Overview

An introduction to the programming and application of machine learning, with a focus on deep learning. By the end of the course, students will be able to implement deep neural networks to perform classification on image, text, and other types of data. Students will also have a high-level understanding of deep neural network models used to generate images, such as autoencoders and GANs. We will focus on implementations in Python, using Numpy and PyTorch.

Course Material

You will need to log into Quercus with your UTORid to gain access to course material, and obtain regular course information (e.g., downloading lecture materials, lab handouts, project information, etc.), submit work, receive grade/feedback and email announcements:

`https://q.utoronto.ca`

Course Sections

Students are expected to fully participate and attend all lectures and practical sessions for the duration of the course.

Section	Instructor	Lecture	[2]Tutorial	[2]Lab	[3]Office Hours
LEC101	Jas Sahota	Wed 7–9pm	Mon 7–8pm	Mon 8–9pm	Fri 6–7pm (by appointment)
LEC102	Kaveh Hassani	Thur 6–8pm	Tue 6–7pm	Tue 7–8pm	Thur 12–1pm (by appointment)
LEC103	Kaveh Hassani	Thur 1–3pm	Mon 1–2pm	Mon 2–3pm	Thur 12–1pm (by appointment)

Please only attend the tutorial/labs assigned to your lecture section. [3]You may attend any of the instructor's office hours **by prior appointment only**. [2]Tutorials and Labs will be taught by teaching assistants. All lectures, tutorials, labs, office hours, and the midterm will be held online throughout the semester. Currently, final exam is set to be in-person but this may change.

Course Staff

Instructors	Kaveh Hassani, Jas Sahota
Email	{`kaveh.hassani, jaspreet.sahota`}`@utoronto.ca` For non-personal, course-related questions, please use our posted office hours, or ask your TAs and peers on Piazza. Otherwise, e-mail your section's instructor and include APS360 the subject.
Office Hours	See above (by appointment only, online).
Head Teaching Assistants	Ali Hadi Zadeh – `a.hadizadeh@mail.utoronto.ca`, Chris Lucasius – `christopher.lucasius@mail.utoronto.ca`, Ali Khodadadi – `ali.khodadadi@mail.utoronto.ca`
Teaching Assistants	Gianluca Villani – `gianluca.villani@mail.utoronto.ca`, Geoffrey Donoghue – `geoff.donoghue@mail.utoronto.ca`, Srinath Dama – `srinath.dama@mail.utoronto.ca`, Hossein Yousefi – `hossein.yousefi@mail.utoronto.ca`, Mustafa Ammous – `mustafa.ammous@mail.utoronto.ca`, Saba Ale Ebrahim – `saba.aleebrahim@mail.utoronto.ca`, Martiya Zare Jahromi – `martiya.zare@mail.utoronto.ca` Pedram Mouseli – `pedram.mouseli@mail.utoronto.ca` Shiva Akbari – `shiva.akbari@mail.utoronto.ca` Amr Mohamed – `amr.mohamed@mail.utoronto.ca`

Textbook

There is no textbook required for the course. Lecture notes and recommended readings will be posted each week. Lecture notes and recommended readings will be posted each week. If you wish to refer to a textbook, the following might be helpful:

- "Deep Learning" by Ian Goodfellow and Yoshua Bengio and Aaron Courville, available online at `https://www.deeplearningbook.org`
- "Deep Learning with PyTorch" by Vishnu Subramanian
- "Introduction to Deep Learning" by Eugene Charniak (uses Tensorflow instead of PyTorch)

Schedule

Weeks	Lecture	Tutorial	Lab
Jan 10	Course and Project Intro. & Machine Learning Intro.	No Tutorial	No Lab
Jan 17	Neural Networks (NN)	Titanic Data Visualization	No Lab
Jan 24	Training Neural Networks	NN Forward Pass	Lab 1: Intro. to Pytorch and NNs
Jan 31	Convolutional Neural Networks (CNNs)	Classification on MNIST	Lab 2: Classificationof Cats and Dogs
	Team Formations and Project Approvals Due		
Feb 07	CNN Architectures and Transfer Learning	CNN Kernels and Loading Data	Lab 3a: Hand GestureRecognition
Feb 14	Autoencoders, Semi-Supervised Learning	Transfer Learning and Preventing Overfitting	Lab 3b: Hand Gesture Recognition
Feb 21 (Reading week)	**No Lecture**	**No Tutorial**	**No Lab**
Feb 28	Word Embeddings and Recurrent Neural Networks (RNNs)	Autoencoders	Lab 4: Data Imputation
	Midterm		
Mar 07	RNNs continuted: LSTMs	Recurrent Neural Networks (RNNs)	Lab 5: Spam Detection
Mar 14	Generative Adversarial Networks (GANs)	Generative RNNs	Project Support
Mar 21	Transformers	Adversarial Networks	Project Support
Mar 28	Graph Neural Networks	No Tutorial	Project Support
	Presentations Due		
April 04	Ethics in Machine Learning	No Tutorial	Project Support
	Final Report Due		

