

MarineCS 100B: Intro to Marine Data Science

Quarter: Winter 2025

Units: 4

Grading: P/NP

Instructor information, meeting times, & materials

Instructor: Max Czapanskiy

Email: maxczap@ucsb.edu

Office hours:

Mondays 4:00-5:00 in CCS 136

Thursdays 9:30-10:30 in CCS 143

The best way to contact me is by email (I will do my best to respond within 24 hours)

Class meets: Tuesday/Thursday 8:00am - 9:15am (South Hall 1431)

Course website: <https://marinecs-100b.github.io/>

Teaching Assistant: Hayden Vega (haydenvega@umail.ucsb.edu)

Basic course information

Welcome! I'm excited to have you in my class this quarter.

Marine scientists have access to more data than ever before. Terabytes of satellite remote sensing imagery, massive climate models, genomes with billions of base pairs - how do marine scientists process, visualize, and analyze data with this size

and complexity? Data science, which combines computer science and statistics with a focal domain, is an important component of the modern marine scientist's toolbox.

Learning objectives: The goal of this course is to introduce you to fundamental concepts and tools for data science as they apply to marine science, giving you a framework for further independent development as a marine data scientist.

- Master fundamental concepts in programming, probability and statistics, informatics, and communication
- Combine skills across fields to answer questions with marine data
- Embrace data science as a creative endeavor and empower yourself to find, learn, and create novel techniques

Course details

Course components: Intro to Marine Data Science has two main components.

The first component is made up of self-directed **Tracks**. Each Track covers a distinct skill set and is divided into six **Modules**. Think of this component of the class as a choose-your-own adventure. Based on your prior experiences and future goals, you will choose the modules that most interest you and complete them at the pace that works best for your learning.

The second component is the **Decoding Project**. This is a project of your own design combining skills from across the Tracks to develop a novel work. I want you to use this opportunity to treat data science as a creative process, rather than a set of pre-developed blueprints for you to memorize.

Weekly schedule: For the first eight weeks of the quarter we will primarily focus on the Tracks. In the last two weeks we will shift our attention to the Decoding Project.
Weeks 1-8:

- Beginning of the week: choose which module(s) you will tackle this week.
- Before class: complete the pre-class preparation for your module. This will include recorded lectures, guided notes, and exercises.

- During class: with a partner, work through the in-class activity of the module(s). These activities challenge you to apply the module's skills to real-world data and questions.
- End of week: complete the weekly reflection to monitor your progress and update your goals.

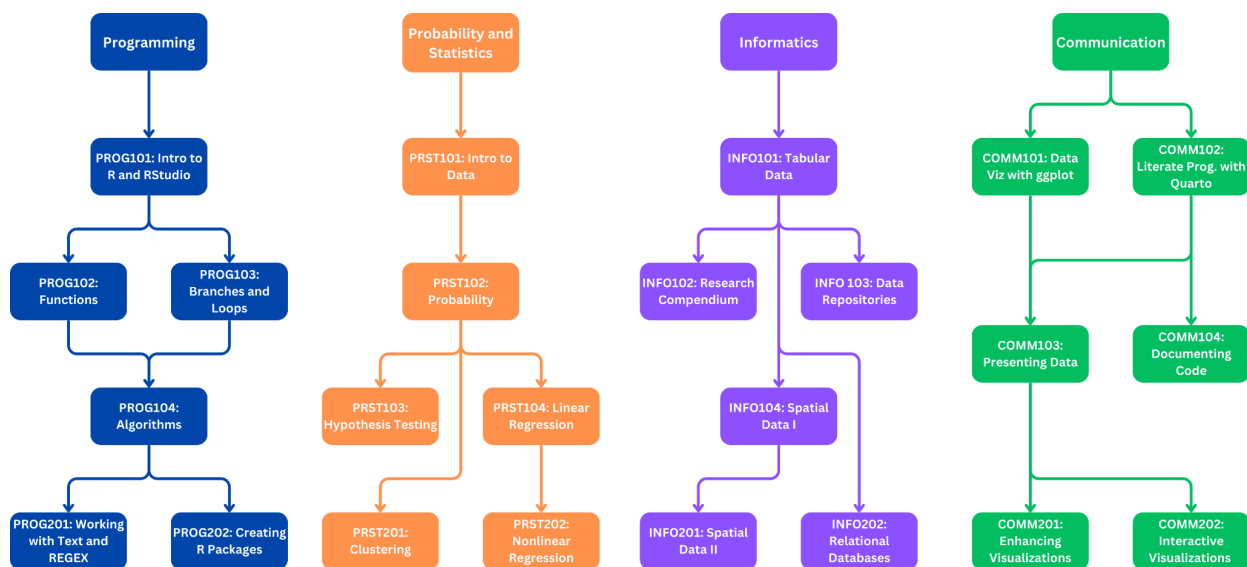
Weeks 9-10:

- This time is set aside for you to work on your Decoding Projects.
- In class you will have access to the expertise of your peers, your learning assistant, and your instructor.

