

ECE 1513: Introduction to Machine Learning

Course Logistics

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Welcome to ECE 1508!

Happy to see you in ECE 1513

Introduction to Machine Learning

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Where and When?

- *Tuesdays* at *6:00 PM till 9:00 PM* at **MS 3154**
- ↳ We have the room till *9:30 PM*, so we will have *breaks* 😊

Tutorials: Saba Ale Ebrahim and Mohammadreza Safavi

- *Mondays* at *7:00 PM till 8:00 PM* at **MS 3154**

Teaching Team

- Saba Ale Ebrahim – *Tutorials* and *Office Hours*
 - PhD Candidate, ECE Department
 - saba.aalebrahim@mail.utoronto.ca
- Fateme Pourghasem – *Assignments* and *Project*
 - M.A.Sc. Student, Institute of Biomedical Engineering
 - fateme.pourghasem@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
 - ↳ You can login through the *Quercus* page
- All course materials will be shared on *Quercus*

Please! Feel free to ask questions on Piazza!

What Do We Learn?

We study *Machine Learning!* from *scratch*

You may wonder what do we learn in this course?

- **Part I: Unsupervised Learning**
 - 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 Quercus](#)

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 25, 2025 at 6:00 - 9:00 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 **four**
 - ↳ **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!*

Read [the post on Quercus](#) for more details

Course Calendar

Week #	Date	Notes	Posted	Deadline
1	Jan 06 - Jan 10			
2	Jan 13 - Jan 17		Assignment 1	
3	Jan 20 - Jan 24			
4	Jan 27 - Jan 31		Assignment 2	Assignment 1
5	Feb 03 - Feb 07			
6	Feb 10 - Feb 14		Assignment 3	Assignment 2
7	Feb 17 - Feb 21	Reading Week-- No Lectures		
8	Feb 28 - Feb 28	Midterm Exam -- Feb 25		
9	Mar 03 - Mar 07		Assignment 4	Assignment 3
10	Mar 10 - Mar 14			Project: Proposal Submission
11	Mar 17 - Mar 21		Assignment 5	Assignment 4
12	Mar 24 - Mar 28			
13	Mar 31 - Apr 04			Assignment 5
14	Apr 07 - Apr 11	Examination Time -- No Lectures		Project: Final Report and Source Codes

- You could check it out [here](#)
- Also, follow the [course board on Quercus](#) for updates

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*

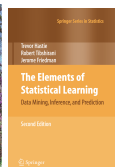
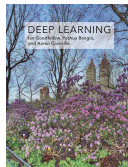
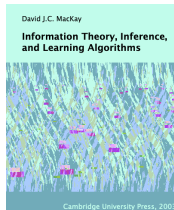
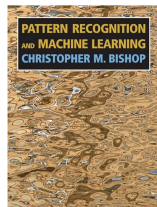
↳ We cover pretty much *the same things* in this course

- 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? 😊