Course Syllabus
CS436/580L Introduction to Machine Learning

Course Description
Machine learning is the science of getting computers to make decisions without being explicitly programmed. This course provides a broad introduction to machine learning and its applications. It introduces students the basic ideas and intuition behind different machine learning techniques and algorithms as well as an understanding of how and why they work. The course also discusses applications of machine learning and practical guidelines in applying machine learning techniques in real-world problems.

Learning Objectives
On the completion of the course, students will:
• Have knowledge of basic concepts, algorithms, and techniques of machine learning
• Understand the differences between various machine learning techniques and which ones are appropriate for different problems
• Be able to use machine learning tools
• Be able to apply machine learning techniques to real-world problems

Prerequisites
• Required courses: CS 333 (Algorithms) and MATH 327 (Probability with Statistical Methods), or equivalents
• Programming: programming assignments can be implemented in any popular programming languages, such as C, C++, Java, or Matlab. No programming-specific issues will be covered in this course.

Textbook
This is a recommended book. The library has one copy on course reserve.

Main Topics
• Introduction
• Supervised learning (parametric/non-parametric learning, generative/discriminative learning, hypothesis evaluation)
• Model selection and computational learning theory (bias/variance tradeoffs, PAC learning, VC theory)
• Unsupervised learning (k-Means, EM, clustering evaluation)
• Reinforcement learning (Q-learning, temporal difference learning)
• Ensemble learning (bagging, boosting, random forests)

Lecture Notes
Lecture notes will be posted on mycourses (generally before class). Lecture notes do not capture everything covered in class. Some significant parts of a class, including discussions and in-class exercises, may not be included in the lecture notes.
Grading

1. For **CS580L** students, your grade will be based on

- Four homework assignments 20% (5% each)
- Two exams 40% (20% each)
- 6-8 short quizzes 10% (2% each, counting the top 5 highest grades)
- Presentation 15%
- Project and Report 15%

For **CS436** students, your grade will be based on

- Four homework assignments 24% (6% each)
- Two exams 50% (25% each)
- 6-8 short quizzes 10% (2% each, counting the top 5 highest grades)
- Presentation 16%
- Project and Report (optional) 10 bonus points (at maximum) added to the base grade

2. **Assignments** There will be 4 assignments in the form of question answering/programming on key concepts and algorithms. They are developed in order to help you understand the lecture materials and prepare for the two exams.

   All solutions of assignments must be typed (no handwritten solutions accepted) and submitted in hard copy. Electronic submission to the TA in advance is acceptable if you expect to be late or miss the class on the due date.

3. **Exams.** Exams will be in class, open book/notes. Exam I will take place during (or close to) Week 7, and Exam II during or close to Week 12. Exam II will cover the materials that were not covered in Exam I.

   You must take each Exam during the one time that we give it; we will not give makeup Exams.

4. **Quizzes.** The quizzes will take place during classes, and we will announce some of the quizzes during class at least one class period in advance. Some other quizzes will be pop-up quizzes (given right after the introduction of a topic). We will only consider the top five scores in deciding your overall quiz score. A discussion will be held after each quiz.

   You must take each quiz during the one time that we give it; we will not give makeup quizzes.

5. **Group Presentation**

   Each student will be required to form a presentation group (of 2 and only 2 students) to give one presentation on a selected topic (a list of topics provided by the instructor). The presenters will also be responsible for conducting group discussions and answering questions. Presentations will be held during the last 3 weeks of classes.

6. **Group Project (required for graduate students)**

   Each CS580L student will be required to form a project group (2-3 students) to conduct a term project on a topic proposed by the group and approved by the instructor. In the project, the group will apply machine learning algorithms and techniques learned in this class to a real-world problem or a research problem in another field.

   Each project group is required to submit and present in class a project progress report (in presentation slides format) during the middle of the semester, and submit a final project report (in technical report format) at the end of the semester.
**Academic Honesty Expectations**

Please review the academic honesty document and make sure that you understand it! The link is at: [http://www.binghamton.edu/watson/about/honesty-policy.pdf](http://www.binghamton.edu/watson/about/honesty-policy.pdf).

Discussion of general concepts and questions concerning the homework assignments among students is encouraged. However, each of you is expected to work on the homework solutions on your own. Sharing of any part of solutions is prohibited. If you are unclear about the policy, please consult with the instructor before you act.

**Late Policy:**

Each assignment is due at the beginning of class on the due date. Any assignment received within the next 24 hours will be penalized by 20% of the full credit; any assignment received within the time between 24 hours and 48 hours pass the deadline is penalized by 40% of the full credit; No assignment will be accepted after 48 hours pass the deadline. Rare exceptions of this policy may be made at the discretion of the instructor under demonstrably circumstances.