

# Introduction to Machine Learning (INF385T)

## University of Texas at Austin School of Information

**Class Meetings:** Wednesdays 3-6pm in UTA 1.210A

**Instructor:** Danna (pronounced similar to "Donna") Gurari (rhymes with Ferrari)

**Pronouns:** she/her/hers

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**Office Location:** UTA 5.442

### Course Overview

#### *Summary*

This class will cover core and cutting edge concepts employed in machine learning to solve artificial intelligence problems. Students will learn the theory behind a range of machine learning tools and practice applying the tools to, for example, textual data (natural language processing), visual data (computer vision), and the combination of both textual and visual data. The class format is split between reading and lab assignments for the first half of the semester followed by a research project the second half of the semester. Each class consists of a lecture and in-class lab tutorials.

#### *Objectives*

By the end of the course, the goals are for students to:

1. Understand the key concepts in machine learning, a critical precursor to effective collaborations in industry or academia. Towards this aim, students will:
  - Characterize the process to train and test machine learning algorithms
  - Critique core and cutting edge machine learning algorithms
  - Identify the challenges for designing modern machine learning systems that can harness today's "big" datasets
  - Recognize ways to evaluate the predictive power of machine learning systems
2. Apply machine learning systems to perform various artificial intelligence tasks. Towards this aim, students will:
  - Develop programming skills by writing code in Python
  - Experiment with machine learning libraries, including scikit-learn and TensorFlow
  - Evaluate machine learning algorithms for tasks in various application domains, including for analyzing text and analyzing images
  - Employ cloud computing resources in order to take advantage of modern hardware and software platforms

3. Conduct and communicate original research. Towards this aim, students will:
- Propose a novel research idea (this will be an iterative process)
  - Design and execute experiments to support the proposed idea
  - Write a research paper about the project (and possibly submit it for publication)
  - Present the project to the class

#### *Prerequisites*

While there are no requirements, a background in programming is strongly recommended.

#### *Website*

<https://www.ischool.utexas.edu/~dannag/Courses/IntroToMachineLearning/>

#### *Class Participation*

Students are expected to attend every class. Every student should demonstrate ongoing engagement in class discussions and complete the material discussed in every lab session. Beyond two unexcused absences will lower your final grade.

#### *Reading Assignments*

Students will have weekly assigned readings with associated questions to answer about the material in the first half of the course. Each assignment description will be posted on the course website before the due date. These assignments will offer training in thinking critically about machine learning concepts and brainstorming novel research ideas to fill existing gaps/problems. Each assignment must be submitted in Canvas by 11:59pm on its due date.

#### *Lab Assignments*

Four lab assignments will be assigned for the first half of the course. Each assignment description will be posted on the course website before the due date. These lab assignments will develop students' skills to build systems similar to those described in the weekly readings. Each assignment must be submitted in Canvas by 11:59pm on its due date.

#### *Final Project*

Assignments related to the final project will be due during the second half of the course. Details about each assignment will be posted on the course website prior to its deadline. The goal for the final project is to further develop students' skills in conducting and communicating original research.

*Tentative Schedule*

Week	Lecture Topic(s)	Assignment Due
1	Introduction	
2	Regression, Regularization	Problem Set 1
3	Classification: Decision Tree, Naive Bayes	Lab 1
4	Classification: Nearest Neighbor, Support Vector Machine	Problem Set 2
5	Feature Representation, Dimensionality Reduction	Lab 2
6	Ensemble Learning, Computer Vision, NLP	Problem Set 3
7	Artificial Neurons, Gradient Descent	Lab 3
8	Neural Network Architecture & Training	Problem Set 4
9	Convolutional Neural Networks	Lab 4
10	Recurrent Neural Networks	Project Pre-Proposal
11	Autoencoders, Unsupervised Learning	Project Proposal
12	Active Learning, Curriculum Learning, Reinforcement Learning	
13	Algorithm Fairness, Accountability, and Transparency	Project Outline
14	Bias, Ethics, and Value-Sensitive Design	
15	Students' Project Presentations	Project Videos
16	<i>No Class</i>	Final Projects

