Course Syllabus: Machine Learning Applications

Dillard College of Business Administration
BUAD 5643 – Online
Fall 2026

Contact Information

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Course Description

This graduate course introduces students to statistical learning: the set of tools used to extract patterns from data and to build models that predict outcomes on data the model has not seen. Students will study both regression and classification methods, along with the resampling and regularization techniques used to evaluate and improve them, and will implement each method in Python. The emphasis throughout is on intuition and judgment — understanding what a method assumes, when it is appropriate, and how to interpret and communicate its output — rather than on statistical derivation. No prior Python experience is assumed; the course also serves as a working introduction to the Python language.

General Learning Goals

- Demonstrate critical thinking and problem solving by selecting, applying, and defending appropriate statistical learning techniques for a given business problem, through homework assignments and exams.
- Communicate quantitative analyses and their limitations in a professional manner to audiences with varying levels of technical background.
- Integrate statistical evidence with knowledge from other business disciplines — finance, marketing, management, and accounting — to support decision making under uncertainty.
- Evaluate model output critically, distinguishing predictive accuracy from causal interpretation and recognizing when a model's assumptions have been violated.

Course-Specific Learning Goals

By the end of the course, students will be able to:

- Distinguish supervised from unsupervised learning, prediction from inference, and parametric from non-parametric approaches, and explain the tradeoff between model flexibility and interpretability.
- Explain the bias-variance tradeoff and use training and test error to diagnose overfitting and underfitting.
- Estimate and interpret simple and multiple linear regression models, including models with qualitative predictors, interaction terms, and non-linear transformations.
- Diagnose common regression problems — collinearity, heteroskedasticity, correlated errors, outliers, and high-leverage observations — and describe appropriate remedies.
- Apply K-nearest neighbors to both regression and classification problems and explain how the choice of K governs model flexibility.
- Estimate and interpret logistic and multinomial logistic regressions, including the interpretation of odds and log-odds.
- Apply generative classifiers — linear discriminant analysis, quadratic discriminant analysis, and naïve Bayes — and explain how their assumptions differ from those of logistic regression.
- Evaluate classifier performance using the confusion matrix, sensitivity and specificity, threshold selection, and the ROC curve and area under the curve.
- Implement validation-set, leave-one-out, and k-fold cross-validation, and explain the tradeoffs among them.
- Use the bootstrap to quantify uncertainty in estimates where analytical standard errors are unavailable.
- Explain the high-dimensional problem and apply ridge and lasso regression, including selection of the tuning parameter by cross-validation and the reason lasso performs variable selection.
- Apply principal component analysis and principal component regression as dimension reduction techniques, and describe the interpretability cost they carry.
- Implement all of the above in Python and produce clear, reproducible, well-documented analyses.

Textbook & Instructional Materials

We will use the following free textbook: An Introduction to Statistical Learning.
You will need to download Python 3 onto your computer.
You will need to submit python scripts for homework. I recommend using Spyder on Anaconda.
You will need a two working webcams (or one webcam and a smart phone) to use Lockdown Browser and Respondus Monitor.

Student Handbook

Refer to: Student Handbook

Academic Misconduct Policy & Procedures

Academic Dishonesty: Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted techniques of crediting, or the submission for credit of work not the individual's to whom credit is given). Additional guidelines on procedures in these matters may be found in the Office of Student Conduct.
Office of Student Conduct

Moffett Library

Moffett Library provides resources and services to support student's studies and assignments, including books, peer-reviewed journals, databases, and multimedia materials accessible both on campus and remotely. The library offers media equipment checkout, reservable study rooms, and research assistance from librarians to help students effectively find, evaluate, and use information. Get started on this Moffett Library webpage to explore these resources and learn how to best utilize the library.

Grading

Course Grade - List all graded assignments with their point value and or percentage of total grade. Letter Grade Scale indicate the overall points or % to letter grade scale for example 1270 to 1137 = A.

Table 1: Points allocated to each assignment

Assignments	**Points**
Quizzes (5 quizzes at 2.5 pts each)	12.5
Coding Homework (5 homework at 1.25 pt each)	6.25
Exam 1	25
Exam 2	25
Final Project - Brainstorming	1.25
Final Project - Proposal	6
Final Project – Update 1	6
Final Project – Update 2	6
Final Project – Final Report	12
Total Points	**100**

Table 2: Total points for final grade.

