Agricultural and Applied Economics (AAE)
AAE 722 Machine Learning in Applied Economic Analysis

1. Administrative Details

Credits:	4
Instructional Mode:	In-Person
Day & Time:	T/TH 11:00 am-12:15 pm; F 9:50 -11:45 am;
Semester:	Fall
Dates:	September 3 - December 10, 2025
Room:	Taylor Hall B30

Course Designations and Attributes: General education

Instructor:	Jing Yi, PhD
Contact:	jing.yi@wisc.edu
Office:	218 Taylor Hall
Office hours:	Wednesday 11:00 am – 12:00 pm or by appointment
Class website:	Canvas

Teaching Assistant:	Pragya Mittal
Contact:	pmittal8@wisc.edu
Office hours:	12-2pm on Wednesdays, AAE rm314

Feel free to reach out to me by email if you have any questions or concerns. I'll do my best to respond within 24 hours, so don't hesitate to send a follow-up if you don't hear back from me in that time.

You're also welcome to drop by during my office hours.

2. Course Description

This course provides a fundamental and practical approach to machine learning methods tailored for addressing contemporary economic challenges using large datasets. Building on their knowledge of econometric models, students will master advanced techniques, including regression model selection and regularization, tree-based methods, support vector machines, and neural networks. Emphasizing the development of job-relevant skills, the course offers hands-on experience with industry-standard tools such as Python and GitHub. Students will apply these techniques to real-world scenarios, enabling them to make data-driven decisions in dynamic business environments. By the end of the course, students will have acquired both a solid theoretical foundation and practical experience in using machine learning to solve complex economic and business problems.

3. Requisites

AAE 636 or Econ 704

4. Learning Outcomes

1) Describe and explain the mechanics of the basic machine learning methods.
2) Employ data exploration and visualization tools for analyzing large amounts of data.
3) Select models and conduct post-selection inference of high-dimensional data.
4) Apply machine learning methods on large data sets for economic or policy analysis.
5) Demonstrate the ability to use the Python statistical package for the methods covered in the course.

5. Grading

The final grade for the class will be calculated using the following weights:

Participation (lecture sessions, >25 class meetings)	3.5%
Lab: 13 Assignments (participation not required)	6.5%
Four Homework Assignments (5% each)	20%
Four Quizzes (10% each)	40%
Final Exam	15%
Final project	15%
Proposal	5%
Presentation	5%
Final Report	5%

Note: Bonus points (5%) are available during lectures, quizzes, and exams.

The final grade will be determined by the following percentages:

Letter Grade	Percentage
A	93-100%
AB	88-92.99%
B	83-87.99%
BC	78-82.99%
C	70-77.99%
D	60-69.99%
F	0-59.99%

6. Laboratory Session

The computer lab session will be led by TA to go over the Python coding examples associated with the data exploration, visualization, and machine learning methods covered in the lectures. Remember to submit your code before Sunday 11:59 pm (Central Time).

7. Textbook & Software

Readings will be assigned from:

James, Gareth, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2021. An Introduction to Statistical Learning with Application in Python. Springer. (JWHT). The electronic version is available heherre

For reference and coding examples, the following books are useful:

Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. 2009. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. 2nd Ed. Springer (HTRJ). The electronic version is available here.

Aurélien Géron. 2019. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. 2nd Ed. O'Reilly (Géron).

Matt Taddy. 2019. Business Data Science. McGraw Hill. (Taddy)
Angrish, J.D., and J. Pischke. 2009. Mostly Harmless Econometrics: An Empiricist's Companion. (Angrish) Scott Cunningham. 2021. Causal Inference: The Mixtape. (Cunningham)
https://mixtape.scunning.com/

8. Exams and Final Project

Final project will allow you to apply what you have learned in class to a selected topic, more detail of which will be announced at the beginning of week 4. You are recommended to work in a group with no more than 2 people. Each group will submit a written report with project description, model construction and result analysis. **Group presentations will be held during the last week of class.**

Make-up exams will be given only under extenuating circumstances, for which appropriate documentation will be required, and if advance arrangements are made with the instructor.

9. Homework

Each student must complete each assignment independently. Late homework and lab assignments will receive a 25% and 50% deduction from the full grade, respectively, for each day they are late, unless the student has obtained prior permission or there is an unforeseen emergency. In both cases, written notification from your advisor or doctor will be required.

Additionally, every student is granted a **one-time waiver**: if an assignment is submitted within 12 hours after the deadline, no points will be deducted.

10. Course Structure and Tentative Schedule

1. Introduction (week 1)
2. Statistical Learning (week 2)
3. Linear Regression (week 2-3)
4. Classification (week 4)
5. Resampling Methods (week 5)
6. Linear Model Selection and Regularization (week 6)
7. Moving Beyond Linearity (week 7)
8. Tree-Based Methods (week 8)
9. Support Vector Machines (week 9)
10. Neural Networks (week 10)
11. Survival Analysis and Censored Data (week 11)
12. Unsupervised Learning (week 12)
13. Multiple testing (week 14)

11. Academic Integrity

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

12. Accommodations for Students with Disabilities

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform me of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. I will work either directly with the you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

13. Diversity & Inclusion

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world. https://diversity.wisc.edu/