UNIVERSITY OF SOUTHERN MAINE

COS 322: Foundations of Machine Learning

Department of Computer Science

Fall 2025

Instructor Info

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Student Hours:
Wednesday 2:00 PM - 3:00 PM
Or by Appointment

Course Meetings

Science Building 290, Portland
M/W 11:00 AM-12:15 PM

Services & Policies that Support You

Student Services and Policies Hub

Contents

1. Course Information

1A. Course Description

This course introduces the core concepts and techniques behind modern machine learning. Students will explore how machines can learn from data, with a focus on supervised and unsupervised learning, model evaluation, and basic algorithmic foundations. Topics include linear regression, classification, decision trees, support vector machines, clustering, and an introduction to neural networks. Emphasis is placed on understanding the math and intuition behind algorithms, as well as practical implementation.

1B. Course Materials & Books

Recommend (all optional thus not required)

- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (3rd Edition, 2022) Aurélien Géron.

Supplemental

- Python Data Science Handbook by Jake VanderPlas.
- Introduction to Machine Learning by Ethem Alpaydin (4th Edition).
- Python for Data Analysis (3rd Edition),(Open Edition), Wes McKinney, published by O'Reilly Media.
- Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and the Cloud, Paul J. Deitel & Harvey Deitel.
- Python for Data Analysis, Scott McCoy.
- Deep Learning. Ian Goodfellow and Yoshua Bengio and Aaron Courville, 2016.
- Dive into Deep Learning, Aston Zhang, Alexander J. Smola, Zachary Lipton, Mu Li.

1C. Course Learning Outcomes

The main learning objectives of the course are to:

- Recognize problems where machine learning can be effectively applied.
- Understand and apply key machine learning techniques such as regression, classification, and clustering.
- Gain hands-on experience with tools, including Python and scikit-learn.

2. Coursework & Grading

2A. Course Assessment

Assessment Name	Value
Class Participation	10%
7 Quiz	10%
8 Assignment	40%
Midterm	15%
Final project	25%
Total:	**100%**

2B. Class Participation

Students are expected to attend all the classes in-person. Attendance counts for 5% of your final grade. You will be required to sign your name by the end of every class. More than three absences will result in an "L" grade for this course, meaning the student has stopped attending.

Another 5% of your grade comes from active participation, which includes taking part in class discussions, asking questions, and engaging with your classmates' presentations.

2C. Quiz

There will be seven quizzes given throughout the semester. The quiz is scheduled for in-class completion, and you will have a 20-minute window to complete it. A student's five best scores will be used to compute the quiz average. Since two quizzes will be dropped for all students, makeup quizzes will not be given. Each quiz takes 2%.

2D. Assignment

There are 8 written and coding-based assignments in total, which should be completed individually and are due on the day by 11:59 PM. For example, the first homework due is Sep 15, which means you should submit your work before Sep 15, 11:59 PM. All assignments will be submitted and graded through Brightspace. Each assignment should be submitted with the assignment report (Microsoft Word or PDF file) and the source code file.

2E. Midterm

The midterm will be taken online through Brightspace and must be completed within the specified time.

2F. Final project

Working on a project is one of the best ways to understand how machine learning works in practice. Students will work in groups of 1 to 3 members (individual projects are allowed). Larger teams are expected to take on more ambitious or comprehensive projects. The project includes three milestones: team/topic selection, a project proposal (10%), and a final report and presentation (15%).

In the first milestone, which occurs early in the semester, students will form teams and choose a project topic. The instructor will provide three suggested topics, but students are also encouraged to propose their own ideas.

In the second milestone, which takes place after the midterm, each team will present a short

project proposal in class. The proposal should clearly define the problem being addressed, explain the proposed methods (including at least two machine learning algorithms), and outline how the work will be divided among team members. In addition to the proposal presentation, teams must submit a 2-3 pages project proposal report.

The final milestone will take place during the last week of the semester. Each group will deliver a 20–30 minute presentation followed by a Q&A session. The presentation should describe the methodology, show experimental results comparing the selected approaches, and include a code demonstration. In addition to the presentation, teams must submit a final project report (4–8 pages, research-paper style) and all source code.