Grade	**Points**
A	90+
B	80 to 89.9
C	70 to 79.9
D	60 to 69.9
F	Less than 60

Coding Homework

Coding homework will be due on Fridays of weeks 2, 4, 6, 8, and 10 at 11:59pm. They are worth 1.25 point each. You will need to upload a Python script to the appropriate place in D2L.

Quizzes

Quizzes will be on Fridays of week, 2, 3, 5, 8, and 9 at 11:59pm. They are worth 25 points each. These quizzes will be similar to exam questions. You should treat them like homework. You will take the quizzes online on D2L.

Exams

There will be two online exams. The midterm exam will be held during week 7 and the final exam will be held during week 11. Each exam will be worth 25 points. You will be given roughly 1.5 hours to complete the exam. You will have to use Lockdown Browser as well as Respondus Monitor during the exam.

Cheating

Students are not allowed to capture the exam questions by any means while taking the exam. During the exam, collaboration between/among students, using any artificial intelligence (such as ChatGPT) virtual machine, AI glasses, or any unsanctioned software/browser extension in any way will be considered cheating and will result in an exam grade of zero.

Exam Camera and Sound Requirement

All exams must be completed using Respondus Monitor with two cameras and audio enabled.

The first camera must provide a clear view of your face throughout the exam. The second camera must be positioned to provide a clear side view showing your profile, hands, desk/workspace, and computer screen during the entire exam. It should be roughly three feet away from your body. The purpose of the second camera is to allow the exam environment and use of the computer to be monitored from a different angle.

Students are responsible for positioning and testing their cameras and microphone before beginning the exam. Both camera views and audio must remain available for the entire exam.

Failure to provide the required camera views or audio will not necessarily, by itself, be considered cheating or academic misconduct. However, compliance with these requirements is a condition of taking the exam. A student who is unwilling or unable to provide the required camera views and audio will be considered as refusing to sit the exam.

If you do not take the first exam, the grade on the second exam can replace the missed first exam grade.

Final Project

Students are expected to create teams of 1-4 students for final projects. Project proposals, progress reports, and final submission will be part of the process. All people in groups are expected to contribute. This is your opportunity to demonstrate what you have learned in ways that reach beyond the simple coding assignments. Students commonly find a unique and complex dataset and apply the techniques presented in class to those datasets. Ask yourself what you would

want to show an employer in order to demonstrate what you have learned in this course. The project is divided into five parts.

Late Work

I do not accept late work after the answers have been posted.

Make Up Work/Tests

If you miss the first exam, your score on the second exam will replace it.

Important Dates

- Last day for term schedule changes: Check date on Academic Calendar.
- Deadline to file for graduation: Check date on Academic Calendar.
- Last Day to drop with a grade of "W:" Check date on Academic Calendar.
- Refer to: Drops, Withdrawals & Void

Desire-to-Learn (D2L)

Extensive use of the MSU D2L program is a part of this course. Each student is expected to be familiar with this program as it provides a primary source of communication regarding assignments, examination materials, and general course information. You can log into D2L through the MSU Homepage. If you experience difficulties, please contact the technicians listed for the program or contact your instructor.

Online Computer Requirements

Taking an online class requires you to have access to a computer (with Internet access) to complete and upload your assignments. It is your responsibility to have (or have access to) a working computer in this class. ***Assignments and tests are due by the due date, and personal computer technical difficulties will not be considered reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings.*** Computers are available on campus in various areas of the buildings as well as the Academic Success Center. ***Your computer being down is not an excuse for missing a deadline!!** There are many places to access your class! Our online classes can be accessed from any computer in the world which is connected to the internet. Contact your instructor immediately upon having computer trouble If you have technical difficulties in the course, there is also a student helpdesk available to you. The college cannot work directly on student computers due to both liability and resource limitations however they are able to help you get connected to our online services. For help, log into D2L**.**

Recording Classes

Recording classes is generally prohibited without the professor's explicit permission. Such recordings, when permitted, are for personal use only and may not be uploaded to the internet or otherwise shared, transmitted, or published without the professor's prior consent. Some faculty may not permit recordings of their classes. When it is feasible and appropriate, students may record classes to accommodate disabilities under the Americans With Disabilities Act, with prior approval of Disability Support Services. Such recordings may not be uploaded to the internet or otherwise shared, transmitted, or published.