Grading: Intro to Marine Data Science is a pass/no pass course. In order to pass, you must achieve the following:

- Complete PROG101, PROG102
- Complete two of PROG103, INFO101, COMM101, PRST101
- Complete the *Decoding Project*
- ~~Complete one Module from all four Tracks (breadth requirement)~~
- ~~Complete two additional Modules in two Tracks (depth requirement)~~
- ~~Submit five of the seven weekly reflections~~
- ~~Complete the requirements of the Decoding Project rubric~~

Tracks Details



The four Tracks cover distinct skills necessary for doing data science.

- **Programming** is about how to write and run code - the workhorse tool of data science.
- **Probability and Statistics** is about describing data, assessing evidence, and making predictions.
- **Informatics** is about the representation and organization of data.
- **Communication** is about how to explore and explain your data.

The lines indicate prerequisites, which vary between Tracks. This allows you as students to exercise your judgement in choosing modules. As the quarter progresses you'll learn more about the Tracks and Modules from your peers. If you're feeling a little lost or overwhelmed at the start, I recommend beginning with PROG101-103 then taking on the other 101 modules.

Decoding Project Details

It is very easy for students to accidentally fall into the “flowchart trap” of data science. Skills like programming and statistics are often taught and learned formulaically. “If your data look like *this* then use *this* statistical test, which you can write in R like *this*”. In the real world, coding, stats, and related skills don't work that way. You have to be creative! Real data and questions are far too complex for any universal formulae. You have to figure out how to recombine and reconfigure tools and concepts to address the unique challenges facing you.

Enter the Decoding Project. Inspired by the [Unessay assignment](#), the Decoding Project challenges you to produce anything except a traditional data analysis. As your instructor, my only requirement is that you incorporate skills from all four Tracks. I want you to get weird with it. I want you to challenge yourself to take three steps back and get some perspective. What are you learning this quarter and (more importantly) *why are you learning it?* What is an entirely novel way to take those parts, see new connections between them, and create something brand new?

Decoding Project Schedule

- Week 4: The class collaboratively writes the rubric. This is your chance to have input on how you're graded. What expectations do you have for

yourself? What kind of feedback do you want to receive? What output would you like to have in your portfolio?

- Week 6: Students submit their Decoding Project proposals. Adapt the class-wide rubric to your specific project.
- Week 7: Peer review of proposals. See what your peers are passionate about and provide constructive feedback on things they could incorporate (maybe you've completed a module that could be relevant that they haven't seen yet?).
- Week 9: Dedicated in-class time for projects. At the end of the week, another round of peer review.
- Week 10: Dedicated in-class time for projects. At the end of the week, submit a draft of your project to your instructor for feedback.
- Exam week: Incorporate peer and instructor feedback.

This seems weird, why don't we just have a lecture?

Tracks, Modules, and Decoding Projects? Why aren't we just learning coding, stats, etc the regular way? **That's a fair question!** This course format is experimental. Since you're the guinea pigs, it's only fair you understand the motivations behind it. I can cite peer-reviewed research for some of these problems and solutions, but I've also designed this course based on my own experiences of teaching data science over the last ten years.

Problems

Students come to data science with diverse experiences, identities, and goals.

You're a diverse group of students. You've learned different things in different ways in the past, and your motivations for what you're learning now and where you'd like to go are all different. A traditional lecture format assumes a one-size-fits-all approach will resonate with all of you and you achieve your academic goals. Those two things (diverse students, lock-step classroom) are fundamentally at odds with each other.

Learning programming and statistics is anxiety-provoking and often discourages students from research. These subjects have steep learning curves, especially at the

start. That can lead to frustration and, ultimately, anxiety ([Forrester et al. 2022](#)), which inhibits students' growing identities as scientists ([Cooper et al. 2023](#)). We don't want this to be a "weeder" course!

Real-world data science doesn't look the way it does in textbooks and tutorials.

When you start doing marine research and you encounter a data science problem, it's very likely you'll know about 60%-80% of what you need to solve it. More than half, but less than everything. In graduate school and beyond, you're going to have to diagnose problems, figure out what's missing from your skillset, and teach yourself how to do it. Traditional courses are often good at teaching specific skills (e.g., how to fit a linear regression model), but many students don't learn how to teach themselves.

Solutions

Give students agency over their learning. By putting students in charge of their own learning, the self-directed course design can dramatically increase students' engagement and how they perceive the relevance of the course content to their experiences and goals ([Cohen et al. 2024](#)). If you need more time to complete a module, how does it help you to rush you along to the next task? Conversely, if you want to race forward to a module that really excites you, I want you to have the opportunity to do that.

Provide structure to overcome the early learning curves. The self-directed course design asks more of students, in terms of organization and self-regulation, than traditional courses. To offset the cognitive load that places on you, I have attempted to provide as much infrastructure as possible to support your learning. This includes recorded lectures, guided notes, and pair programming. Classroom structure promotes student engagement and equitable learning outcomes ([Eddy and Hogan. 2017](#)).

Encourage open-ended inquiry and problem solving. Data science isn't a series of formulas. It isn't a flowchart you can follow to the right solution. It requires creativity and critical thinking. That's why there's no fixed final exam or project. I don't want you to succeed in the classroom, then run into new problems in your research that you're totally unequipped for. I can't teach you every technique and solution out

there, but I hope to teach you how to diagnose problems and come up with solutions yourself.

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/>