3. Class Schedule

Week	Date	Topics	Note	Due
1	Sep 3	Introduction of Machine Learning, class overview		
2	Sep 8	Prepare for your ML work zone		
	Sep 10	Data and Data Preprocessing		
3	Sep 15	ML pipeline	Quiz 1	HW1
	Sep 17	Linear regression		
4	Sep 22	Case study: regression task		
	Sep 24	Logistic Regression		HW2
5	Sep 29	k-Nearest Neighbors	Quiz 2	
	Oct 1	Case study: classification task		
6	Oct 6	Midterm Review		HW3
	Oct 8	Midterm		
7	Oct 13	Fall break, No class		
	Oct 15	Decision Tree		
8	Oct 20	Naive Bayes	Quiz 3	HW4
	Oct 22	Support Vector Machine		
9	Oct 27	Case study: classification task		
	Oct 29	Ensemble Learning	Quiz 4	HW5
10	Nov 3	Random Forest		
	Nov 5	Cluster Analysis		
11	Nov 10	K-Means Clustering	Quiz 5	HW6

	Nov 12	Dimensionality Reduction		
12	Nov 17	Case study: clustering task		
	Nov 19	Introduction to Neural Networks		
13	Nov 24	DNN components I	Quiz 6	HW7
	Nov 26	Thanksgiving day, No class		
14	Dec 1	DNN components II		
	Dec 3	Case study: deep learning task	Quiz 7	
15	Dec 8	Final project presentations		
	Dec 10	Final project presentations		HW8

4. Course-Specific Policies

4A. Handing in Assignments

All assignments and reports will be submitted and graded through Brightspace. Each assignment should include the assignment report (Microsoft Word or PDF file) and source code. You should complete all assignments individually.

4B. Late Assignments

Late assignments will be marked down 10% per day that they are late, and assignments submitted after seven days will not be accepted (except under special circumstances such as illness or other unanticipated impediments).

4C. Plagiarism and Use of Artificial Intelligence (AI) in Coursework

Plagiarism is turning in work that is not your own. Searching the internet for answers or using answers created by others is plagiarism and may result in failing the course as well as appropriate disciplinary action. It is your responsibility to not leave your work where others might copy it.

While copying code is not acceptable in this course, it's normal to need help when you're stuck. The best way to develop the problem-solving and coding skills used in machine learning is to first make a serious attempt to solve the problem on your own. If you get stuck, that's okay—ask questions in class, and I'll be happy to help (chances are others have the same question).

You're also welcome to look things up online or use generative AI tools to understand a concept or see how others have approached similar problems. But once you understand it, you must write your own code. A good practice is to put aside the example and re-implement the idea in your own way. Do not copy and paste code—not even a few lines. Every line in your assignment should be something you understand and can explain.

A useful test: Could you sit down and reproduce your solution from scratch in about an hour, without help? If I suspect code was copied, I may ask you to do just that. You're allowed to talk with other students during the analysis, design, and debugging phases of your work. Do not share your code or copy anyone else's.

Plagiarism or unapproved collaboration will lead to disciplinary action, including possible failure of the course.

5. Academic Services & Policies

Below you'll find a brief list highlighting some of the most crucial student services and supports.

- **Request disability accommodations** | (207) 780-4706 | dsc-usm@maine.edu
- **Report Interpersonal violence** | (207) 780-5767 | usm.titleix@maine.edu
- **Report on-campus emergencies and safety concerns** | (207) 780-5211 or your local police agency.
- **Get academic help** | mycampus.maine.edu/group/usm/learning-commons
- **Get technology help** | usm.maine.edu/computing/helpdesk
- **Meet with an academic advisor |** usm.maine.edu/advising

For USM's most complete and current information on services available to students, as well as academic policies, use the QR Code to go to the Student Services and Policies Hub webpage[1].

[1] https://mycampus.maine.edu/group/usm/student-services-and-policies-hub

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