

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: Supraja Gurajala, Dunn 307, Phone: 315-267-2091 (gurajas@potsgdam.edu)

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:

All graduating students with a major in Computer Science shall demonstrate 10 specific learning outcomes. Learning outcomes that are applicable to CIS 431 are shown in bold, below. Students in the Computer Science program at SUNY Potsdam are expected to graduate with a:

1. Knowledge of discrete and continuous mathematics --- including elementary probability and statistics – and the ability to apply logic and mathematical proof techniques to computing problems.

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

2. Knowledge of basic theory of computability and complexity of computation.

Not emphasized in CIS 431.

3. Knowledge of and the ability to apply programming fundamentals in at least two programming languages.

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

4. Knowledge of fundamental data structures and algorithms --- including analysis of their correctness and complexity --- related to various fields of computer science, and the ability to apply this knowledge to problems through the use of appropriate programming languages.

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

5. Knowledge of computer architecture and organization, computer operating systems, and computer networks, and the ability to apply this knowledge to problems through the use of appropriate programming languages.

Not emphasized in CIS 431.

6. Competence and effectiveness in technical oral, written, and visual communication, particularly as they apply to the dissemination of technical information on subjects dealing with computing technology and applications.

Not emphasized in CIS 431.

7. Knowledge of and skill in applying good practices in software engineering.

Not emphasized in CIS 431.

8. The ability to function effectively in teams to accomplish a common goal.

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

9. An understanding of professional, ethical, legal, security, and social responsibilities and issues, including an awareness of impact of computing on individuals, organizations, and society.

Not emphasized in CIS 431.

10. A commitment to continuing professional development.

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.

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

90% >=	A
80% - 90	B
70% - 80	C
60% - 70	D
< 60%	F

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

Due Dates

All due dates for the course will be strictly enforced. Prior approval will be required from the instructor for any late submission.

Tentative Schedule:

Week	Topics	Assignment
1	Course Introduction Introduction to Supervised and Unsupervised ML	
2	Regression: Topics include	
3	Linear regression, logistic regression, multivariate regression, support vector machine (SVM)	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	Problems 2: Topics NN, clustering, Bayes
10		
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	
	Final Exam: Project Presentations	

Impact of extracurricular activities on class work

You make the choices about how you will spend your time, including investing your time in non-academic activities. As a student, you need to give priority to your academic work, and prevent extracurricular commitments from negatively impacting your work for classes. You are, of course, free to participate in activities that are meaningful to you; however, do not expect me to give special consideration because of time management issues that arise from those activities. You should not be

missing class because of extracurricular activities, nor should you allow yourself to fall behind on assignments. **NOTE: I will not give extensions that relate to participation in extracurricular activities, even if the activity is related to Computer Science.**

Computer Use

You can do your programming assignments on the PC workstations in DUNN 302. They are connected via a Local Area Network to a server, so you can sit down at any of the machines and log in to your own account. These machines use a version of the Unix operating system called Linux.

You must use your SUNY Card to enter the Unix lab. Your computer account in the Unix classroom is your private property, and should be treated as such. Please protect yourself by keeping your password private and making sure that you completely log out every time you use your account. It is your responsibility to prevent others from plagiarizing your work.

Expectations for the Course

- You will be expected to come prepared to class and be an active participant in class discussions. You should plan on spending a significant time outside class in reviewing course material covered in class. It is critical that you keep up with the course material on a timely basis.
- Academic dishonesty: Students are expected follow the "SUNY Potsdam Academic Honor Code" (SUNY Potsdam 2014-2016 Undergraduate Catalog, p. 42) by doing their own work on quizzes, exams and programming assignments unless specifically directed otherwise by the instructor. Copying is strictly forbidden. Students caught cheating will receive a grade of 0 for that evaluation. Repeated offenses 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 43 of the SUNY Potsdam 2014-2016 Undergraduate Catalog.
- Disability Assistance: Anyone who has special needs that must be accommodated to fulfill the course requirements should notify the instructor and the Director of Accommodative Services, 111 Sisson Hall, 267-3267. The college has resources available to assist qualified students with their academic studies.
- Food and Drink in Class and Lab: Beverages are allowed in the classroom as long you clean up after yourself and do not disturb others. In the Unix lab, food and drink are restricted to the coffee table. **UNDER -NO- CIRCUMSTANCES ARE FOOD AND BEVERAGES (EVEN GUM) ALLOWED NEAR THE COMPUTERS.**
- No devices are allowed during class. Notes must be hand-written
- Accommodation of Religious Observances: We will make reasonable accommodation for a student's religious beliefs. Please notify us within the first week of classes about any scheduled class date that conflicts with a religious observance.

