

ECON 3400 Applied Machine Learning

Tuesdays and Thursdays 9:35 AM – 10:55 AM at Wh 117

Instructor Contact

Name: Dr. Hanchen Jiang

Delivery method: In person: 9:35 AM – 10:55 AM at Wh 117
Course materials will be posted on Canvas

Office Hours: Tuesday 2 – 3 PM at Wh 342 or by appointment

Communication: Please contact me via email at hanchen.jiang@unt.edu

Welcome to UNT!

As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of the students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation. UNT's full Non-Discrimination Policy can be found in the UNT Policies section of the syllabus.

Course Description and Objectives

Have you ever wondered how online platforms recommend new content tailored to your interests, how analysts forecast housing prices in fast-changing markets, or how financial institutions detect fraudulent credit card transactions in real time? The answer often lies in *Machine Learning* (also known as Statistical Learning or Econometrics of Big Data) - teaching computers to make predictions and identify patterns based on data.

In this course, you'll explore fundamental machine learning techniques through hands-on coding exercises in Python, uncovering how these methods power real-world applications in economics, business, policy analysis, and beyond. By the end, you'll have the skills and knowledge to turn raw data into actionable insights that drive better decisions.

By the conclusion of this course, you will be able to:

- Understand core machine learning techniques and how they apply to data analytics.
- Build, evaluate, and refine predictive models in Python using real-world economic data.
- Interpret and communicate model outcomes to inform better decisions.

Career-Ready Skills

- Prepares students to use machine learning techniques to identify patterns, make predictions, and generate insights from data.

- Builds hands-on technical skills through coding exercises and predictive modeling with real-world economic data.
- Connects machine learning methods to workplace applications in economics, business, finance, policy analysis, and other data-driven fields.
- Develops students' ability to evaluate and refine models for practical decision-making contexts.
- Strengthens students' capacity to interpret and communicate model results as actionable insights for professional audiences.

Course Prerequisites

- **Required:** ECON 4630 Data Analysis in Economics, or equivalent statistical courses, such as:
MATH 3680 Applied Statistics
DSCI 3710 Business Statistics with Spreadsheets
GEOG 4185 Statistical Research Methods in Geography
PSCI 3300 Political Science Research Methods
- **Recommended:** ECON 4870 Intro to Econometrics (or equivalent)
It would be perfectly OK if students take this course and ECON 4870 concurrently in the same semester.

Course Materials

- Textbook: James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2023). **An introduction to Statistical Learning: With Applications in Python**. Springer Publishing.
This textbook has an official online, free version: <https://www.statlearning.com/>
- Course materials (e.g. syllabus, lecture notes, problem sets, etc) you need will be provided on Canvas.
- Importantly, **Laptops are required during class, for assignments and projects, and potentially for exams.** You will be expected to connect to the UNT wireless network. If you don't own a laptop, you may borrow one from the library: <https://library.unt.edu/services/laptop-checkout/>

Course Requirements

This course is **in-person**, and we meet on **every Tuesday and Thursday 9:35 AM – 10:50 AM**. Before each lecture, I will post lecture notes on Canvas. ***No remote access to the lecture or recorded lecture videos will be allowed.***

Class Participation — 20%

Regular attendance and active engagement are important for both understanding machine learning methods and developing practical Python programming skills. Accordingly, class participation constitutes a meaningful portion of the course grade.

Participation may take several forms depending on the material and format of a particular class meeting.

- During lecture-based classes, participation may include brief in-class questions, polls, or other low-stakes activities designed to check attendance, engagement, and basic understanding.
- During Python lab sessions, students may be asked to work along with the examples demonstrated in class and submit their completed or partially completed Python code or Jupyter notebook at the end of the session.

Participation activities are intended primarily to encourage consistent attendance, active involvement, and learning by doing. Specific instructions for individual participation activities will be provided in class and/or through Canvas. The format and frequency of these activities may vary over the semester as appropriate to the pace and needs of the course.

Exams — 25% Short Exams; 35% Comprehensive Final Exam

The course will include **several Short Exams** and **one Comprehensive Final Exam**.

- Short Exams will generally focus on recently covered material and are intended to assess basic understanding, interpretation, and application of important concepts. They may include true/false questions, multiple-choice questions, short-answer questions, and brief written-response questions.
- The Comprehensive Final Exam will be cumulative and will assess students' understanding of the major concepts covered throughout the course, including their ability to interpret results and connect ideas across different topics.

