

ECO 491

The Econometrics of Artificial Intelligence

Course Syllabus

Credits: 3 (three) undergraduate hours or 4 (four) graduate hours

Semester: Fall 2026

Meeting Times: Mondays and Wednesdays, from 1:00 pm to 12:20 am

Location: DKH 317

Instructor: Marcelo C. Medeiros

Email: marcelom@illinois.edu

Office Hours: on demand. Students must schedule by emailing the instructor.

Course Description

This course examines machine learning (ML) and artificial intelligence (AI) through an econometric lens. The course is divided into four blocks. In the first block, students learn how modern machine-learning methods construct predictions and representations, how they differ from conventional econometric estimation, and how econometric ideas improve evaluation, uncertainty quantification, causal analysis, and decision-making. The emphasis is not on treating algorithms as black boxes but on understanding their objectives, assumptions, empirical behavior, and appropriate economic uses. The second block introduces natural language processing tools, starting with simple bag-of-words and dictionary models, moving through sentiment analysis, topic models, and word embeddings, and ending with an attention mechanism. The third block covers transformers and large language models. Finally, the fourth block covers applications of AI and ML to answer relevant economic questions.

Prerequisites

Econ 471 or 491 with the title Intermediate Econometrics, and Econ 491, Applied Machine Learning. Strongly Recommended Linear Algebra (Math 225/227/257/415/416).

Grading

This class uses a plus/minus grading system. Letter grades will be assigned only at the end of the semester based on the overall score. **There is no curve in this class.**

Evaluation will be based on three assignments submitted online via Canvas (30%), one online exam (30%) via Canvas, a group presentation (up to four members) about an academic paper using AI/ML to answer economic questions (20%), and a final project proposal (20%).

Important deadlines:

First assignment: 9/16

Second assignment: 10/19

Third assignment: 11/16

Online midterm: 10/28

Final project submission: date of the final exam as posted in Course Explorer.

Plus/Minus Grade Cutoffs:

A+	97-100	B+	87-89	C+	77-79	D+	67-69	F	0-59
A	93-96	B	83-86	C	73-76	D	63-66		
A-	90-92	B-	80-82	C-	70-72	D-	60-62		

Academic Assistance

Students are encouraged to use the many resources we offer across campus to support their academics. We recommend that you seek them out starting early in the semester, not just in times of academic need, to develop good study habits and submit work that 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](https://studentcode.illinois.edu/article1/part4/1-401/)

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/>

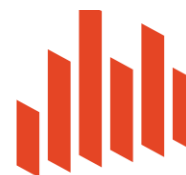
Students with Disabilities

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 Student Assistance Center (217-333-0050 or <http://odos.illinois.edu/community-of-care/referral/>). Based on your report, the staff in the Student Assistance 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

Students requesting a religious observance accommodation must fill out the 'optional resource' form found at <https://odos.illinois.edu/resources/students/religious-observances> and send a copy of the form they receive after submission to the instructor by the end of the third week of classes. All assignment due dates are listed in the syllabus; it is the student's responsibility to read the syllabus thoroughly and make all requests before the deadline. In the case of exams or assignments first announced after this period, students must submit the form to the instructor as soon as possible but no later than three days after the assignment or exam is initially announced.

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 only be released to the student if 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 its 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	Description
1	08/24	Introduction and course logistics
	08/26	Review of linear regression and econometric fundamentals
2	08/31	Linear econometric models for Big Data: Principal Component Analysis
	09/02	Linear econometric models for Big Data: Ridge regression
3	09/07	Labor Day – No class
	09/09	Linear econometric models for Big Data: LASSO and friends
4	09/14	Fundamentals of Neural Networks (NN): Shallow NNs
	09/16	Fundamentals of Neural Networks (NN): Shallow NNs
5	09/21	Fundamentals of Neural Networks (NN): Deep NNs
	09/23	Fundamentals of Neural Networks (NN): Deep NNs
6	09/28	Fundamentals of Neural Networks (NN): Convolutional NNs
	09/30	Fundamentals of Neural Networks (NN): Recurrent and LSTM NNs
7	10/05	Fundamentals of Neural Networks (NN): Generative and Adversarial NNs
	10/07	Fundamentals of Neural Networks (NN): Generative and Adversarial NNs
8	10/12	Reinforcement Learning
	10/14	Reinforcement Learning from Human Feedback
9	10/19	Natural Language Processing: Dictionary models and bag-of-words
	10/21	Natural Language Processing: Topic models
10	10/26	Natural Language Processing: Sentiment analysis
	10/28	No in-person class. Asynchronous video
11	11/02	No in-person class. Asynchronous video
	11/04	Natural Language Processing: Word embeddings
12	11/09	Natural Language Processing: Attention
	11/11	Transformers
13	11/16	Using AI-generated data in econometric models
	11/18	Agentic AI
14	11/30	Student presentation
	12/02	Student presentation
15	12/07	Student presentation
	12/09	Student presentation