Practical Machine Learning
DATA-4810 and PECN-6810
Spring 2026: 01/12/2026- 05/07/2026
Class Hours: Tues/Thurs, 12:30am – 1:45pm
Location: Norman Mayer, 200B

Instructor: John Levendis
Office Location: Howard-Tilton Memorial Library B20
Email: jlevendis@tulane.edu
Office hours: Please see Module 0 in the course's Canvas page for the latest office hours.

Course Description

This course provides a practical introduction to machine learning with minimal mathematical theory. Students will learn to select appropriate models for different problems, build and evaluate models using modern statistical software, and effectively communicate results to non-technical audiences. The course emphasizes hands-on application and interpretation of machine learning. (3 credit hours)

Prerequisites: DATA 3520 or similar (such as Econometrics from Econ, or something from the stats department like MATH 3080)
Meeting Time: 3 hours per week

Course Learning Goals: By the end of this course, students will:
- Understand when and why to use machine learning in real-world contexts
- Appreciate the tradeoffs between model complexity, interpretability, and performance
- Develop intuition for matching modeling approaches to business problems
- Recognize the importance of proper validation and the dangers of overfitting
- Gain confidence in their ability to conduct independent data analysis projects

Course Learning Objectives: By the end of this course, students will be able to:
- Build and evaluate at least 5 different types of ML models in R
- Calculate and interpret standard performance metrics
- Implement k-fold cross-validation to properly assess model performance
- Engineer at least 5 meaningful features from raw data
- Select appropriate models based on bias-variance tradeoff considerations
- Diagnose overfitting and apply at least 2 strategies to address it
- Create professional visualizations to communicate model results
- Write 6-10 page analysis reports explaining model choices and results to non-technical audiences
- Present ML findings in 10-minute presentations using appropriate visual aids
- Complete full ML pipelines from data cleaning through final predictions and presentation of conclusions

Required Software/Packages

- R (latest version), RStudio (latest version)

Required textbook:

- Nwanganda, Fred and Mike Chapple (2020). Practical Machine Learning in R. Wiley. ISBN: 9781119591511

Supplemental (free online):

- James, Witten, Hastie & Tibshirani. *Introduction to Statistical Learning.* www.statlearning.com

Criteria for Assigning Course Grades:

Your course grade is determined by five equally weighted components:

Item	Weight
Problem Set avg	0.20
Exam I on regression	0.20
Project I on regression	0.20
Exam II on classification	0.20
Project II on classification	0.20

Grade	Percent
A	100% to 93%
A-	< 93% to 90%
B+	< 90% to 87%
B	< 87% to 83%
B-	< 83% to 80%
C+	< 80% to 77%
C	< 77% to 73%
C-	< 73% to 70%
D+	< 70% to 67%
D	< 67% to 63%
D-	< 63% to 60%
F	< 60% to 0%

Week by Week Schedule

No.	Week of	Topic
1	Jan 12 - Jan 18	Introduction to R and Machine Learning
2	Jan 19 - Jan 25	Intro to R - Data Preparation & Feature Engineering
3	Jan 26 - Feb 1	Introduction to Regression and CV
4	Feb 2 - Feb 8	Advanced linear models (interactions and polynomials)
5	Feb 9 - Feb 15	Model Selection and Regularization
6	Feb 16 - Feb 22	MARDI GRAS HOLIDAY, NO CLASS ON TUESDAY
		In-class regression presentations
7	Feb 23 - Mar 1	Regression projects due. Class presentations.
		Exam 1 (regression)
8	Mar 2 - Mar 8	Logistic regression

9	Mar 9 - Mar 15	Classification metrics
10	Mar 16 - Mar 22	Decision Trees
11	Mar 23 - Mar 29	SPRING BREAK. NO CLASSES
12	Mar 30 - Apr 5	Ensembles I - Bagging and Random Forests
13	Apr 6 - Apr 12	Ensembles II - Boosting
14	Apr 13 - Apr 19	NO CLASS ON TUESDAY APR 15
		k-Nearest Neighbors
15	Apr 20 - Apr 26	Neural Networks. Presentations
16	Apr 27 - Apr 29	Presentations continued
17	May 2 - May 7	EXAM WEEK
		Exam 2 (classification)

Problem Sets

Problem Sets will require you to apply some of the concepts from classroom using R (or Python). You should begin working on these as early as possible. **I will drop your lowest Problem Set grade**. Students should expect to complete the following problem sets:

