CIS 431 – Machine Learning
Spring 2020

Textbook: Recommended:

- Ethem Alpaydin, Introduction to Machine Learning, Second Edition
- Stephen Marsland, Machine Learning: An Algorithmic Perspective.
- Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/en-us/um/people/cmbishop/prml/.
- Tom Mitchell, Machine Learning, http://www.cs.cmu.edu/~tom/mlbook.html.

***Instructor*:** Dr. Supraja Gurajala,
Office Hours: Mondays & Wednesdays: 10:00 am - 12:00 noon
Fridays: 10:00 am - 11:00 am
Class Time/Place: T,TH 9:30am to 10:45am Dunn hall 208
Final Exam: Tuesday, May 19, 12:30 - 2:30 pm, Dunn hall 208

Course Description:

Introduction to modern machine learning algorithms and methods. Includes algorithms and approaches for regression, classification, clustering, probabilistic and statistical methods, and neural networks. The course emphasizes implementation of and application of machine learning. Prerequisite: CIS 303 with minimum grade of 2.0

Learning Outcomes:

Upon completion of this course :

1. *Students will learn the mathematical foundations of machine learning algorithms and apply this knowledge in programs and other assignments.*

2. *Students will design, write, and test programs for a variety of machine learning methods in a specified implementation language.*

3. *Students will apply knowledge of data structures in programming assignments and the project. Efficient handling of large data sets is emphasized.*

4. *Students will work in teams to design and implement the course project.*

5. *Students will extend their knowledge of machine learning algorithms, methods, and tools in the course project by using methods/tools that are not covered in other assignments.*

Grading for the Course:

1. ***Homeworks and Assignments:*** 30 %

    a. Programming assignments: 5-6 programs, including topics such as regression, classification, clustering, and applications (*e.g.*, PCA, dimensionality reduction, IIV).
    b. Problems assignments (non-programming, theoretical/mathematical problems)

2. ***Exams:*** 30%

    a. Midterm 1 – 15 % Date: TBA
    b. Midterm 2 – 15 % Date: TBA

    Exams will be closed book and closed notes unless specified otherwise. Any request for re-grading must be received in writing and within 3 days of receiving your graded exam back. Prior notice must be given to your instructor. No make-ups will be granted unless satisfactory documentation is produced to show an extenuating circumstance.

3. ***Project:*** 30%
    Team or individual project (depending on the number of students in the class) that gives students an opportunity to explore ML tools and applications to solve a particular real-world problem.
4. ***Research Papers:*** 10%

    This semester all students will prepare and present a paper related to Machine Learning. They will research the topic, select a paper, and prepare a 20 minute presentation on the paper.

Course Policies

1. ***Late work***

    All due dates for the course will be strictly enforced. Prior approval will be required from the instructor for any late submission, including making up missed exams.

2. ***Attendance***

    Attending all lectures and labs and completing required work is crucial to your success in this course. While attendance is not graded per se, in-class graded work cannot be made up without prior arrangement with the instructor. In the event of absences from weekly labs, you are required to complete the missed lab work before the beginning of the next lab session. The instructor and CS tutors will be available to help you with completing labs during posted office and tutoring hours.

3. ***Absences***

    As noted above, in-class graded work cannot be made up without prior arrangement with the instructor.

Accommodation of Religious Observances: I will make reasonable accommodation for a student's religious beliefs. Please notify me within the first week of classes about any scheduled class date that conflicts with a religious observance.

4. *Academic Integrity*

You are expected follow the "SUNY Potsdam Academic Honor Code" (SUNY Potsdam Undergraduate Catalog, https://catalog.potsdam.edu/content.php?catoid=7&navoid=566) by doing your own work on all required work for the course unless specifically directed otherwise by the professor. **Copying is strictly forbidden, regardless of the source** (online, other students). Students caught cheating will receive a grade of 0 for that evaluation. More than one offense will result in dismissal from the course and possible disciplinary sanctions by the university. Academic Misconduct definitions, procedures, due process, and student rights are described on page in the SUNY Potsdam Undergraduate Catalog, as cited above.

5. *Grade Distribution*

At the end of the semester, I will calculate what fraction of the possible points you have earned, and your grade will be based on this distribution:

4.0: 95 – 100%
3.7: 90 – 94%
3.3: 85 – 89%
3.0: 80 – 84%
2.7: 77 – 79%
2.3: 73 – 76%
2.0: 70 – 72%
1.7: 67 – 69%
1.3: 63 – 66%
1.0: 60 – 62%
0.0: <60%

Note that final grades may be determined using a class curve of the course-grade averages.

Tentative Schedule:

Week	Topics	Assignment
1	Course Introduction Introduction to Supervised and Unsupervised ML	
2	**Regression**: Topics include Linear regression, logistic regression, multivariate regression, support vector machine (SVM)	
3		Programming 1: Regression
4	**Classification:** Topics include SVM, K-Nearest Neighbor, Decision Tree	Problems 1: Regression, classification, gradient descent

5	**Gradient descent**	Programming 2: Classification
6	Project introduction and organization Midterm 1	Midterm preparation
7	**Clustering: k-means**	Programming 3: Clustering
8		
9	**Bayesian theory and techniques**	
10		Problems 2: Topics NN, clustering, Bayes
11	Projects – work day Midterm 2	Midterm preparation
12	**ML applications:** e.g., PCS, dimensionality reduction, IIV	Programming 4: Bayesian techniques
13		
14		
15	Additional topic TBD	
16	**Final Exam: Project Presentations**	