The University of Iowa
The College of Liberal Arts and Sciences
Spring, 2025

DATA 4750:001 Probabilistic Statistical Learning
1:30 p.m. – 2:20 p.m. Mondays, Wednesdays, and Fridays in 313 PH

Title of Course:	DATA 4750:001 Probabilistic Statistical Learning
Course meeting time and place:	1:30 p.m. – 2:20 p.m. MWF in 313 PH
Department of Statistics and Actuarial Science:	`https://stat.uiowa.edu`
Course ICON site:	`https://uiowa.instructure.com/courses/244230`
Course Home:	`https://clas.uiowa.edu`

Instructor: Sanvesh Srivastava

Office location: 219 SH
Student drop-in hours: Mondays, Wednesdays, and Fridays 12:30 p.m. to 1:30 p.m. Students are invited to drop by during these hours to discuss questions about the course material or concerns. I am also available by appointment if you are unable to attend my drop-in hours.
Phone: 319-335-0824
E-mail: `sanvesh-srivastava@uiowa.edu`
DEO: Kung-Sik Chan, 241 SH, and `kung-sik-chan@uiowa.edu`.

Course Description

This course focuses on essential machine learning and statistics ideas that are critical in analyzing modern complex and large data. Selected topics are covered in supervised learning: linear models, deep neural networks, and non-parametric models. Besides supervised learning, essential topics from non-linear dimension reduction, clustering, and causal inference are part of the course.

Learning Objectives

The students will develop an understanding of various statistical learning methods and will learn the computational skills to apply these methods to real-world data sets, to pursue a career in applied statistics, and to pursue research in statistical sciences and other data sciences. The students also learn about elementary theoretical ideas behind popular statistical/machine learning methods.

It is expected that students will read the book, work on problems as required to master the material, and spend time applying the statistical learning methods to real-world data sets. You are expected

to put in 6-8 hours of work outside of class. A few of you will do well with less time than this, and a few of you will need more.

Textbook and course materials

The required textbook for this course is:

- Title: *Patterns, Predictions, And Actions: Foundations of Machine Learning*
- Authors: *Moritz Hardt and Benjamin Recht*
- Publisher: *Princeton University Press*
- Edition: *First*

A pdf copy of the book is available on the web (`https://mlstory.org/`) and Canvas. Note the pdf has slight differences from the print version, but they have little pedagogical/learning consequences.

The print version of the book has no exercises; however, the book's website has a set of problems; see the file *Hardt-Recht-Book-Problems.pdf* on Canvas. The homework problems in this course will be from these exercises and other books. For example, *Probabilistic Machine Learning* (PML) book series by Kevin P. Murphy of Google. This book has two versions *Probabilistic Machine Learning: An Introduction (2022)* and *Probabilistic Machine Learning: Advanced Topics (2022)*, which are freely available from `https://probml.github.io/pml-book/`. I **do not** recommend buying these books. You can use these books for solving problems similar to those assigned for homework.

The instructor will post announcements, homework problems, lecture notes, and other course information in Canvas.

Pre-requisites

STAT 4540 and some prior exposure to mathematical statistics and programming in R, Python, or Matlab is recommended.

Attendance

Attending classes is required, but the instructor won't take attendance.

Office hours

The instructor *is available for in-person office hours* every Monday, Wednesdays, and Fridays from 12:30 p.m. and 1:30 p.m. in SH 219.

The instructor *is available for office hours via Zoom*. A student is required to email the instructor about scheduling the meetings and give the instructor sufficient time to respond. *A student can also schedule the meeting before or after the lecture but not during the lecture*. If you are unable during these times, then you should email the instructor for an appointment and suggest a set of

time slots that suit you. *You should email early enough so that the instructor has enough time to schedule a meeting.*

Grading System

Your grade will consist of homeworks (30%), two midterms (10% each, 20% total), a project (20%) and a final exam (30%). At the end of the semester, homework, midterm, project, and final grades are normalized within each category in order to calculate the final course grade.

A plus-minus grading system will be used. Here is a *tentative grading scale:* A,A-: 88%–100%, B+,B,B-: 70%–88%, C+,C,C-: 60%–70%, D: 50%–60%, F:<50%. A+ will be given only in exceptional cases. I reserve the right to change the grade distribution by 10% so that it suits the diversity of students in the class.

Homework

Homework will be usually assigned every other week on Fridays and will be due two weeks later on Friday. Homework submission will be online. Any exceptions, which are possible, will be announced in class or in Canvas. Your work must be legible and include your name at the top to receive credit. Due to time constraints, the grader may grade only some of the assigned questions, but you are responsible for understanding all questions.

All homeworks will contribute towards your final grade. Unless prior arrangements are made well in advance, for reasons judged to be acceptable by me, late homework will receive zero credit as solutions will be posted soon after the homework is due.

Exams

There are **no** quizzes in this class. There are two midterm and one final exams. The midterm and final exams will emphasize examples and key concepts repeatedly mentioned in class and in homework problems. All exams will be closed book. The final exam will be comprehensive and cumulative. You will be allowed *one* A4-sized handwritten "cheat-sheet" for every exam. You can use cheat-sheet from the previous exams (i.e., *one* for the first midterm, *two* for the second midterm, and *three* for the final exam in total).

Project

The project is assigned (typically) after the second midterm (second or third week of April). It consists of a series of questions for analyzing a real-life data set and the students will answer these questions based on the methods and tools learned in the class. A project report summarizing the answers to the questions and related findings will be submitted online. More details will be announced on Canvas as the course progresses.

Grading Errors

Although every effort will be made to mark your work accurately, sometimes grading mistakes happen. If you believe that an error has been made on an in-class problem or exam, then please

email the instructor immediately stating your claim in writing.

Important Dates

Check the office of the registrar website for the academic calendar:
`http://registrar.uiowa.edu/academic-calendar#!spring-2025`

Some important dates for DATA 4750 are as follows:

Midterm I:	Tuesday, March 04, SH 140, 6:30 pm to 7:30 pm
Midterm II:	Thursday, April 10, SH 140, 6:30 pm to 7:30 pm
Final Exam:	Monday, May 11 – Friday, May 16 (to be decided by the university)

Tentative Schedule

Chapter	Week	HW (Assigned)	Deadlines
2	01/20 – 01/24	1	
2	01/27 – 01/31		
3	02/03 – 02/07	2	HW 1
3	02/10 – 02/14		
3	02/17 – 02/21	3	HW 2
4	02/24 – 02/28		
4	03/03 – 03/07		Midterm 1
5	03/10 – 03/14	4	HW 3
Spring Break	03/17 – 03/21		Spring Break
9	03/24 – 03/28		
9	03/31 – 04/04	5	HW 4
10	04/07 – 04/11		Midterm 2
10	04/14 – 04/18	Project	
8	04/21 – 04/25		HW 5
7	04/28 – 05/02		
7	05/05 – 05/09		Project
	05/12 – 05/16		Final Exam

UI and the College of Liberal Arts and Sciences
Information for Undergraduate/Graduate Students

Academic Honesty and Misconduct

All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty.

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor, and finally with the Director or Chair of the school, department, or program offering the course.
Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar's website. Undergraduate students can find policies on dropping and withdrawing here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

University Policies

Accommodations for Students with Disabilities
Basic Needs and Support for Students
Classroom Expectations
Exam Make-up Owing to Absence
Free Speech and Expression
Mental Health
Military Service Obligations
Non-discrimination
Religious Holy Days
Sexual Harassment/Misconduct and Supportive Measures
Sharing of Class Recordings