STAT 4540: Statistical Learning

Fall 2020
2:30 p.m. – 3:20 p.m. MWF World Wide Web via Zoom

Instructor:	Sanvesh Srivastava
Email:	`sanvesh-srivastava@uiowa.edu`
Office:	219 SH (Schaeffer Hall)
Office hours:	Mondays and Wednesdays from 3:30 pm – 5:00 pm via Zoom
Website:	Canvas `https://uiowa.instructure.com/`
Lectures:	2:30 p.m. – 3:20 p.m. MWF World Wide Web via Zoom. *Lecture recordings are available on Canvas.*
Lab:	Labs might replace some lectures.

Departmental Information and Executive Officer

College: College of Liberal Arts and Sciences
Department: Statistics and Actuarial Science
Executive Officer: Kung-Sik Chan (`kung-sik-chan@uiowa.edu`)
Address: 241 SH
Contact: (319)-335-0712
Email: `statistics@uiowa.edu`; `actuarial-science@uiowa.edu`
Website: `http://www.stat.uiowa.edu`

Textbook and course materials

An Introduction to Statistical Learning, with applications in R by James, Witten, Hastie, and Tibshirani. The website accompanying the book is `http://www-bcf.usc.edu/~gareth/ISL/`. This website is an excellent resource for many materials that we will use throughout this course, including a pdf copy of the book.

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

Course Description and Objectives

The course is an introduction to supervised and unsupervised statistical learning, with a focus on regression, classification, and clustering. Methods will be applied to real data using appropriate software. Supervised learning topics include: linear and non-linear (e.g., logistic) regression; linear discriminant analysis; cross-validation, bootstrapping, model selection, and regularization methods (e.g., ridge and lasso); generalized additive and spline models; tree-based methods, random forests and boosting; and support-vector machines. Unsupervised learning topics include: principal components and clustering.

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.

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.

Pre-requisites

An introductory statistics course and a regression course. Prior exposure to programming and/or software, such as R, SAS, and Matlab is recommended, but not required.

Attendance

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

Office hours

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*. The available slots for scheduling the office hour meetings are every Monday and Wednesday from 3:30 pm – 5:00 pm. 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.*

Grades

Your grade will consist of Homework (30%), Project (50%), and a Final Exam (20%). At the end of the semester, Homework, 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-: 77%–88%, C+,C,C-: 60%–77%, 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 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 and midterm exams in this class. There will be one final exam. The final exam will emphasize examples and key concepts repeatedly mentioned in class and in homework problems. The final exam will be comprehensive, cumulative, and closed book. You will be allowed *two* A4-sized handwritten "cheat-sheet" for the final exam. *The current plan is to follow the final exam format and time decided by the university administration, but this is subject to change depending on how the COVID-19 pandemic evolves.*

Project

The project in this class will replace two midterm exams. Depending on our speed, the project will be assigned in the third or fourth week of October. The project will include a series of questions for analyzing a real-life data set and the students will answer these questions based on the tools learned in the class. A project report summarizing the answers to the questions and related findings will be submitted in the last week of classes. More details will be announced on Canvas as the course progresses.

Lab

Labs will be held depending on the needs of the students and will be announced in class or in Canvas.

Extra help

The *Statistics Tutorial Lab*, located in 202 CC. In addition, several graduate students have volunteered to independently tutor students in various courses at mutually-arranged times and fees. Please check the web site `www.stat.uiowa.edu/courses/tutoring.html` for tutoring details.

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#!fall-2020`

Some important **tentative** dates for STAT 4540 are as follows:

Project:	Mon, Oct 19 – Fir, Oct 30 (possible dates of assignment) and Fri, Dec 11 (submission deadline)
Final Exam:	Mon, Dec 14 – Fri, Dec 18 (to be decided by the university)

Tentative Schedule

Chapters	Week	HW (Assigned)	Deadlines
1-2	08/24 – 08/28	1	
2-3	08/31 – 09/04		
3	09/07 – 09/11	2	HW 1 due on 09/11
3-4	09/14 – 09/18		
4	09/21 – 09/25	3	HW 2 due on 09/25
4-5	09/28 – 10/02		
5-6	10/05 – 10/09	4	HW 3 due on 10/09
6	10/12 – 10/16		
6	10/19 – 10/23	5	HW 4 due on 10/23
6-7	10/26 – 10/30		Project assigned
7	11/02 – 11/06	6	HW 5 due on 11/06
10	11/09 – 11/13		
10	11/16 – 11/20	7	HW 6 due on 11/20
Break	11/23 – 11/27		–
8	11/30 – 12/04		HW 7 due on 12/04
8	12/07 – 12/11		Project reports due on 12/11
	12/14 – 12/18		Final Exam