Attendance

Regular attendance is critical for your success in this course. You are responsible for updating yourself with announcements made in class concerning material covered, home works, and any changes in course syllabus, due dates, or other course-related issues.

SUNY Potsdam Department of Computer Science Code of Professional Conduct

1. ***Preamble***

All members of the ACM, including the Computer Science faculty of SUNY Potsdam, are committed to ethical professional conduct as specified in the ACM Code of Ethics and Professional Conduct. Students, taking courses from the faculty, are bound by our commitment.

All members of the Department are obliged to remind one another to behave professionally. Violations should be reported promptly; however, capricious or malicious reporting of violations is, itself, a violation. When reporting, bring all relevant aspects of the incident to the faculty's attention.

2. ***Moral Imperatives***

As a Computer Science student I will...

2.1. Respect all members of the Department.

2.1.1. Be professional in face-to-face and electronic interactions.

2.1.2. Be fair so everyone is free to work and learn.

2.1.3. Be active in preventing discrimination in physical and electronic spaces frequented by Department members.

2.2. Accept and provide appropriate feedback.

2.2.1. Avoid starting or spreading rumors.

2.2.2. Respect confidentiality.

2.3. Be honest, trustworthy, and respect intellectual property.

2.3.1. Only take credit for my own work.

2.3.2. Respect the privacy of others.

2.3.3. Access computing resources only when authorized and report any access risks discovered.

2.4. Contribute to society and human well-being.

2.4.1. Improve public understanding of computing and its consequences.

2.4.2. Consider both the direct and indirect impacts of my actions.

Based on the ACM Code of Ethics and Professional Conduct, retrieved from <https://www.acm.org/about-acm/acm-code-of-ethics-and-professional-conduct> 11 August 2017

Student Support

Every student in this class is a valued individual. If you are struggling with issues outside of the classroom, please know that there are professionals both on and off campus who can assist you. If you need immediate assistance, please contact our campus Counseling Center (with free counseling) at (315) 267-2330 or visit their website. Links to other resources are provided below:

- • ***Rachel Bayliss***- Title IX Support Staff & Title IX Core Team
 - Draime Extension S184, (315) 267-2350
 - VanHousen Extension, Rm. 392, (315) 267-2516

- <http://www.potsdam.edu/offices/hr/titleix>
- • *Bias Incident Reporting-*
 - <http://www.potsdam.edu/about/diversity/biasincident>
- • *Center for Diversity*
 - 223 Sisson Hall
 - (315) 267-2184
 - <http://www.potsdam.edu/studentlife/diversity>
- • *University Police*
 - Van Housen Extension
 - (315) 267-2222 (number for non-emergencies; for an emergency please dial 911)
- • *Student Conduct and Community Standards*
 - 208 Barrington Student Union
 - <http://www.potsdam.edu/studentlife/studentconduct/codeofconduct>
- • *Reachout (24-hour crisis hotline)* ▪ (315) 265-2422
- • *Renewal House (for victims of domestic violence)*
 - SUNY Potsdam Campus Office: Van Housen Extension 390 (open Wednesdays, 9-5:00)
 - (315) 379-9845 (24-hour crisis hotline)
 - Renewalhouse_campus@Verizon.net

And please: if you see something, say something. If you see that someone that you care about is struggling, please encourage them to seek help. If they are unwilling to do so, Care Enough to Call has guidelines on whom to contact. Everyone has the responsibility of creating a college climate of compassion.