## Grading

Final course scores will be calculated as follows:

% of Final Class Grade	
Class Participation	5%
Reading Assignments	25%
Lab Assignments	30%
Final Project	40%

Final course scores represent the following grades (scores are rounded to the nearest integer):

Grade	% of Final Class Grade
A	94-100%
A-	90-93%
B+	87-89%
B	84-86%
B-	80-83%
C+	77-79%
C	74-76%

For detailed information about what grade is required for you to receive credit for this class, please refer to [UT's Graduate Catalog](#). For example, students in the School of Information (iSchool) are required to receive a grade of B or higher in order to include this course in their [program of work toward graduation](#). In addition, the UT Graduate School requires a minimum grade of C or higher to count a course for credit.

### *Late Policy*

Late submissions will be penalized 1% of the grade per hour up to 12 hours. After 12 hours, no credit will be given.

## Resources

Links to required readings will be posted on the course website for each class meeting. They will draw heavily from three textbooks:

- Hands-on Machine Learning with Scikit-Learn & TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurelien Geron
- Make Your Own Neural Network by Tariq Rashid
- Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

## Policies

### *Academic Honor Code*

Each student in the course is expected to abide by the University of Texas Honor Code: “As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.” Plagiarism is taken very seriously. Therefore, if you use words or ideas that are not your own (or that you have used in a previous class), cite your sources. Students who violate University rules on academic dishonesty are subject to severe disciplinary penalties, such as automatically failing the course and potentially being dismissed from the University. Please do not take the risk. Every student is responsible for understanding the Academic Honesty and the University Honor Code which can be found at the following web address: [http://deanofstudents.utexas.edu/sjs/acint\\_student.php](http://deanofstudents.utexas.edu/sjs/acint_student.php).

Please note that all assignments in this course may be processed by TurnItIn, a tool that compares submitted material to an archived database of published work to check for potential plagiarism. Other methods may also be used to determine if a paper is the student’s original work. These tools will assist in deciding if an assignment has been plagiarized.

### *Excused Absences*

A student will be given an opportunity to complete any work missed due to absences in observance of a religious holy day or military service. For a holy day, the student must notify me at least two weeks in advance of the absence. Please see the following link for more details: <http://catalog.utexas.edu/general-information/academic-policies-and-procedures/attendance/>. The student will not be penalized for excused absences, but must complete the missed material within a reasonable time after the excused absence.

### *Q Drop Policy*

If you want to drop a class after the 12th class day, you’ll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution. For more information, see: <http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop>.

### *University Resources for Students*

Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we’ll develop strategies to meet both your needs and the requirements of the course. There are also a range of resources on campus:

- *Coping with Stress and Personal Hardships*

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, please consider taking advantage of the support available to you. <http://www.cmhc.utexas.edu/individualcounseling.html>.

- *Accommodations for Disability*

Students of all backgrounds, identities, and abilities are welcome in this class. If there are circumstances that make the learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. If appropriate, also contact the [Services for Students with Disabilities](#), 512-471-6259 (voice) or 1-866-329-3986 (video phone).

- *The Sanger Learning Center*

All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit <http://www.utexas.edu/ugs/slc> or call 512-471-3614 (JES A332).

- *Writing Center*

All students are encouraged to consult the University Writing Center (UWC): <http://uwc.utexas.edu>.

### *Important Safety Information*

If you have concerns about the safety or behavior of fellow students, TAs, or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right—it probably isn't. Trust your instincts and share your concerns.

### *Title IX Reporting*

Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence, and stalking at federally funded educational institutions. UT-Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's relevant policies.

Faculty members and certain staff members are considered "Responsible Employees" or "Mandatory Reporters," which means that they are required to report violations of Title IX to the Title IX Coordinator that are disclosed in writing, discussion, or one-on-one. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee. If you want to speak with someone for support or remedies without making an official report to the university, email [advocate@austin.utexas.edu](mailto:advocate@austin.utexas.edu). For more information about reporting options and resources, visit <https://titleix.utexas.edu> or contact the Title IX Office at [titleix@austin.utexas.edu](mailto:titleix@austin.utexas.edu).