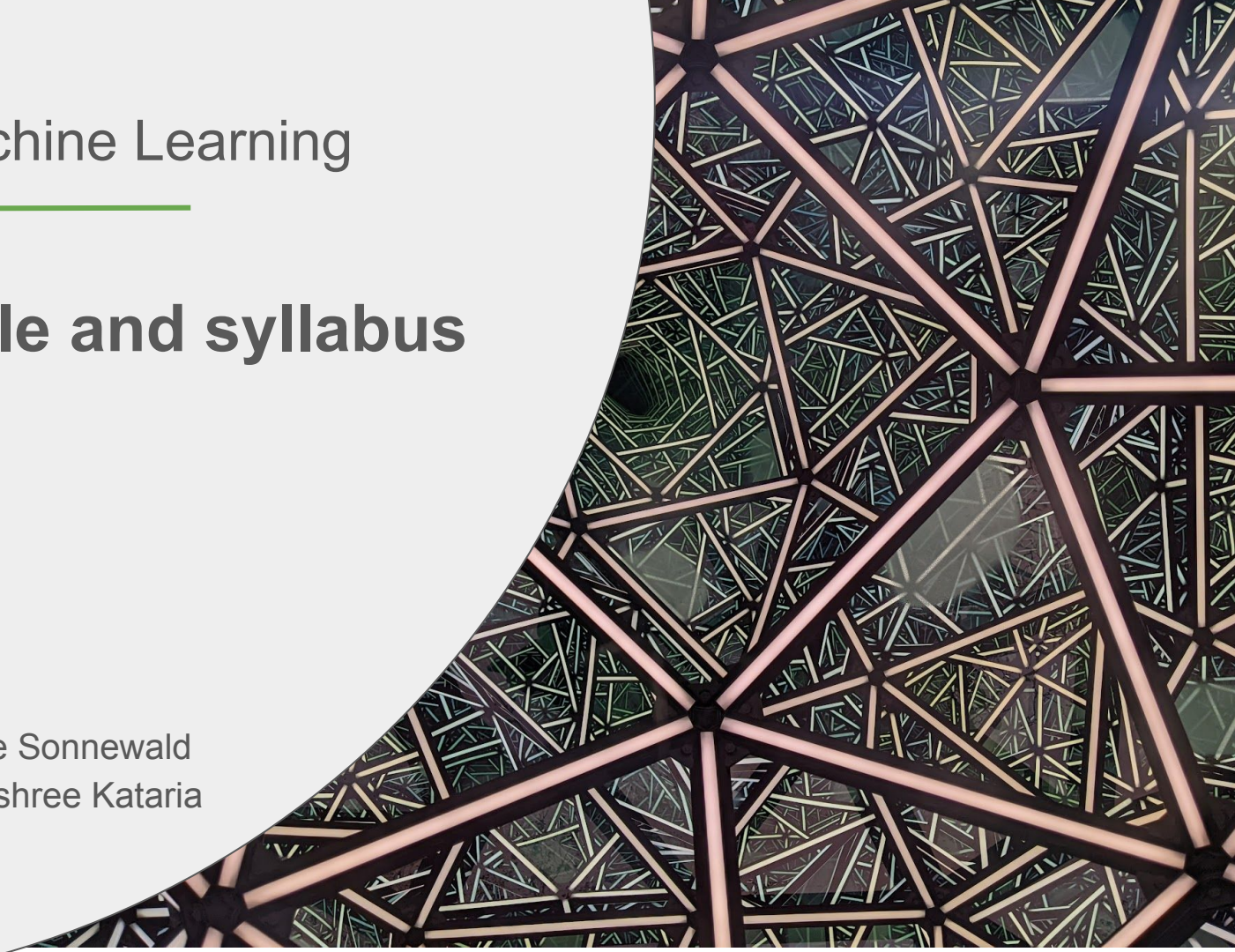# ECS171: Machine Learning

L1 Schedule and syllabus

Instructor: Prof. Maike Sonnewald
TAs: Pu Sun & Devashree Kataria

Welcome to ECS171 Introduction to Machine Learning!

