

EDS 232: Machine Learning for Environmental Science

Quarter: Winter 2024

Units: 4

Grading: Letter

Welcome to Machine Learning



Machine learning (ML) is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks. In this course, we will focus on the core concepts of machine learning that beginning ML researchers must know. We will cover 'classical machine learning' primarily using R, and explore some applications to environmental science.

To understand broader concepts of artificial intelligence or deep learning, a strong fundamental knowledge of machine learning is indispensable.

Some concepts we will cover:

- the core concepts of machine learning
- regression ML techniques
- classification ML techniques
- clustering ML techniques
- real-world environmental applications for ML

Instructor information, meeting times, & materials

Instructor: Mateo Robbins

Email: mjrobbins@ucsb.edu

Student hours: Tuesday 10:45 -11:45pm, (Location: TBD)

The best ways to contact me: email

TA: Allie Coughman

Email: acaughman@bren.ucsb.edu

Student hours: TBD

Class meets:

Lecture: TTh 9:30am - 10:45am PST (Bren 1424)

Section: First 5 weeks: Th 2:00pm - 2:50pm, 3:00 - 3:50 pm

Rest of quarter: Th 12:30 - 1:20 pm, 1:30 - 2:20 pm

Course website:

<https://maro406.github.io/eds-232-machine-learning/>

Required textbook(s) / reader(s):

[Hands-on Machine Learning with R](#), by Bradley Boehmke

Additional course requirements: Here you can add any hardware / software / account / setup requirements that students will need for the course, and what students are required to bring to class.

Access, accommodations and conduct

Course conduct:

[UCSB Student Code of Conduct](#)

I view our course as a learning community, and I request your help in fostering a welcoming environment in the classroom where everyone feels supported, included, and comfortable participating.

Access and Accommodations: Please submit requests for accommodations often and early. It is never too late to apply for DSP accommodations. If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive you may be eligible to use formal accessibility services on campus. To arrange class-related accommodations, [please contact DSP](#). DSP will initiate communication about accommodations with faculty. By making a plan through DSP, appropriate accommodations can be implemented without disclosing your specific condition or diagnosis to course instructors.

Basic course information

Learning objectives: The goal of EDS 232 is to equip students with a strong foundation in the core concepts of machine learning. By the end of the course, students should be able to:

- Build machine learning models in R using popular machine learning packages
- Build and train supervised machine learning models for prediction and binary classification tasks, including linear and logistic regression.
- Apply best practices for machine learning development so that your models generalize to data and tasks in the real world.
- Build and use decision trees and tree ensemble methods, including random forests and boosted trees.
- Use unsupervised learning techniques for unsupervised learning including clustering.

Course details

Course components:

- Lectures: Tuesdays will usually involve a lecture with slides and coding. Thursday will generally be devoted to in-class time for working on assigned labs
- Assignments:
 - **Labs** will be assigned most weeks and will give students a chance to dig into machine learning coding. I will provide you with the beginning/outline of the lab in RMarkdown format for you to complete and submit. You are welcome to collaborate with other students in the class on labs, but if you do I ask that you list the names of your collaborators at the top of your homework submission.
 - **Quizzes** will happen weekly and are designed to help orient you to key course concepts, generally tied to the assigned reading.

Tentative topics:

Week #	Dates	Lecture
1	1/9, 1/11	Introduction, Linear Regression and ML Modeling Fundamentals I
2	1/16, 1/18	Linear Regression and ML Modeling Fundamentals II
3	1/23, 1/25	Regularized Regression
4	1/30, 2/1	Logistic Regression, Classification
5	2/6, 2/8	K-nearest neighbors, Decision Trees

6	2/13, 2/15	Bagging, Random Forest
7	2/20, 2/22	Gradient Boosting
8	2/27, 3/1	Clustering
9	3/6, 3/8	Deep Learning
10	3/13, 3/15	Kaggle

How to be successful in this class

My expectations:

I expect you to take advantage of the opportunities that this course offers you by being an active and thoughtful participant and by trying your best on the various elements of the course. I expect you to take ownership of your learning and to reach out to me or your teaching assistant if you are struggling or have concerns. I expect you to take the opportunity to learn from your peers through activities in lecture and section, and I expect you to be respectful and courteous to one another.

Grades:

Grading is important as it gives feedback to both you and I about how the learning process is going. That said, I think it's useful to keep in mind that at this point in your career what you learn and know is far more important than letter grades on a report card.

Grading breakdown

- Labs : 70%
- Quizzes: 20%
- Participation: 10%

Grading scale

Score	Grade	Score	Grade
92-100	A	80-81	B-
90-91	A-	78-79	C+

88-89	B+	72-77	C
82-87	B	70-71	C-

Additional student resources

Bren Support, Safety, and Resources:

<https://bren.ucsb.edu/diversity/support-safety-and-resources>

The text below is provided by the UCSB Disabled Students Program.

Counseling and Psychological Services (CAPS): As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. CAPS is available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus. They can be reached by phone at 805.893.4411, or online at <http://caps.sa.ucsb.edu>. The CAPS building is the pink building next to the Humanities and Social Science building (HSSB)

Food insecurity: <http://food.ucsb.edu/> includes the Cal Fresh Program <http://food.ucsb.edu/calfresh> and the Associated Students food bank <https://foodbank.as.ucsb.edu>

Resource Center for Sexual and Gender Diversity (RCSGD) in the SRB, offers a host of services for LGBTQI+ students including a library and many events throughout the year. <http://rcsgd.sa.ucsb.edu/>

Dream Scholars/Undocumented Student Services Program offers workshops, helps students find scholarships and financial support as well as providing community for our undocumented students. <http://www.sa.ucsb.edu/dreamscholars/home>

Campus Learning Assistance Services (CLAS) helps students grow academically by offering workshops, walk-in and pre-scheduled tutoring, and writing help both for native and non-native (ESL) English as a second language speakers. Over 50% of students will stop by CLAS at one time or another. <http://clas.sa.ucsb.edu>

Student Resource Building (SRB) houses many campus resources offices, including the African Diasporic Cultural resource Center, the American Indian Resource Center, the Asian Resource Center, the Middle Eastern Resource Center, the Non-Traditional and Re-Entry Student Resource Center.

<http://www.sa.ucsb.edu/student-resource-building/home>

Multicultural Center (MCC), located in UCEN, hosts a wide variety of cultural events and educational programming throughout the year, including film showings, lectures, musical performances, and more: <http://mcc.sa.ucsb.edu/>

Financial Crisis Response Team: If you are experiencing issues of housing insecurity contact the Financial Crisis Response Team at financialcrisis@sa.ucsb.edu to begin application for assistance.

Health and Wellness: Student well-being is integral to academic success, student development, and life satisfaction. On this website, students will find links to a range of services related to well-being such as: assistance with basic needs (food, housing, finances); counseling and physical health resources, daily wellness centers and programs; social connection, and personal safety. <https://wellbeing.ucsb.edu/>