The exact number, timing, topical coverage, and format of the Short Exams may be adjusted to reflect the pace of the course. Exam dates and relevant details will be announced sufficiently in advance through class announcements and/or Canvas.

Unless otherwise announced, exams will be **closed-book and closed-notes**. Students may prepare **one handwritten reference sheet on one standard letter-sized sheet of paper (8.5 × 11 inches), using both sides**. A non-programmable calculator may also be used. Cell phones, computers, and other electronic devices may not be used as calculators during exams unless specifically authorized.

Analytical Projects — 20%

Machine learning is best learned through repeated application. In addition to the Python examples and laboratory activities completed during class, students will complete analytical project work that provides opportunities to apply course methods more independently.

Projects may involve tasks such as preparing and exploring data, estimating statistical or machine learning models, evaluating model performance, interpreting results, and communicating findings using Python. Depending on the pace and development of the course, analytical project work may be organized as one larger project, several smaller components, or a sequence of related submissions completed at different points during the semester.

Detailed instructions, expectations, submission dates, and grading criteria for each project component will be provided sufficiently in advance through class announcements and/or Canvas.

The specific structure and timing of the analytical projects may be adjusted to align with the topics actually covered and the pace of the class. Any such adjustments will be communicated clearly in advance and will be applied consistently to all students.

Grading Distribution

The final course grade will be calculated as a weighted average of the following categories:

Item	Percentage of Final Grade
Short Exams	25%
Comprehensive Final Exam	35%
Class Participation	20%
Analytical Projects	20%
Sum of all Items Total Possible	100%

You should make sure that the exam schedule is not conflicted with other courses. See the university Final Exam Schedules: <https://registrar.unt.edu/exams/final-exam-schedule>

Grading

There is no way to perfectly calibrate an exam so that, for example, students with A performances will score between 90 and 100 points, students with B performances score between 80 and 89 points, etc. Each short exam and the final exam *will be curved* as needed during the grading for the performances to match the awarded grades (see below to check my criteria in this course).

- A: [90%, 100%]. The student demonstrates excellent knowledge of the machine learning models using Python and the intuition behind them, and they also demonstrate an ability to apply, analyze, and interpret the methods to novel situations.
- B: [75%, 90%]. The student demonstrates effective knowledge of the machine learning models using Python and the intuition behind them, but has trouble applying the methods to novel situations.
- C: [60%, 75%]. The student demonstrates essential knowledge of the machine learning models using Python, but has trouble explaining the intuition behind them and cannot apply the methods to novel situations.
- F: [0%, 60%]. The student demonstrates little understanding of the course content.

Grade Appeals

If you think that an exam has been incorrectly graded, submit a written explanation of the problem via email, no later than 1 week after the exams have been returned. This deadline applies regardless of whether you are present in class at the time the exams are returned (e.g. graded in Canvas and announced via email). I will respond to you in writing as soon as possible. If there is still a disagreement, schedule a meeting appointment so that we may further discuss the problem.

Tentative Topics and Schedule

The specific plan for each week's lecture may vary over the semester as appropriate to the pace and needs of the course.

Week	Date	Topic
1	8/18, 8/20	Introduction to Machine Learning
2	8/25, 8/27	Introduction to Machine Learning
3	9/1, 9/3	Lab: Introduction to Python
4	9/8, 9/10	Exam 1 Linear Regression
5	9/15, 9/17	Linear Regression
6	9/22, 9/24	Linear Regression
7	9/29, 10/1	Lab: Linear Regression
8	10/6, 10/8	Analytic Project: Part 1 Exam 2
9	10/13, 10/15	Classification (Logistic Regression)
10	10/20, 10/22	Lab: Classification (Logistic Regression)
11	10/27, 10/29	Analytic Project: Part 2 Exam 3
12	11/3, 11/5	Cross-Validation with Lab
13	11/10, 11/12	Model Selection and Regularization with lab
14	11/17, 11/19	Introduction to Causal Inference
15	11/24, 11/26	Thanksgiving Break (No Classes)
16	12/1, 12/3	Review Session Analytic Project: Final Due

Contacting Me

In person: If you are unable to meet during my office hours, please email me to set up a mutually convenient time.