If you have flu or cold like symptoms be responsible…

Testing for COVID19 is free at tests sites. Information and guidance [here.](#)

Welcome to ECS171 Introduction to Machine Learning!

Intended learning outcomes for L1

- Be familiar with the goals of the course and the material being covered
- Be aware of homeworks, group project, activities, quizzes, midterm and finals
- Know the course logistics of:
    - contact, office hours and what to ask TAs and Prof. S
- Know the structure of the group project

Instructor: Prof Maike Sonnewald

Assistant Professor Department of Computer Science

GG Atmospheric Science and Applied Mathematics

PhD: Complex Systems Simulation in CS from the University of Southampton

Research interests: oceanography and climate, AI and explainability, complex systems

Academic journey: Postdoc at MIT, Ass. Research Scholar at Princeton

Contact through Canvas

Teaching Assistants

- Devashree Kataria (she/her) <dpkataria@ucdavis.edu>
  - Office hours: Friday 2-3 pm Kemper 47
  - Research interests: Machine Learning

- Pu Sun (he/him) <psun@ucdavis.edu>
  - Office hours: Wednesday 2:30-4:30pm at Kemper 47
  - Research interests: Machine Learning and Computer Vision

Contact: Piazza and email

Course goals for you after completing ECS171

1: Understand the key concepts in machine learning, a critical precursor to effective collaborations in industry or academia. Towards this aim, you will:

- **Characterize** the process to train and test machine learning algorithms
- **Critique** core and cutting edge machine learning algorithms
- Identify the **challenges** for designing modern machine learning systems that can harness today's "big" datasets
- Recognize ways to **evaluate the predictive power** of machine learning
- **Compare the assumption** made in each model and the strengths and weakness of each model.

Course goals for you after completing ECS171

2: Apply machine learning systems to perform various artificial intelligence tasks. Towards this aim, you will:

- Experiment with machine learning libraries, including scikit-learn and TensorFlow
- Evaluate machine learning algorithms for tasks in various application domains, including for analyzing text and analyzing images

3: Conduct and communicate original research as a group. Towards this aim, you will:

- Propose a novel research idea (this will be an iterative process)
- Design and execute experiments to support the proposed idea
- Write a research paper about the project
- **Present the project to the class**

ECS171 Will give you tools to build with and on

Critical thinking, validation and understanding tools is central to success

ECS171 Will give you tools to build with and on

Critical thinking, validation and understanding tools is central to success

We will return to validation methodologies throughout the course

ECS171 Will give you tools to build with and on

ECS171 Will give you tools to build with and on

Formulate research question

ECS171 Will give you tools to build with and on

Gather data

ECS171 Will give you tools to build with and on

Data Cleaning and preprocessing

ECS171 Will give you tools to build with and on

Data Cleaning and preprocessing

Critical to success!

ECS171 Will give you tools to build with and on

Data Cleaning and preprocessing

ECS171 Will give you tools to build with and on

Learning models

ECS171 Will give you tools to build with and on

Results!

Rafatirad et al., 2022

Basic information

- ECS171 is in-person and **attendance is mandatory**
- Failing to attend midterm and final exams will **give zero marks**
- Course Meeting Times and materials:
  - Lectures: Tuesday 9-10:20am PT and Thursday 9-9:45am PT Wellman Hall Room 26
    Discussions: Wednesday 8-8:50am PT and Thursday 9:45-10:20am PT Wellman Hall Room 26
  - Note: Lectures and discussions are in-person
  - Syllabus, lecture slides, lecture videos, reading materials, and homework assignments will be uploaded to canvas.ucdavis.edu
- Prerequisites:
  - You are expected to know how to program in python.
  - Programming (ECS 032B or ECS 036C); Statistics (STA 032 or STA 131A or ECS 132); Algebra (MAT 022A or MAT 027A)