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

Absences and Attendance

Students are responsible for attending class and for contributing to the learning environment of a course. Students are also responsible for knowing their course absence policies, which will vary by instructor. All absence policies, however, must uphold the UI policy related to student illness, mandatory religious obligations, including Holy Day obligations, military service obligations, unavoidable circumstances, or University authorized activities. Students may use the CLAS absence form to aid communication with the instructor who will decide if the absence is excused or unexcused. The form is on ICON in the top banner under "Student Tools." More information is at `https://clas.uiowa.edu/students/handbook/attendance-absences`.

Academic Integrity

All undergraduates enrolled in courses offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty. Misconduct is reported to the College, resulting in suspension or other sanctions, with sanctions communicated with the student through UI email. Visit this page for information: `https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code`.

Accommodations for Disabilities

UI is committed to an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as mental health, attention, learning, vision,

and physical or health-related condition) by registering with Student Disability Services (SDS). The student is then responsible for discussing specific accommodations with the instructor. More information is at `https://sds.studentlife.uiowa.edu/`.

Administrative Home of the Course

The College of Liberal Arts and Sciences (CLAS) is the administrative home of this course and governs its add/drop deadlines, the second-grade-only option, and related policies. Other colleges may have different policies. CLAS policies may be found here: `https://clas.uiowa.edu/students/handbook`.

Class Behavioral Expectations

Students are expected to comply with University policies regarding appropriate classroom behavior as outlined in the Code of Student Life. This includes the policies and procedures that all students have agreed to regarding the Steps Forward for Fall 2020 in response to the COVID-19 pandemic. Particularly, all students are required to wear a face covering when in a UI building, including a classroom. In addition, the density of seats in classrooms has been reduced; in some instances, this will allow 6 feet or more between students while other cases, it may be less. Regardless, wearing a face covering and maintaining as much distance as possible are vital to slowing the spread of COVID19. In the event that a student disrupts the classroom environment through their failure to comply with the reasonable directive of an instructor or the University, the instructor has the authority to ask that the student immediately leave the space for the remainder of the class period. Additionally, the instructor is asked to report the incident to the Office of Student Accountability for the possibility of additional follow-up. Students who need a temporary alternative learning arrangement related to COVID-19 expectations should contact Student Disability Services (`https://sds.studentlife.uiowa.edu/fall-2020/covid-19-temporary-learning-arrangements/`; +1 319 335-1462)

Class Recordings: Privacy and Sharing

Some sessions of a course could be recorded or live-streamed. Such a recording or streaming will only be available to students registered for the course. These recordings are the intellectual property of the faculty, and they may not be shared or reproduced without the explicit **written** consent of the faculty member. Students may not share these sessions with those not in the class; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and, in some cases, a violation of the Federal Education Rights and Privacy Act (FERPA).

Communication and the Required Use of UI Email

Students are responsible for official correspondences sent to their UI email address (uiowa.edu) and must use this address for all communication within UI (Operations Manual, III.15.2).

Complaints

Students with a complaint about an academic issue should first visit with the instructor or course supervisor and then with the Chair of the department or program offering the course; students may next bring the issue to the College of Liberal Arts and Sciences; see this page for more information: https://clas.uiowa.edu/students/handbook/student-rights-responsibilities.

Final Examination Policies

The final exam schedule is announced around the fifth week of classes; students are responsible for knowing the date, time, and place of a final exam. Students should not make travel plans until knowing this information. No exams of any kind are allowed the week before finals with very few exceptions made (for labs, ESL and some world language courses, and off-cycle courses): https://registrar.uiowa.edu/final-examination-scheduling-policies.

Nondiscrimination in the Classroom

The University of Iowa is committed to making the classroom a respectful and inclusive space for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited in MyUI to optionally share the names and pronouns they would like their instructors and advisors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University's Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity (https://diversity.uiowa.edu/eod; +1 319 335-0705).

Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community must uphold the UI mission and contribute to a safe environment that enhances learning. Incidents of sexual harassment must be reported immediately. For assistance, please see https://osmrc.uiowa.edu/.