Via Email: **All email must be sent through your UNT student email address (my.unt.edu) specifically to me at hanchen.jiang@unt.edu .**

- Email from any other source or to any other email address is unlikely to make it through UNT filters and will not be answered.
- Please note that I may *not* see messages sent through Canvas. Therefore, send an email instead of a Canvas message to ensure a response.
- If you contact me via email, the **subject line** of your email must include “ECON 3400” followed by the subject of your inquiry. For example: ECON 3400: Exam 2 Grades
- Email correspondence should be appropriate and should not contain requests for me to provide you with missed assignments, handouts, notes, grades, etc. and should never be a request to treat your coursework and grade differently than what is outlined on this syllabus. Inappropriate emails and student requests will be forwarded to the appropriate campus office and/or official.

Outside of office hours, you can receive assistance at the Econ Help Center in Wooten Hall Room 310. See the instruction on Canvas for Help Center hours of operation.

Other Course Policies

Late work or Make-up Exams

No late submission or make-up exams will be given unless you notify me of the situation as soon as possible by email and can provide documented evidence of a valid excuse. The instructor is the judge of what constitutes a valid excuse.

Withdrawals

University policy relative to withdrawals will be followed. Please consult with your academic advisor or UNT academic calendar for the last date you can:

- Drop with an automatic grade of W
- Drop with a W if you are passing the course
- Last day you can drop a course at all

It is vital that you consult with your academic advisor prior to dropping any course. It can have dire effects on your financial aid and/or academic record.

Copyright Notice

Materials used in connection with this course may be subject to copyright protection. Materials may include, but are not limited to: documents, slides, images, audio, and video. Materials in this course

Web site are only for the use of students enrolled in this course, for purposes associated with this course, and may not be retained for longer than the class term. Unauthorized retention, duplication, distribution, or modification of copyrighted materials is strictly prohibited by law.

Course Evaluation

Student Perceptions of Teaching (SPOT) is the student evaluation system for UNT and allows students the ability to confidentially provide constructive feedback to their instructor and department to improve the quality of student experiences in the course. You should receive an email from SPOT listing the timeframe in which you can participate in the SPOT evaluation.

Technical Requirements & Skills

Minimum Technology Requirements and Skills

- Laptop with speakers, webcam with microphone and Microsoft Office
- Reliable internet access
- Working knowledge of Canvas [Canvas Technical Requirements](https://clear.unt.edu/supported-technologies/canvas/requirements) (<https://clear.unt.edu/supported-technologies/canvas/requirements>)

Technical Assistance

Part of working in the online environment involves dealing with the inconveniences and frustration that can arise when technology breaks down or does not perform as expected. Here at UNT we have a Student Help Desk that you can contact for help with Canvas or other technology issues.

UIT Help Desk: <http://www.unt.edu/helpdesk/index.htm>

Email: helpdesk@unt.edu

Phone: 940-565-2324

For additional support, visit [Canvas Technical Help](https://community.canvaslms.com/docs/DOC-10554-4212710328) (<https://community.canvaslms.com/docs/DOC-10554-4212710328>)

Rules of Engagement

Rules of engagement refer to the way students are expected to interact with each other and with their instructors. Here are some general guidelines:

- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language on the basis of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information,

veteran status, or any other characteristic protected under applicable federal or state law will not be tolerated.

- Treat your instructor and classmates with respect in any communication online or face-to-face, even when their opinion differs from your own.
- Always use your professors' proper title: Dr. or Prof., or if in doubt use Mr. or Ms.
- Unless specifically invited, don't refer to your instructor by first name.
- Use clear and concise language.
- Proofread and fact-check your sources.
- Avoid slang terms such as and texting abbreviations.
- Use standard fonts such as Ariel, Calibri or Times new Roman and use a size 11 or 12 point font
- AVOID USING ALL CAPS WHEN TYPING, IT IS REALLY ANNOYING TO THE READER.
- Limit and possibly avoid the use of emoticons like :) or ☺.
- Be cautious when using humor or sarcasm in emails or discussion posts as tone can be difficult to interpret digitally.
- Speak from personal experiences. Use "I" statements to share thoughts and feelings. Try not to speak on behalf of groups or other individual's experiences.
- Do not send confidential information via e-mail
- Keep in mind that online posts can be permanent, so think first before you type.

See these [Engagement Guidelines](https://clear.unt.edu/online-communication-tips) (<https://clear.unt.edu/online-communication-tips>) for more information.