Contact and office hours

General: Piazza

- Bonus may be offered up to 5% for participation
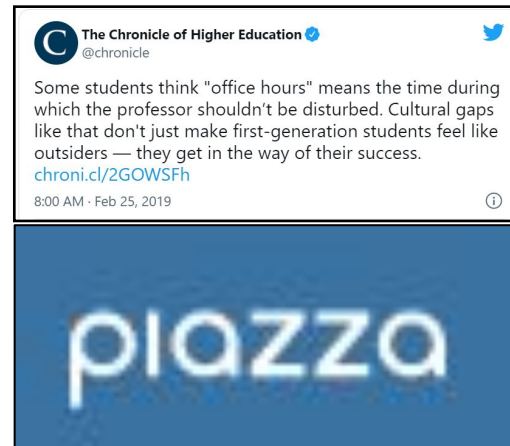
Prof. Sonnewald:

- **Contact through canvas**
- Questions regarding lectures, group project, and personal inquiries
- Office hours: Zoom or in-person 1-3:00 pm

TAs:

- Questions regarding coding, homework assignments, and grading

Timing:

- Emails sent on the weekend will be responded to on Monday
- Emails after 5pm will be responded to starting the next business day
- Piazza question responses only on MWF

The Chronicle of Higher Education ✔
@chronicle

Some students think "office hours" means the time during which the professor shouldn't be disturbed. Cultural gaps like that don't just make first-generation students feel like outsiders — they get in the way of their success.
chroni.cl/2GOWSFh

8:00 AM · Feb 25, 2019

piazza

Important dates and announcements

- Final exam: According to course builder, approx 18 March 2024
- Midterm exam: Friday 15th February 2024 (Lecture hour)
- Assignment deadlines are Friday 11:30 am Pacific Time
  - Accepted with an automatic 5% deduction until Sunday evening
- Course Drop Date: 15th Jan 2024 (10 Day Drop)
- Homework due dates online provisional
- Bonus of 3% to Piazza contributions

Group	Weight
Assignments	15%
Class Activities	5%
Project	15%
Midterm Exam	30%
Final Exam	35%
Total	100%

Exams

• All exams are in-person. Missing an exam is equivalent to 0 credit.

• Exams are non-cumulative.

• 1 midterm (during lecture hour)

• Covers Lecture 1~Lecture 9 (included)

• 1 final (according to course builder)

• Covers lecture 10~Lecture 17 (included)

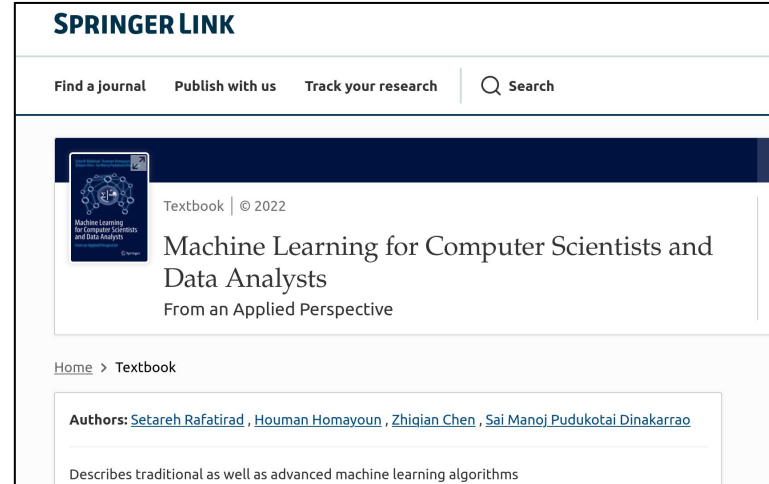• Any changes/updates to the date and time of the exams will be announced.

