

MATH 6310 – Fall 2020

Introduction to Data Sciences
MW 4:00-5:20PM, PKH 111

INSTRUCTOR: Keaton Hamm

Email: keaton.hamm@uta.edu

Office: TBD, but all office hours will be held virtually

Webpage: Canvas. Supplemental material may appear at <https://keatonhamm.com/teaching/>

OFFICE HOURS:

Online by appointment

PREREQUISITES:

Linear Algebra and programming experience

TEXTBOOK:

Matrix Methods in Data Mining and Pattern Recognition, by Lars Eldén (available free online)

COURSE DESCRIPTION: We are collecting a phenomenal amount of data these days from every endeavor that human beings are involved in. But harnessing this data requires sophisticated techniques due to its large scale and complexity. At a fundamental level, most data is represented as vectors in real or complex Euclidean space where the dimension may be on the order of millions. Thus, linear algebra provides some of the core tools for data analysis.

This course will cover topics in linear algebra and numerical as it pertains to analysis of data. The focus will be on exploring theory which is used in real Data Science applications, including, but not limited to, matrix factorization, low-rank matrix approximations, random matrix theory, tensors, kernel methods, graph theory, and optimization. Some special topics will be covered, time permitting, such as supervised and unsupervised learning, data clustering, matrix completion, and compressed sensing. The theory will be complemented with illustrative applications.

LEARNING OBJECTIVES: Students will learn

- ⊕ How to compute various matrix factorizations and understand their quantitative and qualitative differences and similarities
- ⊕ How to use optimization methods for solving linear systems of equations and for reducing dimensionality of data sets
- ⊕ Use of tensors to represent and analyze data
- ⊕ How to use Kernel matrices to cluster data
- ⊕ Basic theory of supervised learning
- ⊕ Basic theory of Neural Networks including function description of networks, backpropagation, training and testing
- ⊕ What applications utilize the methods discussed

COURSE MATERIALS: The textbook is available to you freely online through SIAM [here](#), but you will have to access it via a UTA computer. You will also need access to a computer with a functioning programming environment. You may use any language you like; I suggest either

Matlab or Python (Matlab is available for download for students; instructions may be found [here](#)). If you have questions about the programming component of the course, please email me.

IMPORTANT DATES:

August 26: First day of class

November 6: Last day to drop class

November 25-28: Thanksgiving Break*

December 8: Last day of classes

* After Thanksgiving break, instruction will be completely online, with no on-campus elements.

INSTRUCTION MODALITY (HYBRID 3): This is a “Hybrid 3” course. An announcement will be posted on Canvas prior to the first week of class detailing what this will mean for this particular course.

GRADING POLICY: Your final grade in this course will consist of weekly homework assignments (both theoretical and programming), and a participation component. The breakdown of points will be as follows:

POINT BREAKDOWN:

| | |
|----------------------|-----|
| Homework Assignments | 60% |
| Final Project | 40% |

Your final grade will be calculated on the usual grade scale of A: 90-100, B: 80-89, C: 70-79, D: 60-69, F: < 60.

HOMEWORK: There will be weekly homework assignments posted on Canvas. Students are welcome to work together on homework assignments. However, each student must turn in their own written solution, which may not be simply copied from another person’s work (or from any other outside source). If you work with someone else on a problem or assignment, give them credit in your write-up by name (e.g., “I worked with X on this problem/assignment”). Additionally, sharing and/or copying solutions from an electronic solutions manual or similar source is prohibited; note that this includes consulting and/or posting a homework question to an online forum. Homework should be typeset using LaTeX or written in legible, complete sentences, showing calculations and reasoning in a clear, logical order.

FINAL PROJECT: At the end of the course, there will be a final project assignment. Midway through the semester, I will post a description on Canvas detailing the assignment. The projects can be either theoretical or applied in nature, and I will work with students to find a suitable topic that is of interest and relevance to the coursework.

