Overview

This course is a hands-on introduction to deep learning. By the end of the course, you will be able to implement deep neural networks to classify images, text, graphs, and other types of data. You will also be able to implement deep neural network to generate images and text. Moreover, you will learn how to apply tricks to train deep models efficiently, how to debug them, how to train your models without having access to human annotations, and how to train your deep models on small data. We will focus on implementing deep neural networks in Python, using Numpy and PyTorch libraries.

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.

Course Sections

Students are expected to fully participate and attend all lectures and practical sessions for the duration of the course. Lectures, tutorials, and labs will be in-person.

Section	**Instructor**	**Lecture**	[2]**Tutorial**	[2]**Lab**	[3]**Office Hours**
LEC101	Kaveh Hassani	Mon 7–9pm GB120	Wed 7–8pm GB120	Wed 8–9pm SF1013	Tue 5–6pm (by appointment)
LEC102	Kaveh Hassani	Tue 3–5pm GB119	Thu 3–4pm GB221	Thu 4–5pm SF1013	Tue 5–6pm (by appointment)

[3] Office hours are **by prior appointment only**. [2]Tutorials and Labs will be taught by TAs.

Course Staff

Instructor	Kaveh Hassani
Email	`kaveh.hassani@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 the instructor and include APS360 the subject.
Office Hours	See above (by appointment only).
Head Teaching Assistants	Ali Hadi Zadeh – `a.hadizadeh@mail.utoronto.ca` Chris Lucasius – `christopher.lucasius@mail.utoronto.ca`
Teaching Assistants	Gianluca Villani – `gianluca.villani@mail.utoronto.ca` Ali Khodadadi – `ali.khodadadi@mail.utoronto.ca` Geoffrey Donoghue – `geoff.donoghue@mail.utoronto.ca` Justin Beland – `justin.beland@mail.utoronto.ca` Srinath Dama – `srinath.dama@mail.utoronto.ca` Yan Li – `yyaann.li@mail.utoronto.ca` Mustafa Ammous – `mustafa.ammous@mail.utoronto.ca`

Textbook

There is no textbook required for the course. If you wish to refer to a textbook, the following publicly available books are recommended:

- Dive into Deep Learning by Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola
- Deep Learning by Ian Goodfellow and Yoshua Bengio and Aaron Courville

Schedule

Weeks	Lecture	Tutorial	Lab
Sep 12	Introduction	No Tutorial	No Lab
Sep 19	Artificial Neural Networks	Data Visualization	No Lab
Sep 26	Training Artificial Neural Networks	Forward-Pass	Lab 1: Introduction to Pytorch
Oct 03	Convolutional Neural Networks - Part I	MNIST Classification	Lab 2: Cats/Dogs Classification
Oct 10	Convolutional Neural Networks - Part II	CNN Kernels and Loading Data	Lab 3: Hand Gesture Recognition
Oct 17	Unsupervised Learning	Transfer Learning and Preventing Overfitting	Lab 4: Data Imputation
Oct 24	Recurrent Neural Networks - Part I	Autoencoders	Lab 5: Spam Detection
Oct 31	Recurrent Neural Networks - Part II	Recurrent Neural Networks	Project Support
Nov 07	**No Lecture**	**No Tutorial**	**No Lab**
Nov 14	Generative Adversarial Networks	Generative Recurrent Neural Networks	Project Support
Nov 21	Transformers	Generative Adversarial Networks	Project Support
Nov 28	Graph Neural Networks	No Tutorial	Project Support
Dec 05	Ethics	No Tutorial	No Lab

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 several times.
- 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 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. Note that exams are **Type X Open book**. Students may bring and use any books, notes, or printed or written material, without restriction. That means you are allowed to bring in anything you want on paper but the only digital device allowed is non-programmable calculator.

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 which must be completed individually. The weighting of the labs are as follows:

Lab	Weight	Deadline
Lab 1	1%	Friday, Oct 07 at 5:00 PM
Lab 2	2%	Friday, Oct 14 at 5:00 PM
Lab 3	3%	Friday, Oct 21 at 5:00 PM
Lab 4	2%	Friday, Oct 28 at 5:00 PM
Lab 5	2%	Friday, Nov 04 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 deep 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		Friday, Sep 30 at 5:00 PM
Project Proposal	5%	Friday, Oct 14 at 5:00 PM
Progress Report	5%	Friday, Nov 04 at 5:00 PM
Project Presentation	10%	Friday, Nov 25 at 5:00 PM
Final Deliverable	20%	Friday, Dec 02 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.

Valid Petitions

The weight of valid petitions will be moved to the final exam without any exceptions. Please do not request deadline extensions for petitions as it will not be considered.

Midterm

The midterm will take place on Friday Oct 21st from 12:01 am to 11:59pm. You will have a period of 24 hours in which you can start the exam, but once it started you will need to complete it in 2 hours. The exam will be through CrowdMark.

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/.

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.

Some Frequent Questions

1– My teammate(s) dropped the course last minute, can we get an extension? No, the goal is simulate real-world industrial experience where your colleagues may resign before the delivery date!
2– While uploading my answers to CrowdMark I faced a technical issue, can I email my answers to you? No, out of 120 minutes, 90 minutes is for answering questions and 30 minutes for uploading your answers. You should be able to fix the issue.
3– After uploading my answers to CrowdMark I realized I had uploaded wrong files, can I email my answers to you? No, out of 120 minutes, 90 minutes is for answering questions and 30 minutes for uploading your answers. You should double check your submission in that 30 minutes.
4– I have two midterms next week, can I extend the deadline for lab submission? No, the schedule is announced at the start of semseter to let you plan in advance.