academic offence.

For assignments, we will follow the *Consultation Collaboration* policy, detailed in the course FAQ document posted on eClass.

### Exam Conduct

- Your student photo I.D. is required at exams to verify your identity.
- Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed.
- All cell phones must be turned off and stored in your bags.

### Cell Phones

Cell phones are to be turned off during lectures, labs and seminars.

## 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 early 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. (Please see [Online Etiquette Guidelines](#))

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.

## **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.

### **Copyright:**

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