INSTITUTIONAL INFORMATION: UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page

(<https://resources.uta.edu/provost/course-related-info/institutional-policies.php>) which includes the following policies among others:

- ⊕ Drop Policy
- ⊕ Disability Accommodations
- ⊕ Title IX Policy
- ⊕ Academic Integrity
- ⊕ Student Feedback Survey
- ⊕ Final Exam Schedule

COVID-19 PROCEDURES: All students, faculty, staff, and visitors on campus are expected to strictly adhere to the following safety procedures:

- ⊕ Everyone must measure their temperature daily and complete the COVID-19 Self-Screening Checklist prior to coming to campus every time. Prior to coming to campus or while on campus if you are experiencing any of the following symptoms that are new, worsening or occurring in a way that is not normal for any chronic conditions you may have, please remain or return home.
 - Cough
 - Shortness of breath or difficulty breathing
 - Chills
 - Repeated shaking with chills
 - Muscle pain
 - Headache
 - Sore throat
 - Loss of taste or smell
 - Diarrhea
 - Feeling feverish or a measured temperature greater than or equal to 100.4 degrees Fahrenheit

Your presence on campus indicates that you have completed your daily self-screening, including a daily temperature check to ensure no fever and that you are not exhibiting any signs or symptoms of possible COVID-19 and that, to your knowledge, you have not come into close contact with a person confirmed positive for COVID-19.

- ⊕ Masks or coverings must be worn (covering mouth and nostrils) while in campus buildings and elsewhere on campus when it's not possible to stay 6 feet away from other people. Reusable, washable fabric face masks for individuals are available at Central Library and the information desk at the University Center.
- ⊕ Maintain social distancing by keeping at least 6 feet between yourself and others.
- ⊕ Classrooms, labs, and seating areas will be set up with reduced capacity to maintain the correct distance. Please do not move chairs or furniture around.
- ⊕ Cleaning supplies will be available in classrooms. Please clean your work area when you arrive.
- ⊕ Wash hands often with soap and water for at least 20 seconds after being in a public place, before & after eating, after touching frequently touched surfaces, after blowing your nose, sneezing, etc. If soap and water are not readily available, use hand sanitizer (at least 60% alcohol) for 20 seconds. Cover coughs and sneezes with a tissue or use the inside of your elbow.
- ⊕ Avoid crowded areas or those with close-quarters, such as elevators. Take the stairs if at all possible. If taking the elevator is necessary, avoid touching the buttons with exposed fingers.

If you have been in close contact with a person who is lab-confirmed to have COVID-19, you may not return to work or class until the end of the 14-day self-quarantine period from the last date of exposure. You are required to complete the [Close Contact or Personal Diagnosis Form](#).

In cases of close contact or symptoms, your absence from campus/classroom activities may be excused. You must communicate immediately with your instructor, especially if graded work is missed.

If diagnosed with COVID-19, you may return to campus when all four of the following criteria are met:

1. At least 3 days (72 hours) have passed since recovery (resolution of fever without the use of fever-reducing medications);
2. Improvement in symptoms (e.g. cough, shortness of breath);
3. At least 10 days have passed since symptoms first appeared; and,
4. You have obtained a note from a medical professional clearing you for return to work or class.

MANDATORY FACE COVERING POLICY: All students and instructional staff are required to wear facial coverings (covering mouth and nostrils) while they are on campus, inside buildings and classrooms. Students that fail to comply with the facial covering requirement will be asked to leave the class session. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center's front desk or in their department. Students who refuse to wear a facial covering in class will be asked to leave the session by the instructor, and, if the student refuses to leave, they may be reported to UTA's Office of Student Conduct.

COPYRIGHT POLICY:

Any material that I produce throughout the course is copyrighted, including (but not limited to) syllabi, quizzes, worksheets, exams, reviews, or any in-class material.

DISCLAIMER:

The information here is subject to change at my discretion.