



Carleton
UNIVERSITY

Department of
**Systems and
Computer Engineering**

SYSC 4415

Introduction to Machine Learning

Calendar description

Introduction to supervised and unsupervised machine learning (ML), including deeper knowledge of several algorithms of each type. Evaluation and quantification of predictive performance of ML systems. Use of one or more ML development environments.

Lectures three hours a week, laboratory/problem analysis one hour per week.

<http://calendar.carleton.ca/undergrad/courses/SYSC/>

Prerequisites

(ECOR 2050 or STAT 3502 or STAT 2605 or SYSC 2510), SYSC 2006 (with a minimum grade of C-), and third-year status in Engineering.

Prior knowledge

Students should have knowledge of:

- Are proficient in software development in at least one language
- Can program in Python or learn to do so on their own time within the first two weeks of class
- Understand basic probability and statistics
- Have strong math skills, including working with differential equations, matrix operations, and gradients

Course objectives

This course will follow “The One Hundred Page Machine Learning Book” from cover-to-cover. Students will gain an introductory-level understanding of both supervised and unsupervised machine learning (ML), including deeper knowledge of a number of algorithms of each type. Students will learn how to evaluate and quantify predictive performance of ML systems. Students will also become familiar with one or more ML development environments with practical assignments and demonstrations.

List of topics

- Fundamentals of digital image processing
- Imaging system
- Medical imaging: X-ray, CT, Nuclear medicine

- Image enhancement in the spatial domain
- Image enhancement in the frequency domain
- Image restoration
- Morphological image processing
- Image segmentation
- Feature recognition and classification
- Medical imaging: Ultrasound, MRI
- Medical applications of imaging Review

Learning outcomes

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

- Demonstrate understanding of basic supervised and unsupervised machine learning models.
- Develop models to solve various types of machine learning problems, including regression, classification, natural language processing, and clustering.
- Demonstrate a theoretical and practical understanding of a number of machine learning approaches including decision trees, logistic and linear regression, support vector machines, neural networks, convolutional networks, and recurrent neural networks.
- Apply existing machine learning platforms to develop classification and regression models.
- Understand how to quantify predictive performance of machine learning models (i.e., metrics and basic experiment design)

Graduate Attributes (GAs)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. There are no GA's related to this course. For more information, please visit: <https://engineerscanada.ca/>.

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

Important Information

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)