

Syllabus: STAT 7620

Elements of Statistical Learning

Spring 2024

Course overview

Instructor: Yunzhang Zhu

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Office Hours: Wednesday and Friday 10:00 am - 10:55 am and by appointment (via email).

Grader: Hyoin An

Office Hours: by appointment only

email: an.355@osu.edu

Lectures: 2:20 pm - 3:40 pm, Cockins Hall - Room 232

Class website: This course has a web site on Carmen: <https://carmen.osu.edu>. You will find class notes, homework assignments, solutions, references and other course announcements on the website. Please check out the website on a regular basis.

Textbook: The Elements of Statistical Learning – Data Mining, Inference and Prediction, Hastie, T., Tibshirani, R., and Friedman, J. (2009), 2nd edition, Springer. The second edition (2009) is available as an eBook via the SpringerLink on the OSU library website. (See the course website on Carmen for access).

Course Description

Statistical learning or machine learning methodology explores various ways of estimating functional dependencies between a response variable and possibly a large set of explanatory variables (features), when one is trying to find and understand an unknown, regular component within the realm of noisy, complex data. Modern regression and pattern recognition analyses fall in this framework. This course will provide an overview of supervised learning and discussions of statistical learning algorithms such as Discriminant Analysis, Classification Tree, Support Vector Machines, and Boosting, and illustrate practical uses of the algorithms. In addition, this course will cover Deep learning, optimization, and language models.

Prerequisites

Prerequisites: Probability/Math/Statistics - STAT 6301/6302 or higher, or ECE 6001/7001, or equivalent, or permission of instructor. Familiarity with matrix algebra and linear regression analysis, and working knowledge of common high-level programming languages such as R or Python.

Course schedule (tentative)

Week	Topics
1	Overview and Linear Methods for Regression (Chapter 1 & 3)
2	Penalized Regression (Chapter 3)
3-4	Linear Methods for Classification (Chapter 4)
4-5	Basis Expansion & Kernel Smooth Methods (Chapter 5 & 6)
5-6	Model Assessment and Selection (Chapter 7)
7-9	Tree-Based Methods & Bagging and Boosting (Chapter 9 & 10)
10-11	Optimization
12	Support Vector Machines (Chapter 12)
13-14	Neural Networks (Chapter 11)
15	Language models

Class Attendance Policy

You are expected to attend all lectures.

Grading

Evaluations will be assigned on the basis of your performance on homework assignments a group project, and participation. The weights for each are as follows:

Assignment or category	Percentage
Homework	40%
Group project	50%
Participation	10%

All grades will be posted on Canvas. Your final letter grade for this course will then be determined by the OSU standard grading scale.

Homework Assignments

Homework will be assigned regularly (about every other week) throughout the semester. Homework will involve analytical exercises, computational work, and data analyses. Homework assignments and solutions will be posted on the course website. You should submit your work online. Due dates will be announced in class and on Carmen as well. No late homework will be accepted.

Project

A project will be a key component of the course, which will be completed in groups of about 3 to 4 students (depending on the enrollment size). Presentation and a project report are required for each group. Each group will be asked to choose a research article on advanced topics relevant to the course, provide a summary of the main idea, critically evaluate the idea with a simulation study or demonstrate its effectiveness with a novel application to real data.

Tentative Timeline for Project:

- Week 10: Select a topic and form a group.
- Week 11: Project proposal (1 page) due March 29

- Week 13: Preliminary report (up to 5 pages) due April 12
- Week 15: Project presentation video due April 26 (if time permitting, we may also schedule lightning talks at lecture time)
- Final report (up to 10 pages) due April 29

Participation

In addition to regular class participation, there will be several activities requiring your participation for building connections with the instructor and other students or formulating potential projects (e.g., proposing topics for project). These activities will be announced in class and on Carmen.

Health and safety

The Ohio State University Wexner Medical Center's Coronavirus Outbreak site (<https://wexnermedical.osu.edu/features/coronavirus>) includes the latest information about COVID-19 as well as guidance for students, faculty and staff. Guidelines and requirements for campus safety from the University's COVID-19 Transition Task Force were published on July 1 on the Safe and Healthy website (<https://safeandhealthy.osu.edu>).

Academic Integrity

Although students are encouraged to work together on homework assignments, each student must submit their own written work in his or her own words. Academic misconduct will not be tolerated and will be dealt with procedurally in accordance with University Rule (<http://oaa.osu.edu/procedures>).

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (<http://studentlife.osu.edu/csc/>).

Disability Statement

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614-292-3307; email: slds@osu.edu.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodation Statement

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Disclaimer

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advanced notice.