CS229

Syllabus and Course Schedule

Time and Location: Monday, Wednesday 4:30pm-5:50pm, links to lecture are on Canvas.
Class Videos: Current quarter's class videos are available here for SCPD students and here for non-SCPD students.
Note: This is being updated for Spring 2020. The dates are subject to change as we figure out deadlines. Please check back soon.

Week	Event	Date	Description	Materials
Week 1	Lecture 1	4/6	Introduction and Basic Concepts	**Slides** • Introduction slides [pptx] • Introduction slides [pdf]
	Lecture 2	4/8	Supervised Learning Setup. Linear Regression.	**Class Notes** • Supervised Learning, Discriminative Algorithms [pdf] • Live lecture notes [pdf]
	Assignment	4/8	**Problem Set 0.** Due 4/15 at 11:59pm.	
	Section 1	4/10	**Friday Lecture**: Linear Algebra.	**Notes** • Linear Algebra Review and Reference [pdf] • Linear Algebra, Multivariable Calculus, and Modern Applications (Stanford Math 51 course text) [pdf] • Linear Algebra Friday Section [pdf (slides)]

Week	Event	Date	Description	Materials
Week 2	Lecture 3	4/13	Weighted Least Squares. Logistic Regression. Netwon's Method Perceptron. Exponential Family. Generalized Linear Models.	**Class Notes** • Live lecture notes [pdf]
	Lecture 4	4/15		**Class Notes** • Live lecture notes [pdf]
	Assignment	4/15	**Problem Set 1.** Due 4/29 at 11:59pm.	
	Section 2	4/17	**Friday Lecture**: Probability	**Notes** • Probability Theory Review [pdf] • The Multivariate Gaussian Distribution [pdf] • More on Gaussian Distribution [pdf] • Section slides [pdf (slides)]
Week 3	Lecture 5	4/20	Gaussian Discriminant Analysis. Naive Bayes. Laplace Smoothing.	**Class Notes** • Generative Algorithms [pdf] • Live lecture notes [pdf]
	Lecture 6	4/22	Laplace Smoothing. Support Vector Machines.	**Class Notes** • Support Vector Machines [pdf] • Live lecture notes [pdf]
	Section 3	4/24	**Friday Lecture**: Python and Numpy	**Notes** • Section slides [pdf (slides)] • Jupyter notebook [html] [source]
	Project	4/24	**Project proposal** due 4/24 at 11:59pm.	

Week	Event	Date	Description	Materials
Week 4	Lecture 7	4/27	Support Vector Machines. Kernels.	**Class Notes** • Live lecture notes [pdf]
	Lecture 8	4/29	Neural Networks - 1	**Class Notes** • Deep Learning [pdf] • Backpropagation
	Assignment	4/29	**Problem Set 2.** Due 5/13 at 11:59pm.	
	Section 4	5/1	**Friday Lecture**: Evaluation Metrics	**Notes** • Evaluation Metrics [pdf (slides)]
Week 5	Lecture 9	5/4	Neural Networks - 2	**Class Notes** • See Neural Networks - 1 Notes
	Lecture 10	5/6	Bias - Variance. Regularization. Feature / Model selection.	**Class Notes** • Regularization and Model Selection [pdf, addendum] • Live lecture notes [draft] • Double Descent [link, optional reading]
	Section 5	5/8	**Friday Lecture**: Deep Learning	**Notes** • Deep Learning [pptx]

Week	Event	Date	Description	Materials
Week 6	Lecture 11	5/11	K-Means. GMM (non EM). Expectation Maximization.	**Class Notes** • Unsupervised Learning, k-means clustering. [pdf] • Mixture of Gaussians [pdf] • The EM Algorithm [pdf] • Live lecture notes [draft]
	Lecture 12	5/13	Expectation Maximization (continued)	**Class Notes** • Lagrange Multipliers Review [pdf] • Live lecture notes [draft, in lecture]
	Assignment	5/13	**Problem Set 3.** Due 5/27 at 11:59pm.	
	Section 6	5/15	**Friday Lecture**: Midterm Review	**Class Notes** • Midterm review [pdf (slides)]
	Project	5/15	**Project milestones** due 5/15 at 11:59pm.	
Week 7	Lecture 13	5/18	Factor Analysis.	**Class Notes** • Factor Analysis [pdf] • Live lecture notes [draft, in lecture]
	Midterm	5/20	See details at Piazza post	
	Lecture 14	5/20	Principal and Independent Component Analysis.	**Class Notes** • Principal Components Analysis [pdf] • Independent Component Analysis [pdf] • Live lecture notes [draft, in lecture]

Week	Event	Date	Description	Materials
Week 8	Lecture 15	5/25	Memorial Day, no lecture.	
	Lecture 16	5/27	Weak Supervision	**Class Notes** • Weak Supervision [pdf (slides)] • Weak Supervision [draft, in lecture] **Additional Material** • ML Advice [draft, Canvas video from Fall 2019] • Relevant video from Fall 2018 [Youtube (Stanford Online Recording), pdf (Fall 2018 slides)]
	Assignment	5/27	**Problem Set 4.** Due 6/10 at 11:59pm (no late days).	
Week 9	Lecture 17	6/1	Markov Decision Process. Value Iteration and Policy Iteration. Q-Learning. Value function approximation.	**Class Notes** • Reinforcement Learning and Control [pdf]
	Lecture 18	6/3	Reinforcement Learning continued	

Week	Event	Date	Description	Materials
Week 10 (Last Week of class)	Lecture 19	6/8	Policy search. Reinforce. POMDPs.	**Class Notes** • Policy Gradient (REINFORCE) [pdf]
	Lecture 20	6/10	Recap, Fairness, Adversarial	**Class Notes**
	Project	6/10	**Poster PDF and video presentation.** Due 6/10 at 11:59pm (no late days).	
	Project	6/10	**Project final report.** Due 6/10 at 11:59pm (no late days).	

Supplementary Notes

1. Online Learning and the Perceptron Algorithm [pdf]
2. Binary classification with +/-1 labels [pdf]
3. The representer theorem [pdf]
4. Hoeffding's inequality [pdf]

Optional Topics

1. Decision trees [pdf]
2. Decision tree ipython demo [ipynb]
3. Boosting algorithms and weak learning [pdf]
4. On critiques of ML [slides]

Other Resources

1. Advice on applying machine learning: Slides from Andrew's lecture on getting machine learning algorithms to work in practice can be found here.
2. Previous projects: A list of last quarter's final projects can be found here.
3. Data: Here is the UCI Machine learning repository, which contains a large collection of standard datasets for testing learning algorithms. If you want to see examples of recent work in machine learning, start by taking a look at the conferences NIPS(all old NIPS papers are online) and ICML. Some other related conferences include UAI, AAAI, IJCAI.
4. Viewing PostScript and PDF files: Depending on the computer you are using, you may be able to download a PostScript viewer or PDF viewer for it if you don't already have one.
5. Machine learning study guides tailored to CS 229 by Afshine Amidi and Shervine Amidi.