UC SANTA BARBARA
Bren School of Environmental Science & Management

EDS 222: Statistics for Environmental Data Science

Quarter: Fall 2024
Units: 4
Grading: Letter
Prerequisites: MEDS summer courses or equivalent

Instructor information, meeting times, & materials

Instructor: Max Czapanskiy
Email: maxczap@ucsb.edu
Office hours: Thursdays 2:00pm - 3:00pm (4412 Bren Hall)
        Office hours begin October 10
The best way to contact me is by email (I will do my best to respond within 24 hours)

Class meets:
        Lecture: Tuesdays 9:30am - 10:45am (Bren Hall 1424)
        Lab: Thursdays 9:30am - 10:45am (Bren Hall 1424)
        Discussion Section: Tuesdays 1:00 - 1:50pm (Bren Hall 1510)

Course website: https://eds-222-statistics.github.io/

Teaching Assistant: Leonardo Feitosa (lmfeitosa@ucsb.edu)
Office hours: Mondays 3:30-4:30pm (Location Pine Room 3526)

Required textbook(s) / reader(s):
- *Introduction to Modern Statistics*, by Mine Çetinkaya-Rundel and Johanna Hardin [link]

Computing requirements:

- **[MEDS Computing Requirements & Software Installation Guide](#)**
- R version 4.4.0 (or higher)
- RStudio version 2024.04.2+764 (or higher)

Basic course information

Statistics is the science of collecting, manipulating, and analyzing empirical data. In this class, we will learn the statistical fundamentals that will enable us to draw conclusions about the environment and its interaction with social and economic systems. We will cover fundamental statistical concepts and tools, and then apply and expand upon those tools to learn some temporal and spatial statistical methods that are particularly helpful in environmental data science. Welcome!

Learning objectives: The goal of this course is to enable MEDS students to confidently and competently apply statistical tools to environmental and socio-environmental datasets.

- Master fundamental statistical concepts and learn to apply them in R
- Design, conduct, and interpret linear and nonlinear regression models
- Apply statistical methods to environmental data
- Learn about and address common spatial and temporal dependency issues that arise in environmental datasets

Course details

Course components: All lecture slides and lab materials will be posted to the [course website](#). Homework assignments will be posted, submitted, and graded via Github Classrooms. Reading quizzes will be available on Canvas.

Weekly learning schedule:
- Tuesday lecture: 75 minutes (slides & whiteboard, reading quizzes in advance)
- Thursday labs: 75 minutes (code-along lessons & group problem-solving). **Please bring a laptop.**

- Homework: 4 assignments, usually due Fridays at 5pm.

Important dates:
- Midterm exam: October 31st (in-class)
- Final project proposal due: November 8th @ 5pm
- No class (holiday): November 28th
- Final project presentations: December 12th 4-7pm
- Final project write-up due: December 15th

Reading: In order to make time for hands-on learning during Thursday labs, we will move quickly to cover content in Tuesday lectures. Completing the reading from the textbook and the associated quiz (on Canvas) **before** Tuesday lectures is essential so that content is familiar.

Assignments: Homework assignments will be critical to meeting learning objectives in this course. Assignments will ask you to take the content from lectures and apply it to new datasets and contexts, building on applications completed in Thursday Lab sessions. In some cases, assignments will directly expand on problems completed in Labs, but in other cases will entail new data and new types of problems. There will be four assignments over the course, but they will be weighted towards the beginning of the quarter to allow students to spend more time working on final projects. You are permitted to work with at most two other people on each assignment but must list your collaborators' names at the top of your write-up. **No late assignments are accepted.** However, if extenuating circumstances arise and are communicated *before* the assignment is due, late assignments will be accepted with a 10 percentage point penalty per day, up to 3 days maximum.