Recommended reading

Not required

B: Bishop, 2006, Pattern Recognition and Machine Learning, [PDF available.](#)

R: Rafatirad et al., 2022, Machine Learning for Computer Scientists and Data Analysts, [PDF available](#)

Beyond ECS171: Free courses for further study include from [Coursera](#) and [Udacity](#)

Week 1		
L1	9th Jan	Introduction to ECS171
D1	10th Jan	Tutorial on Jupyter Notebooks (Devashree Kataria)
L2	11th Jan	Introduction to Machine Learning: data, models, and hypotheses
D2	11th Jan	Exploratory Data Analysis (Pu Sun)
	11th Jan	
Week 2		
L3	16th Jan	Validation of hypotheses: regression and clustering
D3	17th Jan	HW1 review (Pu Sun)
L4	18th Jan	Optimization and generalization of models
D4	18th Jan	Polynomial regressor using gradient descent coding example (Devashree Kataria)
	19th Jan	
Week 3		
L5	23rd Jan	Optimization and regularization
	23rd Jan	
D5	24th Jan	HW2 review (Pu Sun)
L6	25th Jan	Artificial Neural Networks I
D6	25th Jan	Building a logistic regression, Newton's method: Activity 1 (Devashree Kataria)
Week 4		
L7	30th Jan	Artificial Neural Networks II
D7	31st Jan	ANN with backpropagation and termination criteria (Devashree Kataria)
L8	1st Feb	Artificial Neural Networks performance and tuning I
D8	1st Feb	A hands-on practice for different activation functions (Pu Sun)

Week 5		
L9	6th Feb	Artificial Neural Networks performance and tuning II
	6th Feb	
D9	7th Feb	Hyper-parameter tuning, backpropagation, regularization, and dropout (Pu Sun)
L10	8th Feb	Probabilistic Classifiers I
D10	8th Feb	Midterm review (Devashree Kataria)
	9th Feb	
Week 6		
L11	13th Feb	Probabilistic Classifiers II
L12	14th Feb	Support vector machines and decision trees
Exam	15th Feb	*Midterm Exam*
Week 7		
L13	20th Feb	Clustering I
D12	21st Feb	Support vector machines and HW3 review (Pu Sun)
L14	22nd Feb	Principal Component Analysis
D13	22nd Feb	Decision Trees and Random Forest (Devashree Kataria)
Week 8		
L15	27th Feb	Clustering II
D14	28th Feb	HW4 discussed (Pu Sun)
L16	29th Feb	PCA, Autoencoders, and kernels
D15	29th Feb	Final exam review (Pu Sun)
	1st Mar	
Week 9		
L17	5th Mar	Reinforcement Learning
Projects	6th Mar	Project Presentation and Demo
Projects	7th Mar	Project Presentation and Demo
	8th Mar	
Week 10		
Projects	12 Mar	Project Presentation and Demo
Exam	13th Mar	*Final Exam*

Group project

The learning outcome from the group project is for you to conduct and communicate original research as a group. This is similar to a setting you might encounter in industry or academia. The project deliverable include writing a research paper, sharing experimental results on the Github code sharing platform, and presenting the project outcome in class through developing an interface to call your model.

The objective of the group project is for you to:

- Develop skills in working as a group and collaborating
- Learn how to develop a product according to project specifications
- Learn how to deliver assigned tasks before the deadline and time management
- Acquire the skill set to research a topic and learn from other techniques and recreate your solution
- Have a hands-on experience to improve your machine learning skill set
- Everybody is expected to work as a group! Credit will not be given to members who fail to sufficiently communicate, participate and contribute to the deliverables

All projects will put to vote before the final exam. The group(s) winning the popular vote will be announced!

Group Project Organisation

Student groups will be announced (see the course schedule), with a max size of five students. Every group will have a leader designated by the TAs. As a group, pick a project and get the instructor's approval on the topic.

The group leader role may be subject to extra credit depending on the efficiency of a group's performance and satisfaction of the group members. The role of the group leader is to:

- Organizes the communications between the group members, communicates with the group constantly to ensure the timely delivery of the expected output.
- Report any problems early as possible.
- Ensure that every task is delivered in a timely fashion and deadlines are met including the final project submission.

