Special Topics in AI I

MSDS 603 (2 units)
Spring 2025
TR 10:00am - 11:50am 03/17/25 - 05/08/25 SFH 529
Lecture

Instructor Information

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Office Hours
Tuesdays and Thursdays 9:00-10:00
Office Location: Room 605

Course Description

This course introduces students to the foundational concepts and methodologies underpinning the field of artificial intelligence (AI). It serves as the first part of a two-course sequence designed to explore cutting-edge topics and emerging trends within AI. The course is structured around selected topics from a core set of subjects, including AI Entrepreneurship, Natural Language Processing (NLP), Reinforcement Learning, Computer Vision, and foundational aspects of Machine Learning Operations (MLOps) and Advanced Data Engineering. Through a combination of theoretical instruction and practical exercises, students will gain a solid understanding of the basics of AI-driven innovation. By the end of this course, students will be well-prepared to engage with more specialized topics and advanced applications in the subsequent course.

Course Learning Outcomes

1. You will learn the different steps of the end-to-end Machine Learning (ML) pipeline.

2. Using open source tools you will get practical hands-on experience in each step of the ML pipeline.

3. Learn the concept of ML system design and apply what you learn to an end-to-end ML/AI application.

Assignments

Labs

There are 1-2 labs to complete each week, usually due by early next week (check Canvas for due dates). Each lab will consist of practicing with the tools we are using and answering questions. Much of these labs can be completed during class time after lecture and demo. Feel free to ask your classmates and me for help in completing the labs. Labs are graded based on correctness and completeness.

Some labs require more time than others. Particularly when we switch to doing everything in the cloud. Be ready for some very frustrating errors to debug.

Individual Assignments

There will be 2 individual assignments. One will focus on systems design and the other will focus on the MLOps toolkit. These must be completed individually. Each assignment will consist of writing up a brief report of some kind which may include creating visualizations, and will be graded based on correctness and completeness.

Mini Quizzes

There will be weekly mini-quizzes (~15 minutes long) based off of lecture and lab material. These are open note/book/internet, held during class, and can be retaken once, and graded based on completeness. These are not meant to be stressful at all, and must be completed individually.

Discussions

Some days we will break up into small groups to discuss a problem, and post your answers in the Slack channel. This goes towards your participation grade.

Project and Project Milestones

The final project will consist of developing a functional ML/AI-powered application, working in groups of 4-5. Throughout the module there will be milestones to meet to ensure every team is progressing through the project. For the milestones, your team will simply need to submit a very brief report in the form of a slide or two. The goal is that by the end of the module you will already have completed much of what you would need for your final presentation simply by completing these milestones.

Milestone 1: the product idea

Milestone 2: requirements gathering

Milestone 3: the system design

Milestone 4: the prototype

Final presentation: each team will present their project during a 5-minute presentation on the last day of class. For the presentation, focus on doing a demo of the product rather than the details of the system design. The goal is really to wow everybody with your awesome product. But, each group will also submit a slide deck which will be graded along with the milestones and presentation.

Late Assignments and Absences

Labs that are 1 minute to 23 hours and 59 minutes late will have 20% deducted from the grade; 24 hours - 48 hours late will have 40% deducted; more than 48 hours late will get a zero.

Homework assignments that are 1 minute to 23 hours and 59 minutes late will have 25% deducted from the grade; 24 hours - 48 hours late will have 50% deducted; more than 48 hours late will get a zero.

Project milestones cannot be turned in late, they will get a zero for the whole group.

Each student is allowed one excused absence to avoid any penalty to their mini-quiz or participation grade for the day that they missed. Excused absences are defined in the attendance section.

Grading Breakdown and Grading Policies

The grade is broken down as follows:

Participation: 5%

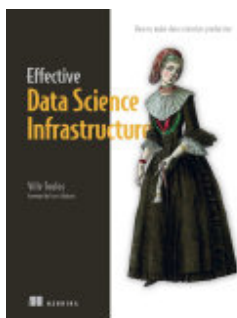Individual Assignments: 10%

Mini-quizzes: 5%

10 Labs: 40%

Final Project and Milestones: 40%

Grading scale is below. I will take the ceiling of the percentage as your final grade.

[0%, 70%): F

[70%, 73%): C-

[73%, 77%): C

[77%, 80%): C+

[80%, 83%): B-

[83%, 87%): B

[87%, 90%): B+

[90%, 93%): A-

[93%, 97%): A

[97%, 100+%]: A+

Texts and Supplies
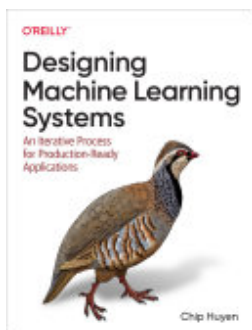
Effective Data Science Infrastructure
ISBN: 9781617299193
Authors: Ville Tuulos
Publisher: Simon and Schuster
Publication Date: 2022-08-16
Required or recommended?: Recommended

Designing Machine Learning Systems
ISBN: 9781098107932
Authors: Chip Huyen
Publisher: "O'Reilly Media, Inc."
Publication Date: 2022-05-17
Required or recommended?: Recommended

Course Schedule

This is a proposed schedule. We will modify the details if we need to, but the general flow of topics will go in this order.

