COMP 3105 Introduction to Machine Learning
Course Outline

Instructor: Junfeng Wen (junfeng.wen [AT] carleton.ca)

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School of Computer Science
Carleton University

Course Information

Instructor: Junfeng Wen

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Classroom: Room location is posted on the public class schedule

Lectures: Wednesdays & Fridays 2:35 pm - 3:55 pm

Office Hours: By appointment

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Calendar.

Course Description

An introduction to methods for automated learning of relationships on the basis of empirical data. Includes topics in supervised and unsupervised machine learning and deeper knowledge of specific algorithms and their applications. Evaluation and quantification of performance of ML systems. Discussion of data ethics.

Recommended Textbooks

There is no required textbook for the course. However, the following textbooks are recommended and freely available online

- *The Elements of Statistical Learning*, Hastie, Tibshirani, and Friedman
- *Pattern Recognition and Machine Learning*, Bishop
- *Deep Learning*, Goodfellow, Bengio, and Courville

Prerequisites

COMP 2402 and (COMP 2404 or SYSC 3010 or SYSC 3110) and COMP 2804 and (MATH 1104 or MATH 1107). Precludes additional credit for COMP 4105 (no longer offered), SYSC 4415. Students are expected to be familiar with linear algebra, calculus, basic statistics and Python programming.

Topics Covered and Learning Outcomes

This course will cover the following (tentative) topics

- Linear regression
- Linear classification

- Generalized linear models
- Model evaluation and selection
- Regularization
- Support vector machines
- Dimensionality reduction
- Clustering
- Probabilistic models
- Neural network basics
- Common neural network models (MLP, CNN, RNN)
- Decision trees
- Ensemble methods
- Data Ethics

Upon completion, students should be able to

- Develop a solid understanding of the fundamental concepts and principles in machine learning
- Understand a wide range of machine learning algorithms from a mathematical perspective, their applicability, strengths and weaknesses
- Design and implement various machine learning algorithms and evaluate their performance in real-world applications

Evaluation

Four assignments 60% (15% each)

- Done in groups of two
- For assignments only, you have three excused days **throughout the term** (rounded up to the nearest day) to account for any unforeseeable difficulties. After that no late submission will be accepted
- Submissions are handled electronically (i.e., through Brightspace). Technical problems do not exempt you from late policy, so if you wait until the last minute and then have issues with your connection, it will still count as a late submission. Consequently, you are advised to
    1. Periodically upload you progress
    2. Attempt to submit your final submission early (e.g., at least one hour in advance of the due date and time) and
    3. Download the submitted files to make sure they are correct

Weekly quizzes 10%

- Done individually on Brightspace
- The lowest two will be dropped from the final grade calculation

Final exam 30%

Intellectual Property

All materials created for this course (including, but not limited to, lecture notes, in-class examples, tutorial exercises, assignments, examinations, and posted solutions) remain the intellectual property of the instructor. These materials are intended for the personal and non-transferable use of students registered in the current offering of

the course. Reposting, reproducing, or redistributing any course materials, in part or in whole, without the written consent of the instructor, is strictly prohibited.

Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are never permitted to post, share, or upload course materials without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Penalties for such offences can be found on the ODS webpage.

Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at scs.ug.advisor@cunet.carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found here. All SCS computer lab and technical support information can be found here. Technical support staff may be contacted in-person or virtually, see this page for details.

University Polices

Academic Accommodations. Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students here.

Student Academic Integrity Policy. Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of F in the course or even being expelled from the program or University. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found here.

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science. Standard penalty guidelines can be found here.

Unauthorized Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis".