

Sp22 - MACHINE LEARNING-WB (51640)

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CS 391L - Machine Learning

Spring 2022 Syllabus

Instructors:

Professor Adam Klivans

Professor Qiang Liu

TAs:

Rahi Kalantari

Yating Wu

Tyler Collins

Yunsong Huang

Shelby Patzer

Office Hours: See Piazza

Communications

Course communications will be facilitated through Piazza. Staff can also be contacted by emailing onlinemachinelearning@austin.utexas.edu.

Course Overview

This course will cover the fundamentals of computational and statistical learning theory. Both mathematical and applied aspects of machine learning will be covered.

Prerequisites

This course does require some sound mathematical foundations. Recommended:

1. a course in probability and statistics,
2. a course in discrete mathematics,
3. a course in linear algebra, and
4. experience with programming in Python and using Jupyter notebooks.

Textbooks

The book “Understanding Machine Learning from Theory to Algorithms,” by Shalev-Shwartz and Ben-David is recommended but not required. It can be found free online [here](https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/) [\(https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/\)](https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/).

Technical Requirements

To participate in this course you must use a laptop or desktop computer.

Your machine should be able to run Python 3 and Jupyter notebooks. You can also use Google Colab if you prefer. Please make sure you have looked over the following: <https://colab.research.google.com/notebooks/welcome.ipynb> [\(https://colab.research.google.com/notebooks/welcome.ipynb\)](https://colab.research.google.com/notebooks/welcome.ipynb) and that your computer supports this setup. We will be using Python 3 (as opposed to 2).

In addition, please make sure your machine adheres to the following program requirements.

Laptop or personal computer with the following requirements:

- Operating System: MAC - OSX Mojave or newer; PC - Windows 10
- Processor/RAM: x86 CPU, multi-core, with virtualization support (Intel: VT-x, AMD: AMD-V); 8GB RAM
- Browser: Mozilla Firefox v20.0 or higher, Google Chrome v25.0 or higher.
- Plug-Ins: Javascript enabled and Third Party Cookies enabled.
- Internet Connection: Cable modem, DSL or better (300 kbps download, 250 kbps upload).
- Camera Resolution: 800 x 600 resolution or better.
- Smartphone or scanner to take pictures and make PDFs of homework submissions.
- Smartphone or other device capable of being used for dual-factor authentication

Topic Outline

New material will be released roughly every two weeks and the sequence is listed below.

Due dates can be found by clicking the 'Dates' tab in the courses main page.

Part 1:

Topics:

Mistake-Bounded Learning, Decision Trees, PAC Learning, and Cross Validation

Perceptron, Linear regression, Gradient Descent, and Boosting

Logistic Regression, PCA, and SVD

Part 2:

Topics:

Maximum Likelihood Estimation and Bayesian Inference

K-means, Gaussian Mixture Models, EM, Multivariate Normal, and Graphical Models

Kernel Methods and Neural Networks

Assignments, Assessment, Evaluation

Homework (40%): There are six homework assignments in this class. Each assignment has two parts: a theory part and a programming part. Homework is due at the time indicated on the assignment and no late homework will be accepted. Homework assignments will be peer-graded and you must complete peer-grading in order to receive a grade for the assignment. Your lowest homework score will be automatically dropped.

Exams (60%): There two exams in this class. Exams are timed and will take no more than two continuous hours. You'll have a many days long window in which to complete the two-hour exam. No exam grade will be dropped. No late exams will be accepted. Exams will be graded by the TAs or instructors.

Final grades will be based on +/- letter grade system and will be curved. The following scheme is just a rough guideline:

A = 94-100

A- = 90-93

B+ = 87-89

B = 84-86

B- = 80-83

C+ = 77-79

C = 74-76

C- = 70-73

D+ = 67-69

D = 64-66

D- = 60-63

F = 0-59

Program Grade Requirements: 30 hour program (9 required hours, 21 elective hour). Required courses, B- or higher. Elective courses, C or higher. To graduate, all students must have a graduate GPA average of at least 3.00.

