Special Topics in Machine Learning
Spring 2024

Course code: BME i9400 - 3 credits

Course Description This course provides a broad overview of modern-day machine learning with an emphasis of techniques that are commonly used in practice to classify biomedical data sets. The course begins with a review of probability theory and linear algebra, which are the foundation for statistical learning. We will then survey a variety of supervised and unsupervised architectures, beginning with logistic regression and including state-of-the-art techniques such as the transformers that power large language models. Throughout the course, students acquire hands-on experience with the presented concepts via application to real-world data sets from a variety of domains. For the Spring 2024 iteration, we will work primarily in the iPython (Jupyter Notebook) environment.

An effort will be made to make this year's course "hands-on", taking the form of Python code snippets that demonstrate the concepts wherever possible. All students should bring a laptop with a working Python environment (instructions will be provided) to class.

Course Objectives

1. To be able to formulate problems in the framework of regression/classification.
2. To become comfortable working in the iPython environment.
3. To be able to apply state-of-the-art machine learning techniques to your data with an understanding of how to optimize performance.

Lectures
Monday 02:00 PM-4:30 PM
Steinman Hall 560
Online TBA

Instructor
Jacek Dmochowski (jdmochowski@ccny.cuny.edu)
Office: ST 460

Office Hours
By email appointment

Helpful Textbooks (all optional):

Deep Learning with Python (Francois Chollet) Publisher
Deep Learning (Ian Goodfellow, Yoshua Bengio, Aaron Courville) HTML version
Pattern Classification (Richard O. Duda, Peter E. Hart, David G. Stork) Amazon

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Topics Covered

Dates and topics subject to change

Week	Date	Topic
1	09.09.24	Probability theory and Bayes' Rule
2	09.16.24	Linear algebra primer
3	09.23.24	Optimization, maximum likelihood, gradient descent
4	09.30.24	Independent Components Analysis
5	10.07.24	Logistic regression
6	10.15.24	Multilayer perceptrons (deep learning)
7	10.21.24	Convolutional networks
8	10.28.24	Sequence models
9	11.04.24	Transformers and language models
10	11.11.24	*Midterm exam*
11	11.18.24	Autoencoders
12	11.25.24	Self-supervised learning
13	12.02.24	Biomedical ML applications
14	12.09.24	*Final project presentations*

Assessment Tools

Performance Criterion 1: Evaluation of homework assignments.
Performance Criterion 2: Grading of midterm exam
Performance Criterion 3: Evaluation of course project.

Final Grade

Homework Assignments	30%
Midterm Exam	30%
Course Project	40%

Lecture Policy

Students are expected to attend all lectures.

Academic integrity

Students may discuss homework but the turned-in workmust be that of the individual student only. *Submission of plagiarized homework solutions will result in referral to the Department Chair.*