Homework	Date Posted	Date Due
1	Thursday 9/26	Monday 10/7 5pm
2	Tuesday 10/8	Friday 10/18 5pm
3	Tuesday 10/22	Friday 11/8 5pm
4	Tuesday 11/12	Friday 11/22 5pm

Regrades: After you get feedback on your homework assignments, you may make corrections and resubmit to earn up to 50% of the lost points. For example, if you receive 70% on a homework assignment, your resubmission can improve your grade up to 85%. Only assignments submitted on time are eligible for regrades. You will receive your initial grade one week after the due date, then you'll have one week after that to submit your corrections.

Final project: During the second half of the course, students will develop a final project that applies the tools learned in this course to a new question, dataset, and context of their choosing. A proposal in the form of one short paragraph describing your project is due November 12th. You will present on your project during the final exam period and submit a write-up in the form of a blog post. More details will be posted on the course website. The final project will be conducted individually.

Grades: The course requirements include homework assignments (4 assignments, 40%), a midterm exam (25%), a final project (25%), class participation (5%), and reading quizzes (5%). The midterm will be in-class and closed book.

Getting extra help: Come to discussion sections and office hours! This is a challenging course. Please communicate with me, the TA (Leonardo), and/or MEDS Staff if you're having a hard time keeping up and we will do what we can to get you the support you need.

Slack: We will have an #eds-222-stats channel in the MEDS workspace. Please feel free to use this as a space to communicate with each other about the content of the course. I will monitor the Slack channel regularly and send relevant links and other information, but do not expect me to respond rapidly to Slack messages regarding questions on course content. Please use office hours or email for direct communication about course content.

Tentative course schedule and topics: This schedule is subject to change; please check the course website for updates.

Week	Tuesday Lecture	Thursday Lab	Reading
0 [9/23 - 9/27]	No class	[Recorded lecture] Course introduction and motivation; Sampling from a population;	• Preface, Chapters 1-2 in *IMS* • [optional] Gender

		study design	Shades and video on RCTs
1 [9/30 - 10/4]	Categorical vs numerical data; summary statistics; law of large numbers; probability density functions; skewness; outliers	Data visualization and computing summary statistics for categorical and numerical data in R	● Chapters 4-6 in *IMS*
2 [10/7 - 10/11]	Relationships between variables; correlation; introduction to ordinary least squares	Correlations; visualizations of relationships between variables in R; OLS in R	● Chapter 7 in *IMS*
3 [10/14 - 10/18]	Measures of model fit; multiple linear regression	Multiple linear regression in R	● Chapter 8, 10 in *IMS*
4 [10/21 - 10/25]	Interactions and categorical variables in linear regression	Interaction models in R	● Chapters 8, 10 in *IMS*
5 [10/28 - 11/1]	Midterm review	Midterm exam	
6 [11/4 - 11/8]	Nonlinear models; Logistic regression ,	Estimating and interpreting logistic regressions	● Chapter 9 in *IMS*
7 [11/11 - 11/15]	The basics of inference; the Central Limit Theorem; hypothesis testing; confidence intervals; ANOVA	Inference and hypothesis testing in R	● Chapters 13, 19.2 in *IMS*
8 [11/18 - 11/22]	Spatial interpolation; kriging	Kriging in R	
9 [11/25 - 11/29]	Course review	No class (Thanksgiving)	
10 [12/2 - 12/6]	Time series analysis; serial correlation; panel data basics	TBD/Slack time	● Chapters 2 and 3 in Hyndman & Athanasopoulos
11	Final project presentations [Tuesday, December 10, 8-11am]		

Access, accommodations and conduct

Course conduct: All students are expected to read and comply with the [UCSB Code of Conduct](#). We are committed to making this course a welcoming and inclusive environment for everyone, regardless of gender, gender identity and expression, race, age, sexual orientation, disability, physical appearance, or religion (or lack thereof). We expect all students to help ensure this environment of inclusivity and will not tolerate harassment of any form.

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.

Additional student 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/

Campus Advocacy, Resources, & Education (CARE) offers 24/7 confidential support and advocacy in situations of sexual assault, dating and domestic violence, and stalking. Located in the SRB, they can be reached at 805.893.4613 or http://wgse.sa.ucsb.edu/care/home

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/