

Fall 2024 Course Syllabus:

STAT 536 - Statistical Learning and Data Mining

Professor	Jared D. Fisher, Ph.D.
Email	fisher@stat.byu.edu
Office	2189 WVB
Office Hour	Monday at 10:00 - 10:50 AM
Class	T/Th at 9:30 - 10:45 AM, in 1166 WVB

TA	Drew Millane
Email	amillane@student.byu.edu
Office	2179 WVB
Office Hours	M/W/F at 1:00 - 2:00 PM

COURSE PURPOSE: Using methods beyond linear regression, you will be able to choose the model best suited for a given scenario and present it to the audience of interest in a way that answers the research questions.

DESCRIPTION: Multiple linear regression, nonlinear regression, local regression, penalized regression, generalized additive models, logistic regression, discriminant analysis, support vector machines, tree-structured regression, neural networks/deep learning, multinomial classification.

PREREQUISITES: Enrollment in Statistics MS program.

LEARNING OUTCOMES: By the end of this course students should be able to:

1. Appropriately explore data to determine an appropriate statistical model.
2. Posit & explain an appropriate statistical model that answers questions related to a dataset.
3. Fit the posited statistical model to the data using statistical software.
4. Appropriately present model results and conclusions from the statistical analysis.
5. Be comfortable submitting a written or oral report of a statistical analysis.

LEARNING METHODS: The following learning methods will be applied in this class.

1. Out-of-class Case Studies (40% of final grade):
 - (a) Submitted in two phases over two weeks (every Tuesday by 9am): first is the proposal, then the full report.
 - (b) Written reports must be no more than 5 single-spaced pages. They may be done in L^AT_EX, Markdown, Quarto, etc. **Do not include code in your report.**

- (c) At least 1 but no more than 3 case studies can be submitted as a 20 minute oral presentation to the professor. Oral presentations must be approved by the professor before the due date. For oral reports, a copy of the slides must be submitted by the deadline. The professor reserves the right to deny permission to submit an oral report. **Do not include code in the oral report.**
 - (d) Except for the midterm and final case study, students can work with 1 other partner on a case study (two people total). If you choose to work with a partner, I reserve the right to deduce points if the work was not distributed evenly (see the grading rubric). If you choose to work with a partner on a case study, you may not work with that student on a case study again.
 - (e) A grading rubric for case study reports is available on the course webpage, Canvas. The same rubric will be used for oral and written reports.
 - (f) No credit will be given for late reports unless the instructor has given prior consent.
2. Midterm Case Study (30% of final grade): The midterm case study will be a written report of a case study. The grading rubric will be the same as that used for the case studies. Students may not collaborate on the midterm case study. The midterm case study will be given on October 15 and due October 22.
 3. Final Case Study (30% of final grade): The final case study will be an oral presentation of no more than 30 minutes given during finals week to the professor. Students may not collaborate on the final case study. Failure to complete the final case study will result in an incomplete for the course. The final case study will be given on December 10 and presented to Dr. Fisher during finals week.

COURSE MATERIALS: The *required* course textbook will be

- An Introduction to Statistical Learning with Applications in R by G. James, D. Witten, T. Hastie and R. Tibshirani (free pdf at <https://www.statlearning.com/>).

Other course materials include:

- An Introduction to Statistical Learning with Applications in Python by G. James, D. Witten, T. Hastie and R. Tibshirani (free pdf at <https://www.statlearning.com/>).
- Computer Aged Statistical Inference by B. Efron and T. Hastie (free at <http://web.stanford.edu/hastie/CASI/>)
- The Elements of Statistical Learning by T. Hastie and R. Tibshirani and J. Friedman (2009) 2nd Edition.
- Extending the Linear Model with R by J. Faraway, 2nd ed.

CODING: This class will primarily use R. I provide some list of functions to help you implement the analyses in R and the ISLR book gives nice tutorials. However, python also provides nice toolkits to do many of the things that we will be doing in this class so you can use python if you want.

OTHER IMPORTANT DATES TO BE AWARE OF:

- September 12 - STEM Career Fair prep workshop
- September 19 - STEM Career Fair (fall)
- September 26 - Data Science + Actuarial Career Fair
- September 26 - Career Fair prep workshop
- October 3 - BYU Career Fair (fall)
- October 17 - Fall Graduate School Fair

COURSE POLICIES AND EXPECTATIONS:

1. Please put all computers, phones, etc. away during class, unless of course you are working with the code/data/etc. along with the lesson.
2. Students are expected to participate in class by asking questions, answering questions, and providing useful discussion with other students.

UNIVERSITY POLICIES AND THIS COURSE:

Everything below can be summarized by the two great commandments in Matthew 22:37-39

1. Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind.
2. Thou shalt love thy neighbour as thyself.

Note that the second one is basically the golden rule. Also note that this applies to yourself(!), particularly with respect to mental health, basic needs, and investing in the homework problems to really learn the material.

- Honor Code: BYU is an incredible place where we all can strive to live and learn with the Spirit with us. President Boyd K. Packer said: “If all you know is what you see with your natural eyes and hear with your natural ears, then you will not know very much.” As we’ve all committed to live the Honor Code, we need to do so to qualify for that blessing. It is the university’s expectation, and my own expectation in this class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 801-422-2847 if you have questions about those standards.
 - Academic Honesty In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work, which means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. For example, in this class, you may figure out homework problems with others, but you must write up your own solutions (in fact I would encourage you to figure out as much on your own as you can, because that’s what the exams will be!). Violations of this principle will result in a 0 on that assignment and being reported to the appropriate university office.
 - Dress and Grooming Standards Students are also expected to adhere to the Dress and Grooming Standards, which we have all committed to. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment.

- Intellectual Property: All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, slides, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code and likely the law.
- Preventing & Responding to Sexual Misconduct. In accordance with Title IX of the Education Amendments of 1972, Brigham Young University prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment, including sexual violence committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.

University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or 801-422-8692. Reports may also be submitted through EthicsPoint at <https://titleix.byu.edu/report> or 1-888-238-1062 (24-hours a day).

BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university's Sexual Misconduct Policy, reporting requirements, and resources can be found at <http://titleix.byu.edu> or by contacting the university's Title IX Coordinator.
- Student Disability: Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 801-422-5895 or D-285 ASB.
- Life... When things are happening that make school (and life!) more challenging than it's suppose to be, please know there are resources that can help. Of course, please discuss any needs with me (Dr. Fisher), and I'll do my best to connect you with the resources that can help.
 - Mental Health: BYU Counseling and Psychological Services (CAPS) (1500 WSC, 801 422 3035, caps.byu.edu). CAPS provides individual, couples, and group counseling, as well as stress management services.
 - Basic Needs: If you are struggling with regular food or safe/stable housing, please contact the Dean of Students at <http://deanofstudents.byu.edu> or 801-422-2731 or deanofstudents@byu.edu or 3500 WSC. Another valuable resource, whether or not you are a

member, is your local bishop of the Church of Jesus Christ of Latter-Day Saints. Again, feel free to talk to me if you'd like someone to help initiate these conversations.