Problem Set 1: R basics and data exploration
- Load a provided dataset
- Create summary statistics
- Generate meaningful visualizations
- Write interpretations of patterns found

Problem Set 2: Data preparation, feature creation, and the bias-variance tradeoff
- Handle missing data appropriately
- Engineer meaningful features
- Demonstrate bias-variance tradeoff with polynomial regression
- Interpret the relationship between complexity and performance

Problem Set 3: Regression model comparison
- Build multiple regression models
- Select optimal regularization parameters
- Compare model performance
- Explain which features were selected and why

Problem Set 4: Classification fundamentals
- Implement logistic regression
- Calculate and interpret all classification metrics
- Create ROC curves
- Compare different probability thresholds

Problem Set 5: Tree-based models

- Build and prune decision trees
- Implement random forests
- Compare interpretability vs. accuracy
- Analyze feature importance

Problem Set 6: Advanced classification
- Implement k-NN with optimal k
- Build a simple neural network
- Compare all classification methods
- Write recommendations for method selection

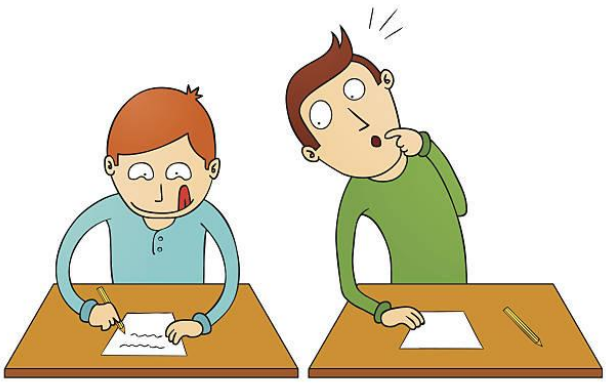
Additional Expectations:

Civility: Please be civil in all interactions with your classmates and instructors. Classroom behavior that interferes with either (a) the instructor's ability to conduct the class or (b) the ability of students to benefit from the instruction is not acceptable. Examples may include routinely entering class late or departing early; talking while others are speaking; or arguing in a way that is perceived as "crossing the line of civility."

Lateness: If you are habitually late to class, you will be asked to leave and you will be marked as absent.

Email: I communicate with the class via Canvas email. Please make sure that your email address as listed in Canvas is correct, and that you **monitor your emails daily**.

Code of Academic Conduct



The Code of Academic Conduct applies to all Newcomb-Tulane College students at Tulane University. Students enrolled in the School of Professional Advancement (SoPA) have a separate Code. Tulane University expects and requires behavior compatible with its high standards of scholarship. By accepting admission to the university, a student accepts its regulations (i.e., Code of Academic Conduct , Code of Student Conduct and Code of Integrity) and acknowledges the right of the university to take action, including suspension or expulsion, for conduct judged unsatisfactory or disruptive. School of Professional Advancement Code of Academic conduct

Unless I indicate differently on instructions, all assignments and exams are to be completed individually and without any study aid, including textbooks, class notes, or online sites. If you

have any question about whether a resource is acceptable, you must ask the instructor rather than assume.

Accessibility and Accommodations Statement

Tulane University is committed to offering classes that are accessible. If you anticipate or encounter disability-related barriers in a course, please contact the Goldman Center for Student Accessibility to establish necessary accommodations. If approved by Goldman, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. I will never ask for medical documentation from you to support potential accommodation needs. Goldman Center contact information: Email: goldman@tulane.edu; Phone (504) 862-8433; Website: accessibility.tulane.edu.

Welcoming Community Statement

Tulane's core value of "welcoming community" means that we cultivate classrooms and other learning spaces where students, faculty, and staff across the broadest array of backgrounds, experiences, and perspectives can thrive and reach their full potential. In this classroom, we encourage and empower you to participate in building this supportive environment for every member of our community, which requires practicing humility when engaging across differences and acknowledging the perspectives of people who may have divergent or similar viewpoints. Please read the expectations set forth in the Tulane University Student Code of Student Conduct and Tulane's Antidiscrimination Statement.

Religious Accommodation Policy

Per Tulane's religious accommodation policy as stated at the bottom Tulane's academic calendar, I will make every reasonable effort to ensure that students are able to observe religious holidays without jeopardizing their ability to fulfill their academic obligations. Excused absences do not relieve the student from the responsibility for any course work required during the period of absence. Students should notify me within the first two weeks of the semester about their intent to observe any holidays that fall on a class day or on the day of the final exam.

