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	You must be registered in a graduate program to attend this course. 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.
Course Description	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. 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.
Evaluation Method	- Three assignments (45%) - Term project on machine learning algorithms in medicine (40%) - In-class participation (15%)
Auditing	If you are not registered in the class, it is possible for you to audit it (sit in on the lectures). Here are the official university rules on auditors (taken from the Department of Computer Science instructor's advice page): *To audit a course is to sit and listen to the lectures, and perhaps to the tutorials, without formally enrolling. Auditing is acceptable if the auditor is a student at U of T, and no University resources are to be committed to the auditor. The "must be a student" condition means that students of other universities, employees of outside organizations (or even of U of T itself!), or any other non-students, are not permitted to be auditors. (If we did not have this rule, the University would require us to collect auditing fees, and we are not willing to do that.) The "no resources used" condition means that*

	auditors do not get computing accounts, cannot have term work marked, and cannot write exams. In other words, they cannot use instructors time, TA time, or administrative resources of any kind. An auditor may not attend class unless there is an empty seat after the last regularly-enrolled student has sat down. That sounds frivolous, but in fact it is an aspect of an important point: if enrollment in a course has been closed because the room size has been reached, then there may well be physical seats for auditors, because it is rare for every student to appear for a lecture, but auditors will not be allowed to enroll later on in the course, even if some students drop it. Neither instructors nor the department can waive this rule. Often these conditions are perfectly acceptable to auditors; we don't mean to ban the practice, but only to live within the University's rules.
Academic Honesty	You should already be familiar with the University of Toronto's academic honesty policy (the "Code of Behavior on Academic Matters") that deals with issues including plagiarism and cheating. Note that, as should be obvious, plagiarism on problem sets is plagiarism. Using other resources, such as getting your answers from another student or finding them online, rather than working them out yourself, is plagiarism. For a review of the policy please navigate to the following links: http://www.academicintegrity.utoronto.ca/ https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019

Schedule

Date	Lecture	Note
January 10, 2022	Intro to ML in medicine; nearest neighbor classifier	
January 17, 2022	Introduction to Python; basic linear algebra; model evaluation methods	
January 24, 2022	Linear methods for regression and classification; tree-based classifier	
January 31, 2022	ENSEMBLE-based methods; neural networks	Assignment #1 due
February 7, 2022	Supervised learning; 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 practice	
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	