Group Project Requirements

- Pick a topic and consult with your professor if needed (make an appointment and attend Office Hour)
  - Some Public Datasets:
    - https://archive.ics.uci.edu/ml/datasets.php
    - https://www.kaggle.com/datasets
    - https://console.cloud.google.com/marketplace/browse?filter=solution-type:dataset&_ga=2.161760574.328343085.1600146997-189771994.16001 46997&pli=1
- Prepare a 1-page write-up explaining the goal of the project and deliverables to be approved by the instructor:
- Create an action plan and a scheduled road-map to meet the goals. **This road-map must be submitted with your report at the end of the quarter.** The road-map should address the following:
  - Describing the problem scientifically
  - Background study (literature review or related work)
  - Dataset: Understanding and Exploratory Data Analysis
  - Developing Accurate Prediction Model(s)
  - Evaluation of the model(s) and Testing the performance
  - Developing a basic web-based front-end to invoke and run the model(s) on input data and display the prediction output
- Project report format is 1 column, single space, 11 pt. font, written in Latex, submitted as one pdf file of 6-8 pages excluding references with the following sections:
  - Outline
  - Introduction (1 page)
  - Literature review (1 page)
  - Dataset Description (1/2 page)
  - Proposed solution and experimental results (4-5 pages)
  - Conclusion and discussion (1/2 page)
  - References (no limit)
  - One page for the project roadmap
  - Suggestion: about 5 pages of text and 4-5 figures in position, or at the end of the document
- The Github link to the source code of your project should be included in your final report
- Submit the final report including all required material as one pdf file.

Hints for a great final report

- Include visualizations, tables, and plots in your report to show trends and report the performance and training of the model. Figures need to have explanatory captions that explain the trend in them. Plots should also be used during exploratory data analysis. Helpful a guide: https://towardsdatascience.com/a-gentle-introduction-to-exploratory-data-analy
- Reference figures properly in the report.
- Related work (or background or literature review) section, review related published papers with methodology which may help or inspire your research project. For instance, the dataset they used, or the selection of techniques they studied. You need to indicate how your work is different from these past works.
- Include your findings in the conclusion section.

Confirm Participation

As mandated by the U.S. Department of Education, all UC Davis students are required to take two steps pertaining to academic life. For each course in which they are registered, students must:

- Confirm that they have begun academic activity for each registered course
- Read and acknowledge the Code of Academic Conduct

Academic Conduct

- Plagiarism is a violation of UC Davis policy

    - 0 for the 1st attempt

    - F for the course in the 2nd attempt!

Submission guidelines

Submission Guidelines

- Provide your full name and student email
- Submit your homework as one single .ipynb file (Jupyter Notebook)
- Provide your answer below each question in each assignment
- Comment and document your code to explain your approach.
- **For the group project:** Include the name of your group in the project's final submission.

Community

In our discussions, we might make mistakes in our speaking and our listening. However, our learning community will be characterized by empathy, respect, and a desire to improve.

If you are offended by a comment by the instructor or a classmate, please notify me in whatever way is most comfortable for you (in person, email, or anonymous note).

I will do my best to rectify the situation but would also appreciate suggestions for best addressing the incident.

DO THE BEST YOU CAN UNTIL YOU KNOW BETTER. THEN, WHEN YOU KNOW BETTER, DO BETTER.

MAYA ANGELOU
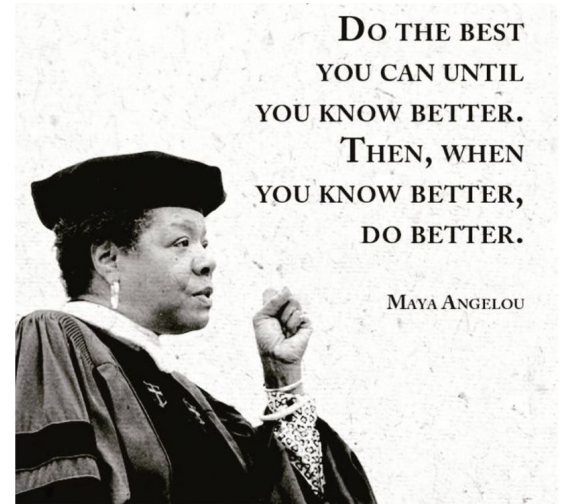
Mental Health

We all struggle from time to time! If you're in distress and need to talk with someone, please visit UC Davis Student Health and Counseling Services or these other crisis resources for support.

