CMSI 5350/EECE 5998 – Machine Learning
Loyola Marymount University, Fall 2022

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Office Hours: Zoom · https://lmula.zoom.us/my/mkorpusik · M/W 3:30-5:30pm

In-person classes: **Pereira Hall 207**
Section 01 · **3:40pm–5:20pm T/Th**

Machine learning (ML) is essential to the success of many new technologies, including autonomous vehicles, search engines, automated medical diagnosis, image recognition, and social network analysis. This course introduces the fundamental concepts and algorithms that enable computers to learn from experience. This course will also cover how ML models that are trained on data from a biased society also become biased.

Learning Objectives
By the end of this class, you will be able to:

- Summarize the theoretical foundations of core algorithms in the field of machine learning.
- Select the appropriate algorithm for tackling a given learning problem.
- Evaluate the performance of machine learning methods for a given task.
- Apply core machine learning algorithms to real-world problems.
- Explain the ethical issues that arise in many machine learning applications.
- Use ChatGPT as a tool for learning new concepts and debugging code.

Prerequisites
The prerequisite courses are Calculus, Linear Algebra, and Probability and Statistics. Students who have not taken these require prior approval of the instructor. Programming, like any skill, is best learned by making mistakes, correcting mistakes, and **learning from mistakes**. If you are working hard and doing your best and still struggling with the material, there are most likely things I could be doing to improve the course. Please let me know!

A note on belonging: The field of Computer Science is plagued with stereotypes. If you hear a voice in your head saying, "Ugh, if I'm wrong or if I'm not impressive enough, it will reflect badly on [groups I identify with, especially, but not limited to, race, gender, English as a second language, etc.]!" then you might be experiencing a **Stereotype Threat**. Just know, you're not alone—many of us have experienced this too. Everyone can do well in this course with a willingness to learn, grow, incorporate feedback, and enjoy.

Laptops and Textbooks
Since this is a programming lab course, it is strongly advised that you bring your computer to class to participate in group exercises and class assignments. Let me know if you need a laptop. Reading at least one of the following textbooks is recommended. Several are available online.

- Hal Daumé III, *A Course in Machine Learning.* http://ciml.info/ (A gentle introduction)

- Andrew Ng, *Stanford Machine Learning Notes*. https://cs229.stanford.edu/main_notes.pdf

- Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006. (On Brightspace)

- Trevor Hastie, Robert Tibshirani, and Jerome Friedman, *The Elements of Statistical Learning*, Springer-Verlag, 2008. https://web.stanford.edu/~hastie/ElemStatLearn/ (Less readable)

- David Barber, *Bayesian Reasoning and Machine Learning*, Cambridge University Press, 2012. http://web4.cs.ucl.ac.uk/staff/D.Barber/textbook/200620.pdf

Schedule

Weeks 0 - 1		**Python**	**Textbook Reading**	**Homework**
Tues	8/29	Intro to Python & ChatGPT	https://bit.ly/3hoYg2P	
Thurs	8/31	Python Functions & Classes	–	
Tues	9/5	Numeric Libraries	–	
Thurs	9/7	Visualization	–	
Weeks 2 - 5		**Intro to ML**		
Tues	9/12	Introduction to Machine Learning	Daumé 1.1-1.2	
Thurs	9/14	Decision Trees	Daumé 1.3-1.4	ps0 due
Tues	9/19	k-Nearest Neighbors	Daumé 3.1-3.3, 3.5	
Thurs	9/21	Evaluation	Daumé 5.5-5.6	
Tues	9/26	Linear Regression (No Class)	Daumé 7.1-7.3	ps1 due
Thurs	9/28	Logistic Regression (No Class)	–	
Tues	10/3	Perceptron	Daumé Ch. 4	
Thurs	10/5	Support Vector Machines	Daumé 7.7	
Weeks 6 - 8		**Advanced Topics**		
Tues	10/10	Advanced Evaluation	Daumé 6.1-6.2	ps2 due
Thurs	10/12	Advice for Applying ML	https://stanford.io/3y9eUt7	
Tues	10/17	Ensemble: Bagging	Daumé 13.1, 13.3	
Thurs	10/19	Ensemble: Boosting	Daumé 13.2	ps3 due
Tues	10/24	Dimensionality Reduction	Daumé 15.2	
Thurs	10/26	Clustering	Daumé 3.4	
Week 9		**Midterms**		
Tues	10/31	Midterm Review	–	ps4 due
Thurs	11/2	MIDTERM (No Class)	–	
Weeks 10 - 12		**Neural Networks**		
Tues	11/7	Projects!	–	Midterm due
Thurs	11/9	Neural Networks	Daumé Ch. 10	
Tues	11/14	Gradient Descent	Daumé 7.4	Proposal due
Thurs	11/16	Computer Vision		
Tues	11/21	Large Language Models	https://web.stanford.edu/~jurafsky/slp3/	
Thurs	11/23	*Thanksgiving*	–	
Week 13		**Bias and Ethics in ML**		
Tues	11/28	Bias & Fairness	Daumé Ch. 8	Milestone due
Thurs	11/30	Ethics in ML	–	
Weeks 14 - 15		**Wrapping Up**		
Tues	12/5	Project Presentations	–	Slides due
Thurs	12/7	Course Eval, Peer/Self-Assessment	–	Assessment due
Tues	12/12	FINALS WEEK (No Class)	–	Report due