CSPB 4622 - Machine Learning Syllabus

Course Information

Instructor Information

Instructor: Hoang Truong (he/him)

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Preferred Method of Contact: For any questions regarding the course, please use the Piazza platform to contact me. For emergency situations, contact me via email and include “CSPB 4622” in the subject.

Course Description

Machine Learning course covers three key units: Supervised Learning, Unsupervised Learning, and Deep Learning. In the Supervised Learning unit, students explore algorithms like linear regression and decision trees to make predictions from labeled training data. The Unsupervised Learning unit focuses on clustering and dimensionality reduction techniques for analyzing unlabeled data. The Deep Learning unit delves into neural networks and deep learning models for tasks like image recognition and natural language processing. Through lectures, exercises, and projects, students gain practical skills to tackle real-world machine-learning challenges.

Learning Goals

1. Understand the foundational concepts and principles of machine learning, including key terminology, algorithms, and methodologies.
2. Gain proficiency in applying supervised learning techniques to make accurate predictions from labeled training data
3. Develop the ability to analyze and interpret data using unsupervised learning algorithms for pattern recognition and clustering.
4. Acquire knowledge of deep learning architectures and algorithms, and apply them to solve complex problems in image recognition, natural language processing, or other relevant domains.
5. Apply learned concepts and techniques to independent projects or research, demonstrating a comprehensive understanding of machine learning principles and their practical applications.

Prerequisites

- Requires prerequisite courses of CSPB 2270 or CSCI 2270, CSPB 2824 or CSCI 2824, CSPB 2820 or CSCI 2820, and CSPB 3022 and CSCI 3022.
- Minimum Passing Grade: C-

Required Texts

- *ISLR second ed.* https://www.statlearning.com/

Class Tools

- We'll use Moodle for lecture videos and the class contents, quiz, and exam. We'll use Gradescope for Homework Assignment submissions. We will use python programming language throughout the course. You're welcome to use any python IDE. We also have a JupyterHub environment loaded with libraries we'd need in https://coding.csel.io/. In case you're using a local Python environment, I highly recommend Anaconda or VSCode with Virtual Env setup for managing packages. For the project submission, we'll use GitHub Classroom.

Grading Categories

Assessment	% of Grade	Description
Reading Quizzes	20%	Reading/video quizzes
Homework	40%	Homework assignments
Projects	35%	Three projects
Participation Discussion	5%	Weekly Piazza discussions

Reading Quizzes

Some modules have short reading/video quizzes that ask you to reflect on your understanding of the material and learning outcomes of that topic.

Homework

The problems will involve implementing algorithms in Python. You are expected to write up your solutions neatly, with full explanations and justifications. You may discuss problems with your classmates, but all work must be your own. See the Collaboration Policy below for more details.

Projects

We will have 3 projects where you choose 1 dataset from the contributed pool and apply EDA and corresponding ML techniques (Supervised, Unsupervised, and Deep Learning).

Participation Discussion

We'll have weekly Piazza discussions, Dataset contributions, and Project progress feedback.

Communication

Communicate any difficulties or concerns as they arise. Please consult me in advance if you anticipate any disruptions that might affect your coursework, especially before deadlines. For all course-related inquiries, please use the Piazza platform to contact me. This ensures all communication is centralized and accessible to all class members, which may provide answers to questions that others might also have. For private matters, you can message me directly on Piazza.

Piazza

- You are expected to participate in Piazza in this course.
- All course communications will be via Moodle announcements and Piazza posts.
- Please set your communication preferences in the Piazza application.
- Instructors will post starter threads on Monday, use these to keep Piazza organized.
- Use the weekly folders to check in with class activities.
- Instructors may not immediately answer Piazza questions. Please help out your fellow students. We will endorse your posts when they contain good advice.
- Instructors are active on Piazza Monday through Friday during business hours.
- Instructors will try to immediately respond to Piazza posts if they are emergencies (Moodle not working, exam not working, etc.).

Method of Instruction

This is a live course and participation is essential. While there is flexibility in when you access the materials, there are strict weekly due dates - no late work is accepted. You may have access to future assignments if you wish to move faster, however, weekly discussion and instructor support will be focused on the current week.

A variety of materials and approaches will be used including: videos, readings, discussions, quizzes, and writing assignments.

As this is an online course, it requires a good deal of self-discipline and time management skills in order to be completed successfully. It is up to you, the student, to understand the schedule and keep up with the assignments. Make sure you know your deadlines and due dates.

Responsibilities and Class Expectations

Students are expected to finish weekly reading materials and video lectures. There are 14 quizzes weekly, 8 coding assignments following each of 8 class topics, and 3 mini-projects following each of 3 big topics above. In addition, students are encouraged to participate in reading discussions and asynchronous discussions on Piazza. The weekly workload of 10 hours would include 2 hours for lectures, 2 hours for reading, 1 hour for quiz, 4 hours for coding assignments, and 1 hour for discussion).

Grading Policies

Submission Policies

All assignments require GitHub commit and regular commit history with written report submission on gradescope.

Grading will be done before the subsequent assignment is due or within 6 days of the due date (whichever is first).

Large one time projects may take two weeks to grade.