For more tailored off-campus support, check out:

- BEAM: Black Emotional and Mental Health Collective
- LGBTQ+ Care (Yolo County)
- Indigenous Circles of Wellness (tele-therapy & sliding scale/scholarships available)
- 2-1-1 Yolo County
- Support Circles for anxiety & depression in American Sign Language (Online; free)

If a particular topic in this course is difficult to speak about in a larger group, please arrange with me— beforehand if possible—to earn your participation grade for a particular class session in another way.

Meditation and mindfulness resources may also be helpful, available here in a number of languages, including ASL. Take a break when you're feeling stressed and try a meditation exercise.

If you are concerned about a friend, classmate, or other member of the UC Davis community, please let a professional know.

Basic Needs

We operate best only when our basic needs are first met.

If you are struggling with food or housing insecurity, please visit the [Aggie Compass Basic Needs Center](#) for resources.

Emergency Preparedness

In the event of an emergency, call (or text, if you are deaf or hard of hearing) **9-1-1.** Be sure you've signed up for the Everbridge Mobile App, part of the UC Davis WarnMe emergency alerting system, which provides users with push notifications for UC Davis WarnMe and Aggie Alert messages. The mobile app can be downloaded for free from the App Store or Google Play.

🚩If you need **assistance during an evacuation**, please let me know and we'll work out a plan to ensure your safety.

🚩If you have a **severe allergy** and can't be around certain items or foods, please let me know and I'll communicate that to our class to keep you safe!

Accessibility

Regardless of disability status, we all have access needs from time to time. Access needs are anything you require of your community or environment in order to participate fully, healthfully, and meaningfully. Please complete this anonymous Access Needs Survey.

I value diversity in learning modalities, approaches, and access needs. To help me better foster your success, please let me know if you have ideas for cultivating a learning environment more conducive to your learning. If any resources are inaccessible, please let me know and we can find alternative formats.

Contact the UC Davis Student Disability Center if you need—or suspect you may need— accommodations as soon as possible at sdc@ucdavis.edu.

Join the Disabled Student Union for community, support, and advocacy.

Here's a map of campus that shows locations of accessible and power-assist entryways in campus buildings.

Accessibility tools you might find useful:

- Otter Transcription/Captioning
- Text-to-speech (Chrome extension)
- Speech-to-text tools: Google Docs Voice Typing feature (under File)
- Zamzar document to audio file converter (listen to your course readings while commuting!)
- Pomodoro time/task management tool
- Canvas Immersive Reader (Chrome extension for web viewing)

Academic skills support

I recommend checking out the following campus resources to build a wider learning community:

- Schedule an appointment with the Writing Support Center or with our librarians.
- Visit the Internship & Career Center website to learn about job opportunities and practice for interviews.
- First-generation students can connect with others at the First Generation Initiative website.
- Those of you new to UC Davis can find additional support through the Orientation program.

Title IX

Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence, and stalking at federally funded educational institutions. UC Davis is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

● Intervene to prevent harmful behavior from continuing or escalating.
● Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
● Investigate and discipline violations of the university's relevant policies.

Faculty members and certain staff members are considered "Responsible Employees" or "Mandatory Reporters," which means that they are required to report violations of Title IX to the Title IX Coordinator that are disclosed in writing, discussion, or one-on-one. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee. For general support visit the Center for Advocacy, Resources & Education (CARE): https://care.ucdavis.edu/. For information regarding confidential and non-confidential resources see: https://sexualviolence.sf.ucdavis.edu/get-support. For more information about reporting options and resources, visit https://sexualviolence.ucdavis.edu/file-rep.

We want you

to succeed