CIV E 779 – Machine Learning for Engineers

Winter 2022 – January 5 to April 8

Instructor: Qipei (Gavin) Mei, PhD
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Lecture Time: Wednesday, Friday 11:00-12:20
Location: NRE 2-080 (Online for the first 3 weeks)
Office Hours: TBD

Course Description

*4 (fi 8) (either term, 3-0-2) Fundamental of machine learning; Supervised learning and unsupervised Learning; regression and classification; practical application of machine learning on engineering. Prerequisites: MATH 125.

Course Synchronous and Asynchronous Content Delivery Schedule

- Lectures are mainly delivered in synchronous manners with recordings to facilitate online students. The delivery methods are subject to change if the rules of the university are changed.
- Presentations are synchronous
- Assignments and project reports are asynchronous.
- The type of final exam is to be determined and will be announced on eClass.

Video and text recording

Please note that synchronous (i.e. 'live') activities in lectures and labs for this course will be recorded (video for lectures and anonymous text logging in labs) and made available outside of class time to all students within this class and to other instructors and teaching assistants of this class.

Students have the right to not participate in the recording and are advised to turn off their cameras and audio prior to recording. 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 Apr 30, 2022 and accessible via eClass (files posted on eClass are stored in a Google Drive folder or in the Zoom cloud affiliated with a UAlberta account). Please direct any questions about this collection to the instructor. The course videos and materials should be posted in public without permission from the instructor.

Course Objectives & General Content

Topics to be covered:

- Linear regression
- Logistic regression
- Neural network
- Support vector machine
- K-means Clustering

- Principal component analysis
- Practical tips for machine learning

Additional topics may be added.

TA Information

TA information will be given by on eClass.

Marking scheme

Activity	(A) Synchronous	Due Date/Schedule	Weight
Two Assignments	Asynchronous	see eClass	35%
Final Project	Asynchronous	see eClass	20%
Project Presentation	Synchronous	see eClass	10%
Paper Presentation	Synchronous	see eClass	5%
Final Exam	TBD	TBD	30%

The Faculty recommended grade point average for a 600 level course is 3.3. Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

Term Work

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

Calculator Policy

Approved programmable or approved non-programmable calculators are permitted in examinations. Any calculator taken into an examination must have a sticker identifying it as an acceptable programmable calculator (green sticker) or non-programmable calculator (gold sticker). Students can purchase calculators at the University Bookstore with the stickers already affixed. Calculators purchased elsewhere can be brought to the Dean's Office where the appropriate sticker will be affixed to the calculator.

Text and References (Mandatory)

No textbook is mandatory

Text and References (Recommended)

A. Ng. “Machine Learning Yearning" (you can get a free version from this website)

A. Ng. “Machine learning” course on Coursera (you can access it from the link)

T. Mitchell. “Machine Learning ", McGraw Hill.

C. Bishop. “Pattern Recognition and Machine Learning”, Springer.

University Policies

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

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty 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 (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

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).

Only those items specifically authorized by the instructor may be brought into the exam facility. The use of unauthorized personal listening, communication, recording, photographic and/or computational devices is strictly prohibited. Students should refrain from bringing any unauthorized electronic device into an examination room, including cell phones, high tech watches, high tech glasses or other such devices.

Faculty of Engineering Statement on Safety During Learning Activities

In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control. Anyone found to be unable to function safely, due to intoxication, behavior, or other reasons, in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of an unsafe work/learning environment.

Learning Outcomes

Students who successfully complete the course will be able to:

- Understand the fundamentals of machine learning
- Implement machine learning algorithms in Python
- Apply machine learning techniques to engineering problems

Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!

WEEKLY SCHEDULE

Week No.	Date	Topics
1	Jan 5, Jan 7	Introduction to machine learning, Python
2	Jan 12, Jan 14	Linear algebra review
3	Jan 19, Jan 21	Linear regression
4	Jan 26, Jan 28	Logistic regression
5	Feb 2, Feb 4	Practical tips for supervised models
	Feb 6	Assignment 1 Due
6	Feb 9, Feb 11	Support Vector Machines
7	Feb 16, Feb 18	Artificial Neural Networks
	Feb 21 - Feb 25	Reading week – No class
8	Mar 2, Mar 4	Convolutional Neural Network
	Mar 6	Assignment 2 Due
9	Mar 9, Mar 11	Clustering
10	Mar 16, Mar 18	Principal component analysis
11	Mar 23, Mar 25	TBD
12	Mar 30, Apr 1	Review session, Final Exam
13	Apr 6, Apr 8	Project presentation
	Apr 10	Final project due

The schedule of the lectures is tentative and subject to change.