



Laboratory Medicine & Pathobiology
UNIVERSITY OF TORONTO

Course Name	Basic principles of machine learning in biomedical research
Coordinator(s)	Bo Wang (bowang.wang@utoronto.ca)
Day and Time	Monday, 10a – 12p
Location	Synchronous online delivery (Zoom)
Prerequisites	Undergraduate level probability, statistics, multivariable calculus, linear algebra
Who can attend	<p>You must be registered in a graduate program to attend this course.</p> <p>This course is open to all graduate students at the University of Toronto, provided you have pre-approval from your department and the course coordinators.</p>
Course Description	<p>This course is intended for graduate students in Health Sciences to learn the basic principles of machine learning in biomedical research and to build and strengthen their computational skills of medical research. The course aims to equip students with the fundamental knowledge of machine learning (ML). During the course, the students will acquire basic computational skills and hands-on experience to deploy ML algorithms using python. The students will learn the current practices and applications of ML in medicine, and understand what ML can and cannot do for medicine. The goal of this course to establish an essential foundation for graduate students to take the first steps in computational research in medicine.</p> <p>Introduction to basic principles and current practices of machine learning in biomedical research. Focus on the fundamental ML algorithms with applications in biomedical data; the application of unsupervised learning in genomic data; the application of supervised learning for medical images.</p>
Evaluation Method	<ul style="list-style-type: none">- Three assignments (45%)- Term project on machine learning algorithms in medicine (40%)- In-class participation (15%)

Schedule		
Date	Lecture	Note
January 10, 2022	Intro to ML in medicine, nearest neighbor classifier	
January 17, 2022	Introduction to python and evaluation methods	By TA
January 24, 2022	Linear methods for regression and classification; tree-based classifier	Assignment #1 due
January 31, 2022	ENSEMBLE-based methods; neural networks	
February 7, 2022	Python tutorial for supervised learning practice	
February 14, 2022	Unsupervised learning for clustering: K-means, Gaussian mixture models	Assignment #2 due
February 21, 2022	Reading week, no class	
February 28, 2022	Unsupervised learning for clustering: auto-encoder, graph-based methods Python tutorial for unsupervised learning	
March 7, 2022	Case study II: single-cell analysis using unsupervised learning	
March 14, 2022	Case study I: cell type classification using supervised learning	
March 21, 2022	Advanced deep learning methods for medical image analysis	Assignment #3 due
March 28, 2022	Term project in-class presentation	
April 4, 2022	Term project in-class presentation	