AI Statement

In this course, the use of artificial intelligence (AI) tools such as Grammarly, ChatGPT, Claude, DALL-E, or any other automated content generators is strictly prohibited. All assignments must be completed independently by the student, and any submission found to have been generated by AI will be treated as a violation of the academic integrity policy. This includes using AI as an idea generation tool. The development of your analytical and writing skills is a core component of this course, and reliance on AI tools undermines this learning process.

Title IX

Tulane University recognizes the inherent dignity of all individuals and promotes respect for all people. As such, Tulane is committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, intimate partner violence, and stalking. If you (or someone you know) has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available: you can learn more at allin.tulane.edu.

Disclosures of gender-based discrimination
To comply with the requirements of Title IX of the Education Amendments of 1972, Tulane University requires all faculty members to report incidents of gender-based discrimination. Please know that if you choose to confide in me, I am required by the university to share your disclosure in a Care Connection to the Office of Case Management and Victim Support Services to be sure you are connected with all the support the university can offer. The Title IX Coordinator is also notified of these disclosures. You choose whether or not you want to meet with these offices. You can also make a disclosure yourself, including an anonymous report, through the form at tulane.edu/concerns.

Statement on Confidentiality and Privacy
Tulane University is committed to protecting the privacy of all individuals involved in a disclosure of gender-based discrimination. Any and all of your communications on these matters will be treated as either "Confidential" or "Private."

Confidential	**Private**
Except in extreme circumstances, involving imminent danger to one's self or others, nothing will be shared without your explicit permission. ▪ Counseling & Psychiatric Services (CAPS) | (504) 314-2277 ▪ The Line (24/7) | (504) 264-6074 ▪ Student Health Center | (504) 865-5255 ▪ Sexual Aggression Peer Hotline and Education (SAPHE) | (504) 654-9543	*Conversations are kept as confidential as possible, but information is shared with key staff members so the University can offer resources and accommodations and take action if necessary for safety reasons.* ▪ Case Management & Victim Support Services | (504) 314-2160 or srss@tulane.edu ▪ Tulane University Police (TUPD) | Uptown - (504) 865-5911 | Downtown – (504) 988-5531 ▪ Title IX Office & Title IX Coordinator | (504) 865-5611 or titleix@tulane.edu ▪ Student Affairs Professional On-Call (24/7) | (504) 920-9900

Title IX Safeguards for Pregnant and Parenting Students

Title IX also provides reasonable protections and support for pregnant and parenting students. Discrimination on the basis of a student's pregnancy, childbirth, false pregnancy, termination of pregnancy, or recovery from any of the previous conditions is prohibited by Title

IX, and Tulane is committed to providing equal access to academic programs and extracurricular activities to students who might be, are, or have been pregnant. If you need support related to a pregnancy or any of the previously listed conditions, visit pregnancy.tulane.edu for more information, including a list of resources. Student who believe that they may have experienced pregnancy discrimination can file a complaint with the Title IX Office by contacting 504-865-5611 or titleix@tulane.edu, visiting the office in Jones Hall 308, or filing a report at Tulane.edu/concerns.

Emergency Preparedness & Response

EMERGENCY NOTIFICATIONS: TU ALERT	**SEVERE WEATHER**
In the event of a campus emergency, Tulane University will notify students, faculty, and staff by email, text, and/or phone call. You were automatically enrolled in this system when you enrolled at the university. Check your contact information annually in Gibson Online to confirm its accuracy.	▪ Follow all TU Alerts and outdoor warning sirens ▪ Seek shelter indoors until the severe weather threat has passed and an all-clear message is given ▪ Do not use elevators ▪ Do not attempt to travel outside if weather is severe Monitor the Tulane Emergency website (tulane.edu/emergency/) for university-wide closures during a severe weather event
ACTIVE SHOOTER / VIOLENT ATTACKER	**EVERBRIDGE APP**

From: Tulane Office of Emergency Preparedness and Response

Terms of Use:

A student's continued enrollment in this course signifies acknowledgment of, and agreement with, the statements, disclaimers, policies, and procedures outlined within this syllabus and elsewhere in the Canvas environment. This Syllabus is a dynamic document. Elements of the course structure (e.g., dates and topics covered, but not policies) may be changed at the discretion of the professor.