

Introduction to Machine Learning

Course Logistics

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Winter 2026

Welcome to ECE 1508!

Happy to see you in ECE 1513

Introduction to Machine Learning

Instructor: Ali Bereyhi

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Where and When?

- *Tuesdays at 5:00 PM till 7:00 PM* at **BA 1170**
- *Thursdays at 5:00 PM till 7:00 PM* at **MC-252**

Tutorials: Saba Ale Ebrahim and Mohammadreza Safavi

- *Thursdays at 6:00 PM till 7:00 PM* at **MC-252**

Teaching Team

- Saba Ale Ebrahim – *Tutorials and Office Hours*
 - PhD Candidate, ECE Department
 - saba.aleebrahim@mail.utoronto.ca
- Saeed Jafari – *Assignments and Project*
 - PhD Candidate, ECE Department
 - saeed.jafari@mail.utoronto.ca
- Mohammadreza Safavi – *Tutorials and Office Hours*
 - M.A.Sc. Student, ECE Department
 - mohammadreza.safavi@mail.utoronto.ca
- TBA – *Assignments and Project*
 - TBA
 - TBA

Quercus and Piazza

We got a [Quercus page](#)

- You have been automatically enrolled
- Also you got registered at the [Piazza](#) page
 - ↳ *This is the easiest way to reach out*

The course has though its own page on [GitHub](#)

What Do We Learn?

We study **Machine Learning!** from **scratch**

You may wonder what do we learn in this course?

- **Part I: Learning Pattern from Data**
 - Clustering: *K-Means Clustering*
 - Dimensionality reduction: *Principle Component Analysis*
 - Learning data distribution: *Gaussian Mixture Model*

We also recap some notions and develop some intuitions in

- Linear Algebra
- Probability Theory

What Do We Learn?

We study **Machine Learning!** from **scratch**

You may wonder what do we learn in this course?

- **Part II: Supervised Learning**

- Regression: *Linear Regression*
- Classification: *Logistic Regression, Perceptron and Multiclass Classification*
- Training via Stochastic Gradient Descent
- Support Vector Machines
- Overfitting and Underfitting: *Regularization*
- Nonlinear Models and Representation: *Kernels and Neural Networks*

We also recap some notions and develop some intuitions in

- Functional Analysis and Optimization

What Do We Learn?

We study **Machine Learning!** from **scratch**

Don't we study Deep Neural Networks?

- Within **Part II**, we study **Neural Networks (NNs)**, specifically
 - Expressive Power of NNs: *Universal Approximation Theorem*
 - Multilayer Perceptrons (MLPs): *Feedforward NNs*
 - Training MLPs: *Backpropagation*
 - Convolutional NNs

Nonetheless, please note that

- This is **not** a course on **Deep Learning**, but **general ML**
- To study **Deep Learning**, you may consider taking

ECE1508: Applied Deep Learning

Checkout the course **syllabus at Course Page**

How Do We Get Trained?

There are three learning components in the course

- **Assignments**

- ↳ We solve **five sets** of assignments
- ↳ **No need to say** that they are the **best thing** to understand the course!
- ↳ And, of course we do **some programming** as well!
- ↳ Assignments will be solved in Tutorial **after the deadline**
 - ↳ You have **two weeks** time for each assignment
 - ↳ Submission by **deadline at 11:59 PM**
 - ↳ **No extension** will be made! Really Sorry! 😞

Attention!

Assignments make almost **half** of the **course mark**; so, they need effort! They are a part of the learning process, **not supplementary**!

- Midterm Exam
- Final Project

How Do We Get Trained?

There are three learning components in the course

- Assignments
- Midterm Exam
 - ↳ We will have one written exam in the middle of semester
 - ↳ Questions that can be solved by hand, so no programming in the exam
 - ↳ We evaluate our understanding of fundamental concepts
 - ↳ Exam is on February 24, 2026 at 5:00 - 8:00 PM
- Final Project

How Do We Get Trained?

There are three learning components in the course

- Assignments
- Midterm Exam
- *Final Project*
 - ↳ You build **groups** of size **three**
 - ↳ Each group chooses a topic and submits the proposal by **Week 10**
 - ↳ Each group submits the final codes and paper by **Week 14**

Attention!

