CSE-404: Introduction to Machine Learning

Spring 2022

- **Time & Place.** Tu/Th, 12:40-2:00 pm (ET), Chemistry 136.
- **Instructor.** Parisa Kordjamshidi, Office hours: Tue/Thu 2:00-2:45 or Email me for appointment.
- **Teaching Assistant.** Rahul Dey, Office hours: Tue/Thu 3:00-4:00 pm (ET).
- **Teaching Assistant.** Tyler Smith, Office hours: Tue/Thu 11:00am-12:00pm (ET).

Course Description

This course provides an introduction to machine learning to undergraduate students.

The goal of this course is to understand the foundation of machine learning and learn to design, evaluate and use Machine Learning in solving real-world problems. We study a variety of learning algorithms and techniques. We will discuss mostly supervised techniques including decision trees, kNN, rule based learning, on-line learning, (Deep) neural networks, support vector machines, probabilistic approaches as well as unspurvised learning and clustering techniques.

We learn designing a end-to-end machine learning models when starting from raw data, working on preprocessing, extracting features, learning represetnations, designing various model configurations, and evaluation.

Topics to be covered

- Introduction to Machine Learning
- Concept Learning General-To-Specific
- Decision Trees
- Neural Networks
- Deep Neural Networks
- Support Vector Machines
- Probabilistic Models
- Similarity-based Models
- Experimental Evaluation
- Computational Learning Theory
- Learning Rules and Inductive Logic Programming
- Ensemble Learning, Boosting
- Clustering

Course Evaluation

- Final exam (20%)
- MidTerm exam (20%)
- Homework (25%)
- Quizzes (15%)
- Project (17%)
- Attendance (3%)

References

- Tom Mitchell, *Machine Learning* (McGraw Hill 1997)
- C. M. Bishop, *Pattern Recognition and Machine Learning* (Springer 2006)
- Shalev-Shwartz and Ben-David, *Understanding Machine Learning, From Theory to Algorithms* (Cambridge Press 2014)

Prerequisites

Students are required to have taken discrete math and some programming courses to be able to register for this course, a class in linear algebra, in probability and statistics and a basic class in theory of computation and algorithms would be extremely helpful for being successful in this course. Moreover, the students are expected to be fluent in at least one programming language to be able to conduct the project.

Some useful resources for prerequisites

Linear Algebra

- Zico Kolter, *Linear Algebra Review and Reference*
- *Linear Algebra and Matrices*

Probability and Statistics

- Arian Maleki and Tom Do, *Review of Probability Theory*
- David Blei, *Some Probability and Statistics*

Propositional Logic

- Lecture from Logic in Computer Science, University of Liverpool, *Propositional Logic*
- Lecture from CMU course, *Propositional Logic*

Acknowledgment

Most of the course material has been adapted from the following resources:

- CS446: Machine Learning, by Dan Roth.
- Some homeworks adapted from Machine Learning and Inductive Inference, by Hendrik Blockeel.
- These very nice slides and tutorials, by Andrew W. Moore.
