STAT 538 A Wi 24: Statistical Learning: Modeling, Prediction, And Computing

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Instructor: Armeen Taeb ataeb@uw.edu

Class Time	M /W 8:30– 9:50 AM at ECE 003

Office Hours

Instructor: Wednesday 10am-11am after class in Padelford B310.

Grader: Monday 2:30pm-3:30pm in Padelford B226 (concurrent with STAT 302).

Course Description:

Covers the role of optimization in modern `high-dimensional' statistical learning. A significant emphasis is on convex optimization although we will spend a few weeks on integer programming and non-convex optimization more generally.

Ideal prerequisites are STAT 535 or a similar course.

Learning Objectives:

1. Learn about optimization and how it is useful in statistical learning
2. Learn how tools from optimization are useful for analyzing and solving sparse estimation problems
3. Learn about optimization solvers that are commonly used in practice (both convex and non-convex)
4. Learn about uncertainty quantification in high-dimensional inference

Required Texts: Useful references will be provided during the lectures.

Grading policy:

- HW assignments (50%)
- In class Midterm (25%)
- Final exam (20%)

- Scribing (5%)

All graded assignments will be due at 11:59pm Seattle time. Late assignments received within 1 week of their original due date will be given 50% of their earned score. After 1 week, assignments will not be given credit.

Scribe link is here: `https://www.overleaf.com/9959914557qqgdzprrcmgz#bb81ae`

Course timeline

1	W Jan 3	Introduction+convexity	Assign HW1 Linear algebra+convexity	
2	M Jan 8	Convexity continues; Subgradient calculus		
	W Jan 10	Subdifferential, different classes of optimization problems		
3	M Jan 15	Holiday no class	Assign HW2 Convexity	HW1
3	W Jan 17	Duality and KKT conditions		
	M Jan 22	Prediction performance of lasso		
4	W Jan 24	Prediction performance of lasso continued + variable selection consistency and proof	Assign HW3 Lasso and Algorithms	HW2
	M Jan 29	Variable selection consistency and proof		

5	W Jan 31	Uncertainty quantification: debiased lasso		
	M Feb 5	Uncertainty quantification: stability selection		HW 3 due
6	W Feb 7	Graphical modeling and the graphical lasso;	Exam released	
	M Feb 12	Algorithms: Proximal gradient		
7	W Feb 14	Algorithms: Projected gradient descent, accelerated proximal gradient descent	HW 4 released	
	M Feb 19	No class Holiday		
8	W Feb 21	Algorithms: coordinate descent, Primal-dual methods, ADMM		
	M Feb 26	Low rank estimation	HW 5 released	HW 4 due
9	W Feb 28	Finish low rank estimation, started mixed integer programming		
	M Mar 5	mixed integer programming and cutting planes		

10	W Mar 7	mixed integer programming and branch-and-bound, outlook	Take home exam	HW 5 due
	W Mar 15		Take home exam due	Final due

Students with disabilities:

If you would like to request academic accommodations due to a disability, please contact Disabled Student Services, 448 Schmitz (206) 543-8924 (V/TTY). If you have a letter from Disabled Student Services indicating you have a disability that requires academic accommodations, please present this letter to me to discuss the accommodations you might need for the class.

Academic Integrity:

Collaboration and discussions are allowed and encouraged in this class, but copying or letting others copy your work amounts to plagiarism. This includes copying model solutions, e.g., from prior years. Although cheating seldom occurs in graduate classes, if it does, I will take the following action: assign a grade of 0.0 for the exam/homework where the cheating occurred, and **report the incident to the Graduate School Committee on Academic Conduct**, which will decide upon an appropriate University course of action.

Religious Accommodations:

Washington state law requires that UW develop a policy for the accommodation of student absences or significant hardship due to reasons of faith or conscience or for organized religious activities. The UW's policy, including more information about requesting accommodation, is available at **Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/ (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/)** . Accommodations must be requested within the first two weeks of this course using the **Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/). (https://registrar.washington.edu/students/religious-accommodations-request/)**

Student conduct:

Follow the UW Student Conduct Code in your interactions with your colleagues and me in this course by respecting the many social and cultural differences among us, which may include, but are not limited to: age, cultural background, disability, ethnicity, family status, gender identity and presentation, citizenship

and immigration status, national origin, race, religious and political beliefs, sex, sexual orientation, socioeconomic status, and veteran status.

Course Summary:

Date	Details	Due
Mon Jan 15, 2024	HW 1 (https://canvas.uw.edu/courses/1698315/assignments/8980839)	due by 11:59pm
Wed Jan 24, 2024	HW 2 (https://canvas.uw.edu/courses/1698315/assignments/9044603)	due by 11:59pm
Wed Feb 7, 2024	Homework 3 (https://canvas.uw.edu/courses/1698315/assignments/9067728)	due by 11:59pm
Sun Feb 11, 2024	Midterm (https://canvas.uw.edu/courses/1698315/assignments/9090114)	due by 11:59pm
Mon Feb 26, 2024	Midterm correction (https://canvas.uw.edu/courses/1698315/assignments/9117633)	due by 11:59pm
Tue Feb 27, 2024	Homework 4 (https://canvas.uw.edu/courses/1698315/assignments/9100528)	due by 11:59pm
Wed Mar 13, 2024	Assignment 5 (https://canvas.uw.edu/courses/1698315/assignments/9126191)	due by 11:59pm
Fri Mar 15, 2024	Final (https://canvas.uw.edu/courses/1698315/assignments/9157548)	due by 11:59pm
	scribing (https://canvas.uw.edu/courses/1698315/assignments/9180569)	