Applied Machine Learning (CS 441) – Fall 2024

Instructor: **Derek Hoiem** (dhoiem)

Lectures: Tues/Thurs 9:30-10:45, 1320 DCL

Overview

Machine learning (ML) algorithms convert raw data into predictive models or insights. ML is used for speech recognition, driving safety, compression, data analytics, ad recommendation, photo enhancement, robotics, gaming, and more. Application of ML is changing our lives daily, and masters of ML are the wizards of the information age.

Course Objectives

This course teaches how to use machine learning techniques to solve a wide variety of problems. By the end of this course, you should have a strong grasp of the general principles of machine learning, including familiarity with common approaches, assumptions, and methodologies. You should be able to assess the strengths, weaknesses, and use cases of ML algorithms, and to select and apply the right tools for custom classification, regression, and analysis problems. You should have a good foundation for application to computer vision, language, time-series, audio, and other data, and be aware of ethical concerns about applications of ML. These capabilities will be developed through practical exercises and projects, guided by lectures covering a wide range of topics, and reinforced in exams.

Prerequisites

You should enter the course with basic programming skills and a working knowledge of linear algebra, probability/statistics, and calculus. Previous experience with Python will be very helpful but is not required.

Assignments and Grading

Grading is based on a combination "Experience Points" (EP) and exam scores.

Experience Points: There are five homeworks, each with a "core" worth 100 points and additional "stretch goals" that provide the opportunity to explore projects of interest at greater depth and earn additional points. The final project is worth up to 100 points for a basic project, or up to 150 points for an advanced project. You can also earn up to 50 points for recorded participation in in-class quizzes and surveys. The target number of EP depends whether you are in the 3 credit or 4 credit version of the course:

- **3 credit: EP_target = 500 points**
- **4 credit: EP_target = 625 points**

Earning points beyond this will further boost your grade, as explained under grade calculation.

Exams (200 points): There will be three exams during the semester. Your highest two scores count for 100 points each. The exams are cumulative, with more emphasis on material not tested in previous exams. The exams will be administered at CBTF, so they are 50 minutes and closed book/notes.

Grade calculation:

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Course_Grade = (EP + highest_exam + 2nd_highest_exam) / (max(EP, EP_target) + 200)
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For experience points, only your total matters, so you could earn 500 points through, e.g. four core assignments and a basic final project, or five core assignments. Earning EP beyond EP_target increases their weight, increasing your course total. For example, suppose your exam scores are (85, 75, 90) and you earn 550 EP. Your grade for the 3 credit version is (550 + 90 + 85) / (550 + 200) = 96.7% and for the 4 credit version is (550 + 90 + 85) / (625 + 200) = 87.9%.

Letter grades will be assigned based on the following thresholds. Thresholds may be lowered (but not raised) if warranted by the grade distribution, but large changes are not expected.

97	94	90	87	84	80	77	74	70	67	64	60	<60
A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

Late policy: Aim to get all projects in on time to stay on track in the course. You have a *total of ten free late days for regular projects*. Use them wisely. Additional late days come at a penalty of five experience points per day late. *To receive any credit, your project must be submitted within two weeks of the deadline, with no exceptions, regardless of whether you use free late days.* The reason for this is to ensure that the class is roughly in sync. You have a short grace period for the submission deadline, e.g. a project submitted less than one hour late will not count as late. The final project cannot be submitted late. It is very rare to receive additional late days due to common interruptions like travel, sickness, and competing responsibilities; typically, a note from the Dean of Students or other official that validates the emergency is required.

Absence policy: In-person lecture attendance is encouraged, but lectures will be recorded. Please stay home if you are sick to avoid spreading. Contact the instructor by email if you have a serious illness or hospitalization that requires accommodation. See Part 5, 1-501 of the Student Code for detail.

Changes from assignment and grading policies in syllabus: While I try to be transparent and predictable, I maintain the right to make any changes that I deem in the best interest of the students as a whole, and will communicate any changes as promptly as possible.

Academic Integrity

You are welcome to discuss homework and projects with your classmates, but do not show or share any code. Also, you may not use any code from the Internet or any other outside sources, unless it is specifically approved by the instructor. Be sure to acknowledge any help that you do get from other students or outside works, even if it's just a small suggestion. *Violations will go on record at the university, and the minimum penalty will be a zero for the entire assignment.* See http://studentcode.illinois.edu/.

General Information

Textbook: The lectures are not directly based on any textbook, but will point you to relevant readings from David Forsyth's *Applied Machine Learning*, which is considered our primary text, or other online resources. The AML book is really quite good and worth reading, even for parts not covered in lectures.

- David Forsyth, *Applied Machine Learning*. Springer International Publishing, 2019. Available at the University of Illinois Library (https://www.library.illinois.edu). Follow the link to "SpringerLink - Full text online" to download the PDF. You can use this proxy link to log in the University of Illinois Library with your Illinois credentials and download the book: https://link-springer-com.proxy2.library.illinois.edu/book/10.1007/978-3-030-18114-7.

To obtain **disability-related academic adjustments** and/or auxiliary aids, students with disabilities must contact the course instructor and the as soon as possible. To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should contact Disability Resources and Educational Services (DRES) and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail disability@illinois.edu. http://www.disability.illinois.edu/.

Mental Health: Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911.

CBTF

- This course uses the Grainger College of Engineering's Computer-Based Testing Facility for its exams.
- The policies of the CBTF are the policies of this course, and academic integrity infractions related to the CBTF are infractions in this course.
- If you have accommodations identified by the Division of Rehabilitation-Education Services (DRES) (http://www.disability.illinois.edu/) for exams, please submit your Letter of Accommodations (LOA) through the CBTF website (https://cbtf.illinois.edu/students/dres) as soon as possible. It can take up to five days for your LOA to be processed and if you make a reservation before your LOA has been processed, your reservation will not include your testing accommodations and you will be required to reschedule. This must be done each semester you use the CBTF.
- If you have any issue during an exam, inform the proctor immediately. Work with the proctor to resolve the issue at the time before logging off. If you do not inform a proctor of a problem during the test then you forfeit all rights to addressing the problem you experienced during your exam.
- Take the CBTF Orientation (https://go.illinois.edu/student-orientation) (10 minutes) and review all instructions on the CBTF website (https://cbtf.illinois.edu/students) before your first exam.