*The projects of **ECE1508** and **ECE1513** **cannot be** the same! Any overlap between the projects should be discussed in advance!*

Course Calendar

Week #	Date	Notes	Posted	Deadline
1	Jan 05 - Jan 09			
2	Jan 12 - Jan 16		Assignment 1	
3	Jan 19 - Jan 23			
4	Jan 26 - Jan 30		Assignment 2	Assignment 1
5	Feb 02 - Feb 06			
6	Feb 09 - Feb 13		Assignment 3	Assignment 2
7	Feb 16 - Feb 20	Reading Week-- No Lectures		
8	Feb 23 - Feb 27	Midterm Exam on Feb 24		
9	Mar 02 - Mar 06		Assignment 4	Assignment 3
10	Mar 09 - Mar 13			Project: Proposal Submission
11	Mar 16 - Mar 20		Assignment 5	Assignment 4
12	Mar 23 - Mar 27			
13	Mar 30 - Apr 03			Assignment 5
14	Apr 06 - Apr 10	Examination Time -- No Lectures	Project: Presentation	Project: Final Report and Source Codes

In Person Lectures!

The course is **in-person** and ···

··· *by Regulations the attendance is mandatory in in-person courses!*

attendance
~~MATTERS~~

Recording might be available

- They are mainly for **recap** and **cannot be guaranteed**
- I strongly advise to **attend** the lectures
 - You don't want to miss my **performance** 😊
 - ECE1513 is taught **on the board**

Programming in Python

We mainly use Python for programming

- ↳ Basic knowledge in Python is enough
 - ↳ Don't run away if you don't have, you only need a bit of more efforts
- ↳ We just need basics, we will learn all packages that we need
 - ↳ Matplotlib, NumPy, Scikit-Learn, Pandas, PyTorch
- ↳ Programming is not the only major thing!
 - ↳ We get some hands-on experience with implementing
 - ↳ But, we are here to learn Fundamentals of Machine Learning!

No Major Prerequisites

The course is **self-containing** meaning that

you will learn **all background** you need!

I assume that we all have some **basic math** in mind

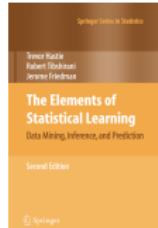
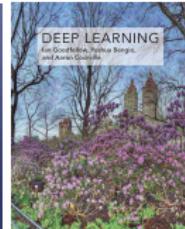
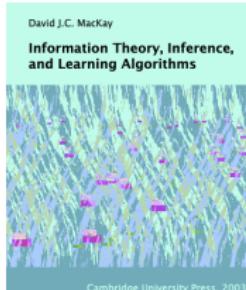
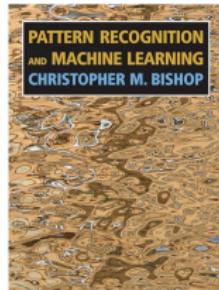
- ↳ linear algebra, calculus, and probability theory

But we review **whatever we need** from these topics **whenever needed!**

There are some other **related courses**, the most important one is

- CSC 311/2515 and ECE 421/1504
 - ↳ These course are considered **exclusions**
 - ↳ We cover pretty much **the same things** in this course
- ECE 1508: Applied Deep Learning
 - ↳ Totally fine (*actually suggested*) to have it before or with this course
 - ↳ It focuses on **Deep Learning** not general **Machine Learning**

Textbooks



Materials are mostly collected from

- Bishop's textbook, which can be accessed online [at this link](#)
- MacKay's book that is available online [at this link](#)

Also some parts are taken from

- Mitchell's textbook that is available online [here](#)
- Goodfellow et al. that can be accessed online [at this link](#)
- *Elements of Statistical Learning (ESL)* by Hastie, Tibshirani and Friedman

Terms and Conditions!



The instructor keeps the right reserved for himself to modify online materials

- *last minute before the lecture* ☺
- *after the lecture has been given*
 - *Typically happens due to typos*

The instructor keeps the right reserved for himself to deliver the notes

- *in form of mini-batches* ☺

Date and Signature

No such thing as a stupid question!

Did you know that we got [a Wikipedia page](#) on this?

- ↳ Trust me! Your question will **never** sound stupid!
- ↳ **If you don't ask**; then, I need to ask!
 - ↳ **Interaction** is the best tool to avoid getting bored!

Any Questions? ☺