Change of Schedule

A student dropping a course (but not withdrawing from the University) within the first 12 class days of a regular semester or the first four class days of a summer semester is eligible for a100% refund of applicable tuition and fees. Dates are published in the Schedule of Classes each semester.

Refund and Repayment Policy

A student who withdraws or is administratively withdrawn from Midwestern State University (MSU) may be eligible to receive a refund for all or a portion of the tuition, fees and room/board charges that were paid to MSU for the semester. HOWEVER, if the student received financial aid (federal/state/institutional grants, loans and/or scholarships), all or a portion of the refund may be returned to the financial aid programs. As described below, two formulas (federal and state) exists in determining the amount of the refund. (Examples of each refund calculation will be made available upon request).

Services for Students with Disabilities

In accordance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Midwestern State University endeavors to make reasonable accommodations to ensure equal opportunity for qualified persons with disabilities to participate in all educational, social, and recreational programs and activities. After notification of acceptance, students requiring accommodations should make application for such assistance through Disability Support Services, located in the Student Wellness Center, (940) 397-4140. Current documentation of a disability will be required in order to provide appropriate services, and each request will be individually reviewed. For more details, please go to Disability Support Services.

Emergency Aid Resources for Basic Needs

Unexpected life circumstances can affect anyone. If you are experiencing challenges meeting basic needs—such as housing, utilities, food, transportation, healthcare, technology, textbooks or other life necessities, resources may be available to help. Visit the Student Emergency Support and Resources webpage

to learn more, and explore emergency support opportunities through MSU and how to access them. For additional information, please contact the Office of Student Affairs: Clark Student Center #108, (940) 397-7500, student.affairs@mstuexas.edu.

College Policies

Campus Carry Rules/Policies

Refer to: Campus Carry Rules and Policies

Smoking/Tobacco Policy

College policy strictly prohibits the use of tobacco products in any building owned or operated by WATC. Adult students may smoke only in the outside designated-smoking areas at each location.

Alcohol and Drug Policy

To comply with the Drug Free Schools and Communities Act of 1989 and subsequent amendments, students and employees of Midwestern State are informed that strictly enforced policies are in place which prohibits the unlawful possession, use or distribution of any illicit drugs, including alcohol, on university property or as part of any university-sponsored activity. Students and employees are also subject to all applicable legal sanctions under local, state and federal law for any offenses involving illicit drugs on University property or at University-sponsored activities.

Campus Carry

Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes has prohibited. The new Constitutional Carry law does not change this process. Concealed carry still requires a License to Carry permit, and openly carrying handguns is not allowed on college campuses. For more information, visit Campus Carry.

Active Shooter

The safety and security of our campus is the responsibility of everyone in our community. Each of us has an obligation to be prepared to appropriately respond to threats to our campus, such as an active aggressor. Please review the information provided by MSU Police Department regarding the options and strategies we can all use to stay safe during difficult situations. For more information, visit MSUReady – Active Shooter. Students are encouraged to watch the video entitled "*Run. Hide. Fight.*" which may be electronically accessed via the University police department's webpage: *"Run. Hide. Fight."*

Grade Appeal Process

Update as needed. Students who wish to appeal a grade should consult the Midwestern State University MSU Catalog

*__Notice:__ Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor.

Course Schedule:

Week	Dates	Topic	Assignments
1	8/26-8/29	Statistical Learning	
2	8/30-9/5	Statistical Learning	• Quiz 1 • Coding 1
3	9/6-9/12	Linear Regression	• Quiz 2
4	9/13-9/19	Linear Regression	• Coding 2
5	9/20-9/26	Classification	• Quiz 3
6	9/27-10/3	Classification	• Coding 3
7	10/4-10/10		• Exam 1
8	10/11-10/17	Resampling	• Quiz 4 • Coding 4
9	10/18-10/24	Shrinkage and PCA	• Quiz 5 • Brainstorming
10	10/25-10/31	Shrinkage and PCA	• Coding 5
11	11/1-11/7		• Exam 2
12	11/8-11/14	Final Project	• Proposal
13	11/15-11/21	Final Project	• Update 1
14	11/22-11/28	Thanksgiving Break	
15	11/29-12/5	Final Project	• Update 2
16	12/6-12/12	Final Project	• Project Report