Academic Honesty and Collaboration Policy

Collaboration is not allowed on the homeworks. Every homework needs to be solved individually. We will check for duplicates. Students may post questions about the homeworks on Piazza and may

respond to other students' questions. The online course format allows for multiple methods of identity verification, collusion, collaboration and plagiarism monitoring and detection. A violation of the course policy may include (but is not limited to) the following:

- Providing your UT EID credentials to any other person
- Collaborating or sharing information with another person regarding the material on any assessment or exam.
- Recording any exam, assessment or assignment material in any format
- Failing to properly cite language, ideas, data, or arguments that are not originally yours
- The public (such that it can be viewed by more than one person) posting of any form of a test bank or group of questions from any assignment
- Consulting forbidden materials or sources of information

The University of Texas at Austin Academic Integrity principles call for students to avoid engaging in any form of academic dishonesty on behalf of yourself or another student. Grade-related penalties are routinely assessed ("F" in the course is not uncommon), but students can also be suspended or even permanently expelled from the University for scholastic dishonesty. If you have any questions about what constitutes academic dishonesty, please refer to the [Dean of Students website](http://deanofstudents.utexas.edu/conduct/) (<http://deanofstudents.utexas.edu/conduct/>) or contact the instructor for this course. By proceeding in this course, you agree to abide by the Honor Code of the University of Texas. You will not work with or collaborate with others in any way while completing any of the graded course assignments.

Documented Disability Statement

Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (videophone). Faculty are not required to provide accommodations without an official accommodation letter from SSD. Please notify me as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.). Contact Services for Students with Disabilities at 471-6259 (voice) or 1-866-329-3986 (video phone) or reference SSDs website for more disability-related information: <https://diversity.utexas.edu/disability/> [_ \(https://diversity.utexas.edu/disability/\)](https://diversity.utexas.edu/disability/).

Behavior Concerns Advice Line

If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individuals behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit <https://besafe.utexas.edu/behavior-concerns-advice-line> [_ \(https://besafe.utexas.edu/behavior-concerns-advice-line\)](https://besafe.utexas.edu/behavior-concerns-advice-line)






Academic Advisor Support

If you have additional questions or require support from an academic advisor, please contact the program coordinator at MCSOGradCoordinator@austin.utexas.edu (<mailto:msonline@cs.utexas.edu>). If you are taking this course as part of the Data Science program, you can contact the coordinator at MSDSGradCoordinator@utexas.edu (<mailto:MSDSGradCoordinator@utexas.edu>).

Course Summary:

Date	Details	Due
Tue Jan 25, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053542&include_contexts=course_1332114)	10pm to 11pm
Tue Feb 1, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053543&include_contexts=course_1332114)	10pm to 11pm
Tue Feb 8, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053544&include_contexts=course_1332114)	10pm to 11pm
Tue Feb 15, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053545&include_contexts=course_1332114)	10pm to 11pm
Tue Feb 22, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053546&include_contexts=course_1332114)	10pm to 11pm
Tue Mar 1, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com)	10pm to 11pm

Date	Details	Due
	/calendar?event_id=3053547&include_contexts=course_1332114)	
Sun Mar 6, 2022	 Exam 1 https://utexas.instructure.com/courses/1332114/assignments/5775645)	due by 11:59pm
Tue Mar 8, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053548&include_contexts=course_1332114)	10pm to 11pm
Tue Mar 15, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053549&include_contexts=course_1332114)	10pm to 11pm
Tue Mar 22, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053550&include_contexts=course_1332114)	10pm to 11pm
Tue Mar 29, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053551&include_contexts=course_1332114)	10pm to 11pm
Tue Apr 5, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053552&include_contexts=course_1332114)	10pm to 11pm
Tue Apr 12, 2022	 Sp22 - MACHINE LEARNING-WB (51640) https://utexas.instructure.com/calendar?event_id=3053553&include_contexts=course_1332114)	10pm to 11pm

Date	Details	Due
Tue Apr 19, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053554&include_contexts=course_1332114)	10pm to 11pm
Tue Apr 26, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053555&include_contexts=course_1332114)	10pm to 11pm
Fri Apr 29, 2022	 Exam 2 (https://utexas.instructure.com/courses/1332114/assignments/5822048)	due by 11:59pm
Tue May 3, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053556&include_contexts=course_1332114)	10pm to 11pm
Tue May 10, 2022	 Sp22 - MACHINE LEARNING-WB (51640) (https://utexas.instructure.com/calendar?event_id=3053557&include_contexts=course_1332114)	10pm to 11pm