CS 613 - Machine Learning
Winter 2020, Th 6:30-9:20pm
Section 001 Room: 3675MK 1054-1055
Section 900 Online

Instructor: Dr. Edward Kim
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Office Hours: Wed. Thurs 10:00 AM -11:00 AM and by appointment

Teaching Assistants: Yigit Alparsan - ya332@drexel.edu
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Textbook:
Required:

None.

Recommended:

The Hundred-Page Machine Learning Book, first edition
ISBN-10 199957950X, ISBN-13 978-1999579500

Introduction to Machine Learning with Python, by Andreas Muller and Sarah Guido
ISBN-10 1449369413, ISBN-13 978-1449369415

An Introduction to Statistical Learning by Gareth James and Daniela Witten
ISBN-10: 1461471370, ISBN-13: 978-1461471370

Pre-requisites:
CS 520 (Computer Science Foundations)
CS 570 (Programming Foundations)
CS 571 (Advanced Programming Techniques)
A basic understanding of linear algebra, probability, statistics and calculus.

Course Description: This course covers the fundamentals of modern statistical machine learning. Lectures will cover fundamental aspects of machine learning, including dimensionality reduction, overfitting, ensemble learning, and evaluation techniques, as well as the theoretical foundation and algorithmic details of representative topics within clustering, regression, and classification (for example, K-Means clustering, Support Vector Machines, Decision Trees, Linear and Logistic Regression, Neural Networks, among others). Students will be expected to perform theoretical derivations and computations, and to be able to implement algorithms from scratch. The course will conclude with

a final project and presentation on a machine learning problem of their choosing.

Multiple assignments will also be given to reinforce understanding of each topic. These will include implementing various algorithms as well as theoretical questions. In addition to a final exam, students are expected to submit a mid-semester final project proposal based on a research paper of their choosing. The final project will include implementing and expanding on the chosen paper for a topic/problem/dataset of interest to them.

Students entering the class with sound understanding of probability and statistics will be at an advantage but the course is designed so that anyone with strong background or interest in mathematical modeling and analysis can catch up and fully participate. Thus, a familiarity with linear algebra and statistical methods is recommended but not required.

Course Objectives:

- Implement core ML algorithms including Linear and Logistic Regression, Decision Trees, Neural Networks and Hidden Markov Models.

- Train ML algorithms with a training set and validation set (if necessary).

- Use ML algorithms to do regression and classification.

- Evaluate the quality of an ML algorithm

- Decide on the most applicable ML algorithm

- Can normalize data and project to lower and higher dimensional space as necessary.

Grade Policy:

- You, your instructor, and the TA (if applicable) are bound by the Academic Honesty policy. Students are responsible for reading and understanding the course policies in this syllabus and for announcements made in class and in the course email list. See the academic policy at the end of the syllabus.

- Since this course involves computer programming, while the majority of your work should be original, if at any point you use part of someone else's solution you MUST cite the source of the code. Copy from others (online or classmates) results in an automatic zero for the assignment and additional possible penalties (including course failure and/or escalation to the honor board).

- While you are encouraged to use a versioning system like github or bitbucket, please make your work for this course private. Making your code for this course publically available to others would constitute an academic integrity violation.

- During lecture and recitation sessions please refrain from using mobile phones or otherwise being impolite.

- Any dispute about an assignment grade must be made and resolved within 5 days of receiving your grade. After this period your grade cannot be adjusted.

- Except when groups are explicitly allowed, work must be done individually. You are encouraged to discuss the problems with your classmates but you must not share details of the solutions. If you are unsure whether you have shared too much, discuss the situation with the TA or instructor; it is your obligation to avoid even the appearance of cheating.

100-93 A	89-87 B+	79-77 C+	69-67 D+	59 F
93-90 A-	87-83 B	77-73 C	67-63 D	
	83-80 B-	73-70 C-	63-60 D-	

Grading: All assignments must be completed on the due date. Assignments not handed in at all will receive an F grade. Assignments handed in late, without a proper excuse, will receive a grade penalty every day that it is late.

3 Projects	55%
Midterm Presentations	5%
Midterm Exam	20%
Final Project	20%

Course Calendar*:

What is Machine learning, Regression, Gradient Descent . . . . . Week 1
Logisitic Regression, Classification, K-NN . . . . Week 2
Decision Trees, Bayes, Support Vector Machines, Kernels . . . . Week 3
Feature Selection, Feature Projection, Clustering . . . . Week 4
Unsupervised learning, PCA, LDA, ICA . . . . Week 5
Midterm Exam Review . . . . Week 6
Perceptrons, Neural Networks . . . . Week 7
Convolutional Neural Nets, Embeddings, Deep Learning . . . . . Week 8
Neuro-inspired Machine Learning, Sparse Coding . . . . Week 9
Final Project Presentations . . . . Week 10

University Policies: In addition to the course policies listed on this syllabus, course assignments or course website, the following University policies are in effect:

Academic Honesty:
http://www.drexel.edu/provost/policies/academic_dishonesty.asp

Judicial Affairs Academic Integrity:
http://drexel.edu/studentaffairs/community_standards/facultyStaff/integrity/

Official Final Exam Schedule:
http://www.drexel.edu/registrar/scheduling/exams/

Students with Disability Statement:
http://www.drexel.edu/ods/student_reg.html

Course Drop Policy:

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*Note: This schedule may change throughout the semester.

http://www.drexel.edu/provost/policies/course_drop.asp

Drexel Student Learning Priorities:
http://www.drexel.edu/provost/learningpriorities/

Academic Integrity/Plagiarism Policy
As a reminder, below is the university's academic integrity/plagiarism policy:

"Drexel University Policy on Plagiarism":
Violations of the Academic Integrity Policy include, but are not limited to:
1. Plagiarism
2. Fabrication
3. Cheating
4. Academic Misconduct

Plagiarism - the inclusion of someone else's words, ideas, or data as one's own work. When a student submits work for credit that includes the words, ideas, or data of others, the source of that information must be acknowledged through complete, accurate, and specific references, and, if verbatim statements are included, through quotation marks as well. By placing his/her name on work submitted for credit, the student certifies the originality of all work not otherwise identified by appropriate acknowledgments.
Plagiarism covers unpublished as well as published sources. Examples of plagiarism include, but are not limited to:

-Quoting another person's actual words, complete sentences or paragraphs, or an entire piece of written work without acknowledgment of the source.
-Using another person's ideas, opinions, or theory, even if it is completely paraphrased in one's own words without acknowledgment of the source.
-Borrowing facts, statistics, or other illustrative materials that are not clearly common knowledge without acknowledgment of the source.
-Copying, or allowing another student to copy, a computer file that contains another student's assignment, and submittng it, in part or in its entirety, as one's own.
-Working together on an assignment, sharing the computer files and programs involved, and then submitting individual copies of the assignment as one's own individual work.

Students are urged to consult with individual faculty members, academic departments, or recognized handbooks in their field if in doubt regarding issues of plagiarism.

2. Fabrication - Fabrication is the use of invented information or the falsification of research or other findings. Examples include, but are not limited to:

-Citation of information not taken from the source indicated. This may include the incorrect documentation of secondary source materials.
-Listing sources in a bibliography not used in the academic exercise.
-Submission in a paper, thesis, lab report, or other academic exercise of falsified, invented, or ficti-

tious data or information, or deliberate and knowing concealment or distortion of the true nature, origin, or function of such data or information.
-Submitting as your own written work, printing, sculpture, etc. prepared totally or in part by another."

3. Cheating - Cheating is an act or an attempted act of deception by which a student seeks to misrepresent that he or she has mastered information on an academic exercise that he/she has not mastered. Examples include, but are not limited to:

-Copying from another student's test, exam, quiz, and/or paper.
-Allowing another student to copy from a test, exam, quiz, and/or paper.
-Unauthorized use of course textbook or other materials, such as a notebook to complete a test or other assignment.
-Collaborating on a test/exam/quiz or other project with another person(s) without authorization.
-Using or processing specifically prepared materials during a test such as notes, formula lists, notes written on the students clothing, etc. that are not authorized.
-Taking a test for someone else or permitting someone else to take a test for you."

4. Academic Misconduct - Academic misconduct includes other dishonest acts such as tampering with grades or taking part in obtaining or distributing any part of an administered or unadministered test/assignment. Examples include, but are not limited to:

-Stealing, buying, or otherwise obtaining all or part of an administered or unadministered test.
-Selling or giving away all or part of an administered or unadministered test including questions and/or answers.
-Bribing any other person to obtain an administered or unadministered test or any information about the test.
-Any unauthorized action taken for the purpose of changing a grade in a grade book, on a test, or on other works for which a grade is given.
-Changing, altering, or being an accessory to the changing and/or altering of a grade in a grade book, on a test, a "change of grade" form, or other official academic records of the University that relate to grades.
-Continuing to work on an examination or project after the specified allotted time has elapsed.
-Any buying or otherwise acquiring any theme, report, term paper, essay, computer software, other written work, painting, drawing, sculpture, or other scholastic art work, and handing it in as your own to fulfill academic requirements.
-Any selling, giving, or otherwise supplying to another student for use in fulfilling academic requirements, any theme, report, term paper, essay, computer software, other written work, painting, drawing, sculpture, or other scholastic art work.
-Scientific Misconduct - See http://www.drexel.edu/provost/policies/conduct_of_research/

A step-by-step guide for reporting a case of academic dishonesty can be found on the Student Life Website: http://drexel.edu/studentlife/community_standards/facultyStaff/integrity/. Should you have any questions or need further assistance regarding academic dishonesty, please call 215-895-6074 and ask for Stephen Rupprecht or email sccs@drexel.edu.