UNT Policies

Academic Integrity Policy

Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

ADA Policy

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Access (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the [ODA website](https://disability.unt.edu/) (<https://disability.unt.edu/>).

Prohibition of Discrimination, Harassment, and Retaliation (Policy 16.004)

The University of North Texas (UNT) prohibits discrimination and harassment because of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law in its application and admission processes; educational programs and activities; employment policies, procedures, and processes; and university facilities. The University takes active measures to prevent such conduct and investigates and takes remedial action when appropriate.

Emergency Notification & Procedures

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

Retention of Student Records

Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Canvas online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student's records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 04.008, Records Management and Retention for additional information.

Acceptable Student Behavior

Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The University's expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. Visit UNT's [Code of Student Conduct](https://deanofstudents.unt.edu/conduct) (https://deanofstudents.unt.edu/conduct) to learn more.

Access to Information - Eagle Connect

Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail [Eagle Connect](https://it.unt.edu/eagleconnect) (<https://it.unt.edu/eagleconnect>).

Student Evaluation Administration Dates

Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the [SPOT website](http://spot.unt.edu/) (<http://spot.unt.edu/>) or email spot@unt.edu.

Survivor Advocacy

UNT is committed to providing a safe learning environment free of all forms of sexual misconduct. Federal laws and UNT policies prohibit discrimination on the basis of sex as well as sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking and/or sexual assault, there are campus resources available to provide support and assistance. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-5652648.

Important Notice for F-1 Students taking Distance Education Courses

Federal Regulation

To read detailed Immigration and Customs Enforcement regulations for F-1 students taking online courses, please go to the [Electronic Code of Federal Regulations website](http://www.ecfr.gov/) (<http://www.ecfr.gov/>). The specific portion concerning distance education courses is located at Title 8 CFR 214.2 Paragraph (f)(6)(i)(G).

The paragraph reads:

(G) For F-1 students enrolled in classes for credit or classroom hours, no more than the equivalent of one class or three credits per session, term, semester, trimester, or quarter may be counted toward the full course of study requirement if the class is taken on-line or through distance education and does not require the student's physical attendance for classes, examination or other purposes integral to completion of the class. An on-line or distance education course is a course that is offered principally

through the use of television, audio, or computer transmission including open broadcast, closed circuit, cable, microwave, or satellite, audio conferencing, or computer conferencing. If the F-1 student's course of study is in a language study program, no on-line or distance education classes may be considered to count toward a student's full course of study requirement.

University of North Texas Compliance

To comply with immigration regulations, an F-1 visa holder within the United States may need to engage in an on-campus experiential component for this course. This component (which must be approved in advance by the instructor) can include activities such as taking an on-campus exam, participating in an on-campus lecture or lab activity, or other on-campus experience integral to the completion of this course.

If such an on-campus activity is required, it is the student's responsibility to do the following:

- (1) Submit a written request to the instructor for an on-campus experiential component within one week of the start of the course.
- (2) Ensure that the activity on campus takes place and the instructor documents it in writing with a notice sent to the International Student and Scholar Services Office. ISSS has a form available that you may use for this purpose.

Because the decision may have serious immigration consequences, if an F-1 student is unsure about his or her need to participate in an on-campus experiential component for this course, s/he should contact the UNT International Student and Scholar Services Office (telephone 940-565-2195 or email internationaladvising@unt.edu) to get clarification before the one-week deadline.

Student Verification

UNT takes measures to protect the integrity of educational credentials awarded to students enrolled in distance education courses by verifying student identity, protecting student privacy, and notifying students of any special meeting times/locations or additional charges associated with student identity verification in distance education courses.

See [UNT Policy 07-002 Student Identity Verification, Privacy, and Notification and Distance Education Courses](https://policy.unt.edu/policy/07-002) (<https://policy.unt.edu/policy/07-002>).

Use of Student Work

A student owns the copyright for all work (e.g. software, photographs, reports, presentations, and email postings) he or she creates within a class and the University is not entitled to use any student work without the student's permission unless all of the following criteria are met:

- The work is used only once.
- The work is not used in its entirety.

- Use of the work does not affect any potential profits from the work.
- The student is not identified.
- The work is identified as student work.

If the use of the work does not meet all of the above criteria, then the University office or department using the work must obtain the student's written permission.