Individual Check-In

If you have a unique situation that may be affecting your work or class experience or you need clarification of an email, Piazza, or ZOOM exchange, please email your instructor with the subject line “Individual Check-In”. Your instructor will email you back to set up a Zoom call to discuss the specific situation and work with you to develop a solution and/or strategy to move forward.

Grading Reviews

Requests for grading interviews must be submitted within a week of an assignment being returned.

Any grade review may include a review of all work submitted and your grade may go up or down.

All grades are final on the last day of classes. No grade changes will be made after the last day of classes.

Late Work Policy

A one-time late assignment submission is allowed with reasonable notification to the instructor before the deadline.

Extra credit is available on each assignment. Instructions can be found in the assignment descriptions.

Grading Scale

All coursework grades are final and will not be changed after the last day of classes. Please review your scores during the semester.

93 - 100	A
90 - 93	A-
87 - 90	B+
83 - 87	B
80 - 83	B-
77 - 80	C+
73 - 77	C
70 - 73	C-
67 - 70	D+
63 - 67	D
60 - 63	D-
0 - 59.9	F

Course Topics

- Supervised Learning and Project 1
    - Linear Regression
    - Logistic Regression
    - KNN and Tree
    - Bagging and Boosting
    - SVM
- Unsupervised Learning and Project 2
    - Dimensional Reduction
    - Clustering
    - Recommender Systems
    - Matrix Factorization

- Deep Learning and Project 3
    - Multilayer Perceptron & Gradient Descent
    - CNN
    - RNN

Program Policies and University Policies

Service Interruptions and Support

Due to the online nature of this program, there is always the possibility of service interruptions. If you are unable to access the course materials (Moodle, Piazza, etc.), we encourage you to visit https://www.isitdownrightnow.com/applied.cs.colorado.edu.html.

For non-urgent issues related to platform support, please contact cscihelp@colorado.edu.

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.

For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

CSPB Program AI Policy

Students must represent any work (e.g., ideas, text, code, images) **submitted for evaluation** as the student's own creative or intellectual product. Unless instructors provide explicit permission or instruction to the contrary, students may not submit content for evaluation that was generated, in whole or in part, by genAI tools. Using genAI tools when unauthorized would be considered a potential violation of the University of Colorado Honor Code.

Prohibited conduct includes**:**

- Copying all or part of AI generated content (e.g., text, code, images, solutions) into a student answer on an assessment, essay, test, or other assignment submitted for evaluation (whether in-class or out-of-class).

- Providing a genAI tool with all or part of the prompt for an out-of-class assignment (e.g., essay or coding assignment) and paraphrases or otherwise adapts all or part of the generated content into their response without proper attribution of the genAI tool.
- **In short - do not copy/paste from AI.**

Adapted from Colorado School of Mines AI Policies.

Collaboration Policy

We welcome collaboration! Sharing insights, asking questions, learning by doing, and learning by helping others are essential skills in learning computer science.

Collaboration is discussing ideas of the course with others, sharing insights and extra resources, working through similar questions to an assignment, sharing resources, and helping others. The Piazza forum in your class is an ideal place to share ideas, lead a discussion or be the hero that asks the "dumb question" everyone else is afraid to ask. And Piazza is often a source for content for instructors to include in letters of recommendations. Your leadership, courage, and determination will not go unnoticed.

Collaboration is not:

- "Having a partner." In particular, Group Projects, or projects that specify "working with a partner" will have individual guidelines.
- One student solving problems 1-4, and another solving 6-10.
- An identical group solution submitted by multiple students.

Unless specified in the assignment, all coursework is individual.

In general:

- You must document resources and collaboration on any assignment. This should be in the form of comments at the start of code and/or within solution notes.
- Cite Your Sources: If you collaborated with someone on an assignment, or if your submission includes quotes from a book, a paper, or a web site, you must clearly acknowledge the source.
- Plagiarism is forbidden. Copying answers directly or indirectly from solution manuals, web pages, or your peers is a violation of honor code. The assignments and code that you turn in should be written entirely on your own
- Copying/soliciting a solution to a problem from the internet or another classmate constitutes a violation of the course's collaboration policy and the honor code and may have serious consequences.

- You may not actively search for a solution to the problem from the internet. This includes posting to sources like StackOverflow, Reddit, Chegg, CourseHero, etc.
- StackExchange Clarification: Searching for basic techniques in Python/C++ is totally fine.
- If you have taken this course prior to this semester and have done some/all of homeworks previous code or previous homework solutions may not be reused. You must start each homework from scratch.
- When in doubt, ask. If something doesn't seem right - you are not sure if you can use a resource or if you are feeling pressure to share a specific solution - please reach out to your instructor.

Note: Other information on the Honor Code can be found at www.colorado.edu/policies/honor.html and https://www.colorado.edu/sccr/honor-code.

Requirements for Infectious Diseases

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all applicable campus policies and public health guidelines to reduce the risk of spreading infectious diseases. If public health conditions require, the university may also invoke related requirements for student conduct and disability accommodation that will apply to this class.

If you feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the guidance of the Centers for Disease Control and Prevention (CDC) for isolation and testing. If you have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home but should follow the guidance of the CDC for masking and testing.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, please contact your instructor.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part in adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources including confidential services can be found on the OIEC website.

Please know that faculty and graduate instructors must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don’t Ignore It page.

Religious Accommodations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, please contact me directly.

See the campus policy regarding religious observances for full details.

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.