Date	Topics	Labs	Milestones due	Assignments due
3/18/2025	Introduction; Dev Environment and tools;	Lab 1 - Development Environment		
3/20/2025	Experiment tracking	Lab 2 - Experiment Tracking		
3/25/2025	No class			
3/27/2025	No class		Milestone 1	
4/1/2025	System Design; harms; considerations	No lab		
4/3/2025	Data versioning & Quality	Lab 3 - Data Versioning & Quality		
4/8/2025	Container orchestration	Lab 4 - Container Orchestration	Milestone 2	
4/10/2025	Exp tracking in GCP	Lab 5 -MLFlow in GCP		Assignment 1 Due
4/15/2025	ML pipeline orchestration	Lab 6 - ML orchestration		
4/17/2025	ML pipeline orchestration in GCP; IAS	Lab 7 - ML Orchestration in GCP	Milestone 3	
4/22/2025	Model deployment patterns & serving	Lab 8 - Deployment		
4/24/2025	Model deployment patterns & serving	Lab 9 - Deployment GCP		
4/29/2025	CI/CD/CT; Code quality and versioning	No lab		
5/1/2025	Model monitoring	Lab 10 - Model Monitoring	Milestone 4	
5/6/2025	Operational monitoring; Explainability, privacy and fairness	No lab		Assignment 2 Due

5/8/2025	Final Presentations			
Finals week	No final exam!!!			

Program Learning Outcomes

Effectively use modern programming languages (e.g., R, Python, SQL, etc.) and technologies (AWS, Hive, Spark, Hadoop, etc.) to scrape, clean, organize, query, summarize, visualize, and model large volumes and varieties of data.

Prepare for careers as data scientists by solving real-world, data-driven, business problems with other data scientists, and understand the social, ethical, legal, and policy issues that increasingly challenge and confront data scientists.

Develop professional communication skills (e.g., presentations, interviews, email etiquette, etc.), and begin integrating with the Bay Area data science community.

Attendance Policy

While I will not be taking attendance, attendance is expected. If you are sick and contagious, please let me know ASAP before class so that I can excuse you. Missing class for a job interview is not excusable. For other family emergencies, let me know and I will excuse them on a case-by-case basis.

University Policies

Credit-hour Policy

One unit of credit in lecture, seminar, and discussion work approximates one hour of direct faculty instruction (or 50 minutes plus a break) and a minimum of two hours of out-of-class student work per week through one 15-week semester. For further details, see USF's Credit Hour Policy.

The below resources and additional information can be found in the Student Life Resource Toolkit.

Students with Disabilities

If you are a student with a disability or disabling condition, or if you think you may have a disability, contact USF Student Disability Services (SDS) within the first week of class, or immediately upon onset of disability, to speak with a disability specialist.

If you are determined eligible for reasonable accommodations, please meet with your disability specialist so they can arrange to have your accommodation letter sent to me, and we will discuss your needs for this course. For more information, please visit Student Disability Services, email: sds@usfca.edu, or call (415) 422-2613.

Behavioral Expectations

The University of San Francisco is committed to providing an environment consistent with the academic nature and core values of the institution in which students can participate in learning as a humanizing, social activity rather than a competitive exercise to support the full, integral development of each person and all persons, with the belief that no individual or group may rightfully prosper at the expense of others.

It is important you know what is expected of you academically and behaviorally through the published course syllabus, the Student Conduct Code, and other instructions provided by the instructor. Therefore, you are expected to uphold the following:

- Behave in accordance with the Student Conduct Code and other USF policies
- Refrain from disrupting the ability of fellow students to learn or the instructor's ability to teach. Examples of disruption include:
    - Cell phone or computer use that significantly or repeatedly distracts others
    - Coming to class late, leaving early, or excessively physically relocating oneself in the classroom
    - Speaking frequently without being called on
    - Yelling, cursing, or engaging in aggressive behavior
- When interacting online, communicate in a respectful fashion. This includes, but is not limited to:
    - Refraining from name calling, profanity, or typing in all capital letters
    - Sending multiple emails with one sentence
    - Avoiding rants or discussing non-relevant topics

Open discussion and disagreement are encouraged when done respectfully and in the spirit of academic discourse. There are also a variety of behaviors that, while not against a specific University policy, may create disruption in this course. Students whose behavior is disruptive or

who fail to comply with the instructor may be dismissed from the class for the remainder of the class period and may need to meet with the instructor or Dean prior to returning to the next class period. If necessary, referrals may also be made to the Student Conduct process for violations of the Student Conduct Code.