Download the UNT System Permission, Waiver and Release Form

Transmission and Recording of Student Images in Electronically-Delivered Courses

1. No permission is needed from a student for his or her image or voice to be transmitted live via videoconference or streaming media, but all students should be informed when courses are to be conducted using either method of delivery.
2. In the event an instructor records student presentations, he or she must obtain permission from the student using a signed release in order to use the recording for future classes in accordance with the Use of Student-Created Work guidelines above.
3. Instructors who video-record their class lectures with the intention of re-using some or all of recordings for future class offerings must notify students on the course syllabus if students' images may appear on video. Instructors are also advised to provide accommodation for students who do not wish to appear in class recordings.

No notification is needed if only audio and slide capture is used or if the video only records the instructor's image. However, the instructor is encouraged to let students know the recordings will be available to them for study purposes.

Academic Support & Student Services

Student Support Services

Mental Health

UNT provides mental health resources to students to help ensure there are numerous outlets to turn to that wholeheartedly care for and are there for students in need, regardless of the nature of an issue or its severity. Listed below are several resources on campus that can support your academic success and mental well-being:

- [Student Health and Wellness Center](https://studentaffairs.unt.edu/student-health-and-wellness-center) (https://studentaffairs.unt.edu/student-health-and-wellness-center)
- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testing-services) (https://studentaffairs.unt.edu/counseling-and-testing-services)
- [UNT Care Team](https://studentaffairs.unt.edu/care) (https://studentaffairs.unt.edu/care)
- [UNT Psychiatric Services](https://studentaffairs.unt.edu/student-health-and-wellness-center/services/psychiatry) (https://studentaffairs.unt.edu/student-health-and-wellness-center/services/psychiatry)
- [Individual Counseling](https://studentaffairs.unt.edu/counseling-and-testing-services/services/individual-counseling) (https://studentaffairs.unt.edu/counseling-and-testing-services/services/individual-counseling)

Chosen Names

A chosen name is a name that a person goes by that may or may not match their legal name. If you have a chosen name that is different from your legal name and would like that to be used in class, please let the instructor know. Below is a list of resources for updating your chosen name at UNT.

- [UNT Records](#)
- [UNT ID Card](#)
- [UNT Email Address](#)
- [Legal Name](#)

**UNT eulDs cannot be changed at this time. The collaborating offices are working on a process to make this option accessible to UNT community members.*

Pronouns

Pronouns (she/her, they/them, he/him, etc.) are a public way for people to address you, much like your name, and can be shared with a name when making an introduction, both virtually and in-person. Just as we ask and don't assume someone's name, we should also ask and not assume someone's pronouns.

You can [add your pronouns to your Canvas account](#) so that they follow your name when posting to discussion boards, submitting assignments, etc.

Below is a list of additional resources regarding pronouns and their usage:

- [What are pronouns and why are they important?](#)
- [How do I use pronouns?](#)
- [How do I share my pronouns?](#)
- [How do I ask for another person's pronouns?](#)
- [How do I correct myself or others when the wrong pronoun is used?](#)

Additional Student Support Services

- [Registrar](https://registrar.unt.edu/registration) (https://registrar.unt.edu/registration)
- [Financial Aid](https://financialaid.unt.edu/) (https://financialaid.unt.edu/)
- [Student Legal Services](https://studentaffairs.unt.edu/student-legal-services) (https://studentaffairs.unt.edu/student-legal-services)
- [Career Center](https://studentaffairs.unt.edu/career-center) (https://studentaffairs.unt.edu/career-center)
- [Multicultural Center](https://edo.unt.edu/multicultural-center) (https://edo.unt.edu/multicultural-center)
- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testing-services) (https://studentaffairs.unt.edu/counseling-and-testing-services)
- [Pride Alliance](https://edo.unt.edu/pridealliance) (https://edo.unt.edu/pridealliance)
- [UNT Food Pantry](https://deanofstudents.unt.edu/resources/food-pantry) (https://deanofstudents.unt.edu/resources/food-pantry)

Academic Support Services

- [Academic Resource Center](https://clear.unt.edu/canvas/student-resources) (https://clear.unt.edu/canvas/student-resources)
- [Academic Success Center](https://success.unt.edu/asc) (https://success.unt.edu/asc)
- [UNT Libraries](https://library.unt.edu/) (https://library.unt.edu/)

- [Writing Lab \(http://writingcenter.unt.edu/\)](http://writingcenter.unt.edu/)