

ECON 522**Course Syllabus****Applied Machine Learning in Economics****Credits:** 4 graduate hours**Semester:** Spring 2026**Meeting Times:** TR 2:00 – 3:20 PM

This course is a full-semester, 4-credit-hour course. In accordance with university guidelines, students should expect to spend a minimum of **8 hours per week** on coursework outside of scheduled class time. This includes activities such as reading, completing assignments, working on projects, and preparing for exams. For more information, please refer to the university's policy on [Assigning Credit Hours](#).

Course Description

Overview of different concepts, techniques, and algorithms in machine learning with a view towards applications in economics. Topics covered include regression, classification, model selection, predictive accuracy such as regularized regression, decision trees, boosting, support vector machines, and neural networks. Students acquire the skills to apply basic machine learning methods to solve economics problems.

Prerequisites: ECON 500 and ECON 502**Learning Outcomes**

- **Specialized Knowledge and Practical Application:** Econ students will develop specialized machine learning techniques and quantitative skills that can be applied to a variety of empirical problems to real world situations.
- **Quantitative Reasoning:** Econ students will learn how to analyze relevant data to obtain prediction of economic outcomes. Specifically, they may obtain datasets of very large size with excessively large number of variables, clean the dataset, apply and compare a menu of methods to predict the outcome of interest and decide on the important predictors using appropriate machine learning techniques.
- **Analytical Skills/Problem-Solving:** Econ students will address problems that do not have a clear answer. Specifically, using statistical learning methods students learn how to predict outcomes and discover the few important predictors even in cases the economic theory does not offer clear guidance.

Learning Resources

The main text of the course is:

- (ISLR) An Introduction to Statistical Learning, (with Applications in R), 2nd ed, by James, Witten, Hastie, Tibshirani.
The text is freely available at: <https://www.statlearning.com/>.
A version of the text with applications in Python is available:
- (ISLP) An Introduction to Statistical Learning, (with Applications in Python), by James, Witten, Hastie, Tibshirani, Taylor.
- (Optional) For a deeper treatment on the fundamentals of statistical machine learning you can consult: The Elements of Statistical Learning, by Hastie, Tibshirani, Friedman.
It is available at <https://hastie.su.domains/ElemStatLearn/index.html>.

Computing

The course will make use of the R programming language. Previous experience with R is not required. For a detailed introduction to R language, you can consult:

- An Introduction to R, by Venables, Smith and the R Core Team.
The text is available at: <https://cran.r-project.org/doc/manuals/R-intro.pdf>.

Grading

The final grade of the course will be based on:

- 20% Assignments
- 20% Midterm Exam (Thursday, March 12 or Tuesday, March 10)
- 10% Class Project Proposals (Due March 29)
- 20% Class Project (Due May 3)
- 30% Final Exam

Each component of the course work (each Assignment, Midterm Exam, Final Exam, Project Proposal, Project) will be valued 100 points. The final score will be obtained by applying the weighting scheme given above.

Course Policies

Attendance: Attendance will not be taken. Nevertheless, it is expected that each student will attend class regularly as it is the best way to learn the course content.

Lectures and R Labs:

Lectures explain theories and methodologies of machine learning methods. During the lectures, students will be exposed to the practical aspects of machine learning algorithms using the R language. R Labs are given during the lecture time.

In-class Quizzes:

Quizzes will be given randomly at the start of some lectures after we finish each topic. The quizzes will not be posted on Canvas and will not be graded; their purpose is to test your understanding of the material and give an idea on what to expect for the exams. In total, 7-8 quizzes will be administered.

Exams:

There will be one midterm exam (March 12 or March 10) and one final exam on theories, concepts, and applied aspects discussed during the lectures. Both the midterm and final are in person and closed book. Exam dates and times are *not* flexible. The only exception to this rule is a death in the family or illness requiring immediate attention from a physician. See Article 1 - Student Rights and Responsibilities (for more details on these issues at: <https://studentcode.illinois.edu/article1>)

Assignments:

Students are also expected to submit assignments on which they apply the learning methods to a real data-based problem. The answers to assignments should be submitted on canvas class platform using Rmarkdown. Late submissions will not be accepted unless there is a well-documented and verified reason. In total, there will be 6-7 assignments.

Late Submission Policy:

Assignments and final projects should be submitted by the deadlines. Late submissions will not be accepted unless there is a well-documented and verified reason.

Class Project:

The class project requires students to analyze a relatively complex data set — one with many observations and more than 8 variables — to investigate an interesting question using methods covered in class lectures.

Students may work together in groups of *up to four* to collect and analyze data; however, each student must submit their own individually written report on the results. Each report must also describe the student's specific role within the group. Students are strongly encouraged to form groups of four as early as possible in the semester.

By **March 29**, each group must submit a one-page project proposal. The proposal should outline the research question, provide some preliminary descriptive analysis of the dataset, and describe the methods the group plans to use. All proposals must be approved by the instructor before any data analysis can begin.

Reports will be evaluated based on both the appropriateness of the analysis for the research question and the quality of its execution. Reports will be placed into one of four categories, ranging from *excellent* to *satisfactory*. Reports in the *excellent* category will receive a numerical grade of 100; those in the next category will receive a numerical grade of 95; the third category will receive a 90; and the fourth will receive an 85. Reports that do not meet satisfactory standards will receive lower numerical grades, with the exact number depending on the quality.

