Welcome to **ECE1513: Introduction to Machine Learning!**

This course provides a concrete understanding of fundamentals of machine learning. The course gives an overall viewpoint on the vast area of machine learning and touches the fundamental concepts in supervised and unsupervised learning. It also gives a quick introduction to deep learning. Note that this course aims to cover topics in **Machine Learning and** does **not** target **Deep Learning.** Deep learning and neural networks are introduced and discussed in this course; however, their detailed investigation is covered in a separate course, i.e., **ECE1508: Applied Deep Learning**.

Good to Know About the Course

- The **syllabus** of the course has been listed **here (https://q.utoronto.ca/courses/381364/assignments/syllabus)**
- The details on the **assignments** can be found **here (https://q.utoronto.ca/courses/381364/pages/assignments-what-they-are-and-how-it-works)**
- You may wonder: how does the **Final Project** work? It has been explained **here (https://q.utoronto.ca/courses/381364/pages/final-project-detailed-procedure)**
  - *New: You can use **this link (https://q.utoronto.ca/courses/381364/assignments/1483929)** to submit the name of the group members (just one submission needed per group)*
  - *New: Proposal submission is now open. Proposal submission is carried out through Crowdmark*
- The **course board** is available **here (https://q.utoronto.ca/courses/381364/pages/course-board)** , where you can track the updates of the course
- The **overall calendar of the course** is available **here (https://q.utoronto.ca/courses/381364/pages/overall-course-calendar)**
- You can watch the **course videos** **here (https://q.utoronto.ca/courses/381364/pages/lecture-viedos)**
- Follow up the schedule and contents of the **Tutorials** in **this page (https://q.utoronto.ca/courses/381364/pages/tutorial-materials-and-videos)**
- **Midterm Exam** is on *February 25, 2025* at the *lecture time 6:00 - 9:00 PM*

Course Information

The course will be on **Tuesdays** from **6:00 PM** to **9:00 PM** at **MS-3154**

Days	Time	Location
Tue	**6 - 9 PM**	*Tuesdays at **MS-3154*** *Address: [**Medical Sciences Building, 1 King's College Circle** ⤳ (https://maps.app.goo.gl/iMEHoFZwk6iJ4EXq8)](https://maps.app.goo.gl/iMEHoFZwk6iJ4EXq8)*

Course Staff

Instruction

Ali Bereyhi

Assistant Professor (TS) at ECE Department

Email: [ali.bereyhi@utoronto.ca (mailto:ali.bereyhi@utoronto.ca)](mailto:ali.bereyhi@utoronto.ca)

[(mailto:ali.bereyhi@utoronto.ca) (mailto:ali.bereyhi@utoronto.ca)](mailto:ali.bereyhi@utoronto.ca) Office*:* **BA 7208**

Bahen Centre for Information Technology

40 St. George Street

Office hours: *Wednesdays, 1:00 to 2:00 PM*

TA Team

- *Saba Ale Ebrahim*
  - *PhD Candidate*
  - *Electrical and Computer Engineering Department*
  - *Email: [saba.aleebrahim@mail.utoronto.ca (mailto:saba.aleebrahim@mail.utoronto.ca)](mailto:saba.aleebrahim@mail.utoronto.ca)*
- *Fateme Pourghasem*
  - *M.A.Sc. Student*
  - *Institute of Biomedical Engineering*
  - *Email: [fateme.pourghasem@mail.utoronto.ca (mailto:fateme.pourghasem@mail.utoronto.ca)](mailto:fateme.pourghasem@mail.utoronto.ca)*
- *Mohammadreza Safavi*
  - *M.A.Sc. Student*
  - *Electrical and Computer Engineering Department*
  - *Email: [mohammadreza.safavi@mail.utoronto.ca (mailto:mohammadreza.safavi@mail.utoronto.ca)](mailto:mohammadreza.safavi@mail.utoronto.ca)*
- *Saeed Jafari*
  - *PhD Candidate*

- *Electrical and Computer Engineering Department*
- *Email: saeed.jafari@mail.utoronto.ca (mailto:saeed.jafari@mail.utoronto.ca)*

Tutorial and Q&A Sessions

- *Tutorials start from the second week:*

Days	Time	Location
Mondays	*7 - 8 PM*	**MS-3154** *Address: **Medical Sciences Building, 1 King's College Circle** ↪* *(https://maps.app.goo.gl/iMEHoFZwk6iJ4EXq8)*

What Do We Learn in This Course

The course tries to build a comprehensive viewpoint on machine learning and the topics being covered in this area. Our journey is completed through 3 major steps:

- **Step 1:** We study the unsupervised learning problems, where we try to find out some patterns in the data. We look into problems of clustering, dimensionality reduction and distribution learning.
- **Step 2:** We get into the world of *supervised learning* problems, where we aim to learn the functional relation between pairs of (input/output) data. We take a deep look into fundamental ideas, such as linear regression, logistic regression and support vector machines. We learn how to *train* these models via gradient descent algorithm. We further see how nonlinearity urges us to develop more advanced model.
- **Step 3:** In the last part of the course, we take a look at neural networks and their expressive power. We see that they can be a universal function approximators. We further see how we could use them to learns relations between data points and how to *train* them.

The detailed syllabus of the course can be found at the **Syllabus page of the course.** **(https://q.utoronto.ca/courses/381364/assignments/syllabus)**

Programming in Python

Throughout the course, we will use Pyhton as the main programming language to implement algorithms, solve the assignments, and accomplish the final project. If you have some experience in Python that would be a plus; however, if not, only a quick catch-up of the basic syntax would be enough. We will study required tools in Tutorials. There are some packages that we will get to know them, such as NumPy, Matplotlib, Scikit-Learn, PyTorch and Pandas.

Text Books

- Christopher M. Bishop, *Pattern Recognition and Machine Learning,* Springer [**available online** ⬀ **(https://www.microsoft.com/en-us/research/people/cmbishop/#!prml-book)**]
- David J. C. MacKay, *Information Theory, Inference, and Learning Algorithms,* Cambridge University Press [**available online** ⬀ **(http://www.inference.org.uk/itila/book.html)**]

Learning Procedure

The learning procedure consists of three components:

- **Assignments** that is roughly 50% of the total mark
- **Midterm Exam** that is roughly 30% of the total mark
- **Final Project** that is roughly 20% of the total mark

Let's get through them a bit in detail.

Assignments

No need to say that this is the most important part! There will be five set of assignments. The details on each assignment is given in a **separate post (https://q.utoronto.ca/courses/381364/pages/assignments-what-they-are-and-how-it-works)** . The assignments will count roughly for 50% of your final mark and are *a part of the **learning procedure!*** So, solving them is necessary at each part of the course to understand the next parts properly.

Midterm Exam

In the first week after the reading week, there will be an exam. The exam will ask questions on theory. There will be of course no programming questions in the exam! The exam will only evaluate the understanding of fundamental concepts through questions that can be either explained in words or solved simply by hand. This exam will comprise 30% of the total mark.

Final Project

A separate post (https://q.utoronto.ca/courses/381364/pages/final-project-detailed-procedure) discusses the project procedure in detail. In a nutshell, however, the project will be in groups of 4. Each group proposes its own problem that is to be solved by Mschine Learning by Week 10. The group will then work on the project towards the end of the semester and submit the final report by the last week. This part will be 20% of the total mark, and plays the role of a final evaluation for this course.

Final Words...

That's it for now! Just take a look at the other posts that discuss the type of assignments we will have and how we do the final project through the semester.

Looking very much forward to meeting you on January 7, 2025!

Ali Bereyhi