UNIVERSITY OF CALIFORNIA, DAVIS
GRADUATE SCHOOL OF MANAGEMENT

MACHINE LEARNING (BAX-452, WINTER 2025)

Instructor: Dr. Rahul Makhijani
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Office Hours: Every Sunday 8 - 9 pm
Please feel free to reach out to me via staff email at any point. We can also schedule additional meetings if necessary.

Teaching Team

Ritesh Chauhan ritchauhan@ucdavis.edu, Tiruo Yan tyyan@ucdavis.edu
Office hours: TBD

Class Meetings

Dates: Jan 4, Jan 11, Jan 18, Jan 25, Feb 1, Feb 8, Feb 15, Feb 22, Mar 1, Mar 8.
Times: Section 1:- 9 am - 12:30 pm. Section 2:- 1:30 pm - 5 pm
There would be a Lab section over zoom for an hour every week. (time TBD)

Course Description

This course aims to help students understand the basic theory behind machine learning and formulate corresponding problems for various applications. Students will learn about diverse machine learning algorithms, their strengths, weaknesses, and how to apply them to moderately complex challenges. Emphasis is given on applying algorithms to real-world issues, optimizing the learned models, and assessing expected accuracy.

Course Outline

Although a single course does not do justice to this topic, the course will briefly cover the following topics: -

- Regression
- Classification
- Model Selection
- Model Evaluation
- Dimensionality Reduction

- Clustering
- Trees
- Neural Networks
- Natural Language Processing
- Large Language Models

Course Schedule (tentative)

Date	Topic	Deliverables
Jan 4	Introduction Linear Algebra Overview Linear Regression Recap Bias Variance Tradeoff Gradient Descent	
Jan 11	Logistic Regression MLE Evaluation Metrics	
Jan 18	Model Selection - feature selection Cross Validation Ridge Lasso Regression	HW 1
Jan 25	Decision Trees Random Forests Boosting Algorithms	HW 2
Feb 1	Unsupervised Learning Clustering k-means PCA	HW 3
Feb 8	Deep Learning Overview Introduction to Neural Networks	Project Proposal
Feb 15	NLP overview	HW 4
Feb 22	RNN, LSTM, Transformer	HW 5
March 1	Intro to LLM	HW 6
March 8	Class Presentations	
March 15	Final Exam	

Lab Schedule

Date	Lab Topic
Week 2	Linear Algebra + Python Overview
Week 3	Probability Overview + Numpy/ Pandas / Scikit Overview
Week 4	Project Overview from last year + ML advice
Week 5	Summary of topics covered so far
Week 6	Pytorch tutorial
Week 7	Hugging face tutorial
Week 8	LLM tuning tutorial

Course Project

In your course project, you'll examine a business problem of your choice to analyze data for business insights, acting as consultants to aid a company's decision-making. Course project can be done in groups of 3.

While any data sources can be utilized, ensure originality as it must differ from projects in other MSBA classes.

By the end of week 2, you need to submit the group information. By the end of week 6, you need to submit a one pager that will be a brief outline of the project you plan to work on, potential dataset you would use and evaluation metrics.

In the penultimate class, each group will present their findings via a 10 min class presentation.

The final project report should not exceed 6 pages, including sections like Executive Summary, Background, Analyses, Recommendations, and Conclusion, formatted with 11-point font, 1-inch margins, and double-spaced text. Submissions are due by 11:59 PM Pacific on the Thursday of finals week, with no exceptions.

Grading Breakdown

Evaluation	Percentage
Assignments	45
Course Project	30
Final Exam	20
Attendance*	5

*No attendance would be taken for the first class or for the labs.

Readings and Lecture Notes

Although there is no fixed textbook for this course, the following texts are useful references: -
1. An Introduction to Statistical Learning with Applications in Python.
2. Deep Learning by Ian Bengio and Yoshua Goodfellow.
3. CS 229 course notes

Prerequisites

1. Prior exposure to multivariable calculus and linear algebra.
2. Prior exposure to probability theory.
3. Prior coding experience is highly recommended but not essential.

Homework Assignments

Each homework comprises questions to be answered and/or hands-on tasks. Assignments need to be done in groups of 2. You are encouraged to work with your group members and other classmates to understand how to use Python to achieve what you need to do. Each group is however expected to complete the assignment on their own. You are free of course to discuss the concepts with your classmates, and to discuss similar problems to the ones in the homework.

The homework assignments will be posted on Canvas. They are listed, by due date, in the class schedule. Completed assignments must be typed and submitted on

Canvas by midnight of the submission date (that is, by 11:59 pm), unless otherwise indicated

Late Assignments

Late assignments will have their grades reduced. Assignments late by 24 hours will have the grade reduced by 25%. Assignments late by 48 hours will have grades reduced by 50% and later than 48 hours will not be accepted.

Generally, the Course Assistant should be the first point of contact for questions about any issue with the homework. The course assistant will have the responsibility to make sure that all questions are answered in a timely fashion. If the CA cannot help you to your satisfaction, please do not hesitate to come see me. The class will use Piazza for discussion.

The hands-on tasks in the homework will be based on data that we will provide, or you will have to find. In some cases, you will mine the data to get hands-on experience in formulating problems. For the hands-on assignments you are expected to use Python. You may use other third party software but that would not be supported by the teaching assistant or by myself.

Re-grading

If you feel that a calculation, factual, or judgment error has been made in the grading of an assignment or exam, please write a formal memo to the CA describing the error, within one week after the class date on which that assignment was returned. Include documentation (e.g., pages in the book, a copy of class notes, etc.). If the CA answer did not satisfy your claims, please send me an email with all the required material. I will make a decision and get back to you as soon as I can.

Academic Integrity

All students who take this course are governed by the Univ. of California's standards of ethical conduct for students. These sections set forth the responsibilities of students and faculty to maintain a spirit of academic honesty and integrity. It is essential that you are aware of this code of conduct and the disciplinary actions that may be taken in the event of a violation. A copy of the Code of Academic Conduct may be found in your student handbook or at this site. Further details may be obtained from the GSM Associate Dean or the Office of Judicial Affairs

Statement on Accommodation

To seek accommodation for learning disabilities, visit the Student Disability Center and contact them at sdc@ucdavis.edu or 530-752-3184. Once you receive the Letter of Accommodation, submit it to me as soon as possible within the first two weeks of a course.