Academic Assistance

Students are encouraged to utilize the many resources we have throughout campus to assist with academics and visit the [Connie Frank CARE Center](#). We recommend that you seek them out starting early in the semester, not just in times of academic need, in order to develop good study habits and submit work which represents your full academic potential. Many resources are found on the Economics Website including details about the Economics Tutoring Center, Academic Advising, and other academic support options:

<https://economics.illinois.edu/academics/undergraduate-program/academic-student-support>

Academic Integrity

According to the Student Code, "It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions." Please know that it is my responsibility as an instructor to uphold the academic integrity policy of the University, which can be found here: <https://studentcode.illinois.edu/article1/part4/1-401/>

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policies. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity. **Read the full Student Code at <https://studentcode.illinois.edu/>**

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu. DRES Website: www.disability.illinois.edu/

Community of Care

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the [Connie Frank CARE Center](http://odos.illinois.edu/community-of-care/referral/) (217-333-0050 or <http://odos.illinois.edu/community-of-care/referral/>). Based on your report, the staff in the Connie Frank CARE Center reaches out to students to make sure they have the support they need to be healthy and safe. Further, we understand the impact that struggles with mental health can have on your experience at Illinois. Significant stress, strained relationships, anxiety, excessive worry, alcohol/drug problems, a loss of motivation, or problems with eating and/or sleeping can all interfere with optimal academic performance. We encourage all students to reach out to talk with someone, and we want to make sure you are aware that you can access mental health support at the Counseling Center (<https://counselingcenter.illinois.edu/>) or McKinley Health Center (<https://mckinley.illinois.edu/>).

For mental health emergencies, you can call 911 or walk into the Counseling Center, no appointment needed.

Disruptive Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution for disciplinary action.

Emergency Response Recommendations

Emergency response recommendations can be found at the following website:

<http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/building-emergency-actionplans/>.

Religious Observances

The Religious Observance Accommodation Request form is available at

<https://odos.illinois.edu/community-of-care/resources/students/religious-observances/>. Submit the form to the instructor and to the Office of the Dean of Students (helpdean@illinois.edu) as soon as possible.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <http://registrar.illinois.edu/ferpa> for more information on FERPA. Student information and records will not be released to anyone other than the student unless the student has provided written approval or as required by law.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options. A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here:

<http://www.wecare.illinois.edu/resources/students/#confidential>.

Other information about resources and reporting is available here: <http://wecare.illinois.edu/>.

Student Support

The Counseling Center is committed to providing a range of services intended to help students develop improved coping skills in order to address emotional, interpersonal, and academic concerns. Please visit their website to find valuable resources and services: <https://counselingcenter.illinois.edu/>.

Counseling Center Information: 217-333-3704

Location: Room 206, Student Services Building (610 East John Street, Champaign IL)

McKinley Mental Health Information: 217-333-2705

Location: 3rd Floor McKinley Health Center 1109 South Lincoln, Urbana, IL

Emergency Dean: The Emergency Dean may be reached at (217) 333-0050 and supports students who are experiencing an emergency situation after 5 pm, in which an immediate University response is needed, and which cannot wait until the next business day. The Emergency Dean is not a substitute for trained emergency personnel such as 911, Police or Fire. If you are experiencing a life-threatening emergency, call 911. Please review the Emergency Dean procedures: <http://odos.illinois.edu/emergency/>

Academic Dates and Deadlines

Students should make note of important academic deadlines for making changes to their courses (add, drop, credit/no-credit, grade replacement, etc.). <https://registrar.illinois.edu/academic-calendars>
Please check with your academic department regarding specific procedures and policies.

Course Schedule (subject to change with advance notice)

Week	Date	Topic
1	Jan 20, 22	Introduction to course, introduction to R (ISLR, chapter 1)
		Assignment 1
2	Jan 27, 29	Introduction to Statistical Learning (ISLR, chapter 2)
		Assignment 2
3	Feb 3, 5	Linear Regression (ISLR, chapter 3)
		Assignment 3
4	Feb 10, 12	Classification (ISLR, chapter 4)
		Assignment 4
5	Feb 17, 19	Resampling Methods (ISLR, chapter 5)
6	Feb 24, 26	Linear Model Selection, Regularization, PCA (ISLR, chapter 6), Review - Prepare for the Midterm Exam
7	Mar 3, 5	Review - Prepare for the Midterm Exam.

8	Mar 10, 12	Linear Model Selection, Regularization, PCA (ISLR, chapter 6) Assignment 5
MIDTERM EXAM (Thursday March 10)		
9	Mar 16-20	SPRING BREAK
10	Mar 24, 26	Tree-based Methods (ISLR, chapter 8) Class Project proposal is due March 29. Assignment 6
11	Mar 31, Apr 2	Tree-based Methods (ISLR, chapter 8) Assignment 7
12	Apr 7, 9	Support Vector Machines (SVM) (ISLR, chapter 9)
13	Apr 14, 16	Support Vector Machines (SVM) (ISLR, chapter 9) Assignment 8
14	Apr 21, 23	Unsupervised Learning with Clustering (ISLR, chapter 12)
15	Apr 28, 30	Deep Learning (ISLR, chapter 10) - if time permits. Review - Prepare for the Final Exam. Class Project is due May 3.
16	May 5	Review - Prepare for the Final Exam.