Communication

- Use Piazza for non-personal, course-related questions. This allows your peers to also learn from your answers, and avoids us answering the same questions.
- Piazza questions will be answered by instructors or TAs on Monday-Friday between 9:00am-7:00pm. Questions asked over the weekends, holidays, or after hours will be answered the following regular day.
- Lecture slides and videos will be released on the same week of the lecture. This may be early or late that week, depending on the required modifications.

Evaluation

The evaluation for this course is as follows:

Work	Weight
Lab Assignments	10%
Midterm (open book)	15%
Project	40%
Final Examination[1] (open book)	35%

[1]Please note that the Final Examination is mandatory and will result in a final grade of incomplete (INC) for this course on your transcript if not attempted.

Lab

A key part of the learning in this course is the hands-on programming labs. The scheduled lab time will provide time to work on and receive TA help on the lab exercises. There are 5 labs, all due in the first half of the course. All labs should be completed individually. The weighting of the labs are as follows:

Lab	Weight	Deadline
Lab 1	1%	Mon. Jan 31 at 5:00 PM
Lab 2	2%	Mon. Feb 07 4 at 5:00 PM
Lab 3(a)	1%	Mon. Feb 14 at 5:00 PM
Lab 3(b)	2%	Mon. Feb 28 at 5:00 PM
Lab 4	2%	Mon. Mar 07 at 5:00 PM
Lab 5	2%	Mon. Mar 14 at 5:00 PM

Project

The project in this course will require students to implement a major piece of software that makes use of the material of the course to develop a machine learning application. It is a substantial focus of the second half of this course. The project will be done in teams of four, and will account for **40%** of your final grade. There are several phases and specific deadlines of the project, with several interim deliverable due dates, a preliminary schedule follows:

Deliverable	Weight	Comment
Team Formation and Approval		Mon. Jan 31 at 5:00 PM
Project Proposal	5%	Web. Feb 09 at 5:00 PM
Progress Report	5%	Wed. Mar 02 at 5:00 PM
Project Presentation	10%	Wed. April 06 at 5:00 PM
Final Deliverable	20%	Wed. April 13 at 5:00 PM

Late Work Policy

Late submissions will be accepted up to 24 hours past the deadline with a **20%** grade deduction. Quercus submission time will be used, not your local computer time. You can submit your labs as many times as you want before the deadline, so please submit often and early. No other late work will be accepted, however, we will consider exceptional cases on a case-by-case basis, such as with a doctor's note in the case of illness.

Midterm

The midterm will take place the week of Feb 28. More detail will be shared soon.

Use of TurnItIn

Turnitin.com will be used to assist in the evaluation of the originality of some of the term work. Turnitin.com is only a tool which will assist in detecting plagiarism. Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site - http://turnitin.com/. **If you prefer not to submit your work to Turnitin.com, please let the instructor know before the first lab assignment is due.**

Accessibility

The University of Toronto and your instructors are committed to accessibility. If you require accommodations, or there is anything course-related we can do to help, please get in touch.

Academic Offenses

The University of Toronto expects you to be a full member of the academic community and to observe the rules and conventions of academic discourse. In particular, all of the work you submit must be your own and your work must not be submitted by someone else. Plagiarism is a form of academic fraud, and the department uses software that compares submissions for evidence of similarity. The full text of the policy that governs Academic Integrity at U of T (the "Code of Behaviour on Academic Matters") can be found at:

`https://www.governingcouncil.utoronto.ca/policies/behaveac.htm`

Please don't cheat. It is unpleasant for everyone involved, including us. Here are a couple of general guidelines to help you avoid plagiarism:

- Never look at another student's homework. Never show another student your solution. This applies to all drafts of a solution and to incomplete and even incorrect solutions.
- Keep discussions with other students focused on *concepts* and *examples*. Any code or solutions that you submit should be your alone.
- Do not post any of your assignment questions in a private or public online discussion forum or website in order to solicit solutions from others.

Note that, under the University of Toronto code of conduct, a person who supplies an assignment to be copied will be penalized in the same way as the one who makes the copy. We will use software to detect copying that is quite sophisticated and so is difficult to defeat.

Video Copyright & Privacy

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.