Academic Integrity

As a Jesuit institution committed to Cura Personalis—the care and education of the whole person— USF has an obligation to embody and foster the values of honesty and integrity. All members of the USF academic community are responsible for maintaining the standards of honesty and integrity. The honor code applies to all students (undergraduate and graduate) in the College of Arts and Sciences, the School of Education, the School of Management, and the School of Nursing and Health Professions. Faculty and students in the School of Law should review their own honor code for policies and procedures. Students enrolled in distance learning (online courses) are subject to these policies as well as supplemental policies set forth by their program. All students should review and familiarize themselves with the honor code, prohibited conduct, and procedures.

Counseling and Psychological Services

Many college students experience mental health struggles. Counseling and Psychological Services (CAPS) is a great source of support for issues such as anxiety, loneliness, struggles with relationships, stress, identity development, racial/cultural concerns, and mild depression. However, CAPS does not prescribe medication and does not have a psychiatrist on staff, so students with more severe mental health concerns will be referred off-campus for treatment.

Counseling and Psychological Services (CAPS) offers remote individual and group teletherapy to students residing within California. Students seeking services are scheduled for a 15-20-minute phone triage to assess immediate risk, identify treatment needs, and provide initial recommendations. These may include a crisis intake session, brief, intermittent individual teletherapy (every 2-3 weeks), single session teletherapy, weekly individual teletherapy via UWill, weekly group therapy, or referrals to off-campus providers. There are no fees for services. To make an appointment, students must call 415.422.6352 or request an appointment via the CAPS. CAPS does not accept walk-in appointments.

If you are concerned about a student and would like someone to follow up, please contact the Dean of Students Office at 415.422.5330. If you know someone who is an immediate risk of harming themselves or others please contact Public Safety at 415.422.2911 in San Francisco, or out of state dial 911, or call the National Suicide & Crisis Lifeline by dialing 988. In addition, CAPS All Hours line can be reached 24/7 by calling 855.531.076. All students are encouraged to check out CAPS and access our extensive online resources, podcasts, mental health apps, videos, self-care strategies, and more.

Title IX

The Title IX Office seeks to stop, remedy, and prevent occurrences of sex and gender-based discrimination, sexual harassment, and sexual violence. The University has a Policy on Nondiscrimination based on Sex and Gender, Sexual Harassment and Sexual Misconduct. If you have experienced any of these behaviors, we encourage you to report the incident. If you report these behaviors to any staff or faculty member, they must notify the USF Title IX Coordinator.

Students who wish to report any sexual misconduct should use the online mandatory reporting form, or contact the Title IX Office directly. Other reporting options are available by visiting the Title IX website. The Title IX Office is located in Lone Mountain Room 145.

As an employee at USF, and your Professor, I am a mandatory reporter, meaning I have to share any instances of sexual harassment or sexual violence shared with me or that become known to me. I will have to share this information, including names and any details known, to the Title IX Office to connect you with resources. If you would like more information about the resources available, you can ask me at any time this semester. You do not need to tell me why you are asking to get help for a friend, another student, or yourself.

Confidential Resources for Reporting Sexual Misconduct

- Students may speak to someone confidentially which will not generate a report to the Title IX Office by contacting Counseling and Psychological Services at (415) 422-6352 during M-F 9-4pm, or speaking to a clergy member in University Ministry at (415) 422-4463.
- If you need to speak to a mental health clinician immediately, please call the CAPS 24/7 All Hours Line at 855-531-0761 (available daily, including weekends and holidays, and accepts international calls), Public Safety (415-422-2911), 911, the Suicide Hotline (dial 988), or go to your nearest emergency room
- For off-campus resources, and local Bay Area organizations, view this webpage.

Learning, Writing, and Speaking Centers

The Learning, Writing, and Speaking Centers (LWSC) at USF provide individualized support to assist students in better understanding course material and to aid them on their path to success. Services are free and include tutoring, collaborative peer support services, academic skills coaching, writing, and speaking support. Services are available in-person and on Zoom.

LWSC staff can be reached Monday through Thursday between 8:00am-8:00pm and Friday between 8:00am-5:00pm at LWSC@usfca.edu or through the chat box on our myUSF webpage or

by phone at (415) 422-6713. To make an appointment for subject tutoring, academic skills coaching, the writing center, or the speaking center, students should visit the Student Appointment Dashboard.

Communication

All course communications, like all other USF communications, will be sent to your USF official email address. You are therefore strongly encouraged to monitor that email account.

Gleeson Library

Looking for help with a research paper or project? Set up a consultation with a Librarian or get 24/7 research help online.

Additional USF Resources

USF Food Pantry

The USF Food Pantry is an intermediate, short-term solution for any registered USF student to receive food and toiletry resources. Students are invited to stop by the pantry located on the first floor of Gleeson Library in the Atrium, and take the items that they need. Items are available on a first-come, first-serve basis until our supply is depleted. You will be asked to check-in via QR code before entering the pantry. For more information and the current schedule, visit the USF food pantry website. If you have further questions, please contact the Pantry Coordinator at usfpantry@usfca.edu or 415-422-4099 (during business hours Monday thru Friday from 9:00am - 5:00pm). You can find out about additional food security resources through the USF food insecurity resource page and the CalFresh resources site.