Data Analytics for Systems Management

Professor: Todd Easton
Office: MEK 2340
Email: todd.easton@utah.edu
Phone: Don't call, email is always better.
Class Time: T, Th 9:10-10:30
Class Location: WEB L120
Office Hours: TBD, send email to find a time.

No Textbook

Prerequisite:
6185: Graduate standing. It is assumed that you have met the prerequisites listed below.

5185:
One semester of computer coding: Typical courses include, but are not limited to, CS1400, CS 1420, ME EN 2450, MSE 2100

And

One semester of probability or statistics. Typical courses include, but are not limited to, ME EN 2550, CS3130, ECE3530, or MATH 3070

Course Description

This course provides a broad overview of data analytics within engineering disciplines. Students will program in python and be able to read, visualize, analyze and interpret data to identify trends in order to improve and optimize systems. The topics covered include: arrays, loops, data structures, graphing data, hypothesis testing, regression, clustering, optimization search techniques and simple heuristics such as hill climbing and simulated annealing.

Course Objectives: By taking this course, the student should develop the following skills.

Use computer programs to read and store data

Present data in a graphically appealing format

Perform and interpret statistical tests and confidence intervals

Develop and assess the accuracy of models of data using regression

Classify data groups based upon clustering data

Implement searches for local or global optimal solutions

Create heuristics to enable a computer to determine improved solutions to systems

These objectives will be met by through projects and exams.

Grading Scheme
Projects (between 8 and 12) 50%
Quizzes after the lectures 10%
Midterm Exam 15%
Final Exam 25%

Standard grading 60, 70, 80, 90 with 3s and 7s.

Graduate students will frequently be assigned additional work on various projects or exams.

Attendance:

Attendance is heavily encouraged but not required. However, I view it as your job to be here. All class lectures will be recorded and uploaded. So a person can just watch the lectures, but my lectures are better when there are students in the class to slow me down and ask questions.

Research on learning has indicated several things about the way people best absorb and retain information. Research indicates that learning is better accomplished through a combination of repetition and active thinking about a topic. I will use cards and lecture based tutoring teaching style. If you are here, you can expect to be directly asked questions about the course topics. It is assumed that you will not know the answer to numerous of these questions throughout the semester.

Tentative schedule:
I   Computer programming review and data visualization (4 weeks)
       Introduction to Python
       For and while loops
       Arrays
       Reading data
       Data structures
       Graphing data

II Statistical Analysis (3 weeks)
       Probability review
       Hypothesis testing (f and t tests)
       Confidence intervals
Midterm

III Models of Data (3 weeks)
      Linear regression
      Multiple linear regression
      Clustering (Measures of clustering and K-Means)

IV Using Computers to Find Better Answers (5 weeks)
      Representing solutions in a computer
      Neighborhoods
      Hill climbing heuristic
      Simulated annealing

Warning: This class is both simple and impossible at the same time. Computer coding is so frustrating and rewarding. When code is not working, it is so frustrating. When it works, it is so great. In the first lecture, some slides will discuss this issue. However, you can expect to work in this class. General university policy is every hour of class has 2 hours of homework. You can expect at least that level of work. Starting early and stopping when frustrated is the best way to work through the projects. If you fall behind, the class becomes very difficult.

<u>Departmental and College Policies</u>

1) <u>Academic Honesty:</u>
All students are responsible for their own work. Please review the University of Utah's "Rights and Responsibilities of Students (Student Code/Misconduct)" policies for details about the consequences of misconduct. Students must also complete the Canvas Module for Academic Integrity before accessing other materials on the course Canvas site.

 - Violations include, but are not limited to:
    a) <u>Cheating on an examination:</u>
       such as copying from another's paper, using unauthorized notes, calculators, etc., or giving or receiving unauthorized aid, such as trading examinations, whispering answers, passing notes, or using electronic devices to transmit or receive information.

    b) <u>Plagiarism:</u>
       This is using someone else's work without giving credit. It is, for example, using ideas, phrases, papers, laboratory reports, computer programs, data - copied directly or paraphrased - that you did not arrive at on your own. Sources include published works such as book, movies, Websites, and unpublished works such as other students' papers or material from a research service. In brief, representing someone else's work as your own is academically dishonest. The risk of plagiarism can be avoided in written work by clearly indicating, either in footnotes or in the paper itself, the source of any major or unique idea or wording that you did not arrive at on your own.

Sources must be given regardless of whether the material is quoted directly or paraphrased.

c) Unauthorized collaboration:

This is working with or receiving help from others on graded assignments without the specific approval of the instructor. If in doubt, seek permission from the instructor before working with others. Students are encouraged to learn from one another: Form study groups, discuss assignments, BUT each assignment must be individual work unless specifically stated and turned in as a group assignment.
- Copying another student's assignment and putting your name on it is plagiarism. - You are encouraged to talk to one another about your assignments; however, all assignments must be done by the student whose name is on it!

d) Academic Integrity:

Engineering is a profession demanding a high level of personal honesty, integrity and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the profession, adhere to the Department of Mechanical Engineering Policy for Academic Misconduct.

This policy is based upon:
the University of Utah's Policy 6-400: Code of Student Rights and Responsibilities

As part of the ME policy, students must review and acknowledge the:
"ME EN Academic Misconduct Policy"
This policy states:

Academic Integrity: Engineering is a profession that demands a high level of personal honesty, integrity, and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the engineering profession, adhere to the Department of Mechanical Engineering Policy for Academic Misconduct. This policy is based on University of Utah Policy 6-400: Code of Student Rights and Responsibilities that states *"Academic misconduct includes but is not limited to cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. It also includes facilitating academic misconduct by intentionally helping or attempting to help another to commit an act of academic misconduct."*

Students must acknowledge the ME Academic Misconduct Policy and course-specific definitions of academic misconduct by completing the corresponding CANVAS quiz by the end of the first week of class. Students who are not in compliance with this will receive an EU grade for the course.

The drop, withdraw dates change every semester and can be found at the following link.

University Policies

1. ***The Americans with Disabilities Act***. The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in
   an alternative format with prior notification to the Center for Disability & Access.

   o ***If in-class attendance is a necessary component of the course for pedagogical reasons (e.g., laboratories, studios, or artistic training), state it explicitly.***

      Use this standard language: *"Given the nature of this course, attendance is required and adjustments cannot be granted to allow non-attendance. However, if you need to seek an ADA accommodation to request an exception to this attendance policy due to a disability, please contact the* <u>*Center for Disability and Access*</u> *(CDA). CDA will work with us to determine what, if any, ADA accommodations are reasonable and appropriate*

   Basic Needs Student Support Statement. Success at The University of Utah includes learning about and using available resources. The <u>Basic Needs Collective</u> (BNC) is a coordinated resource referral hub. They educate about and connect students to campus and community resources to help them meet their basic needs. As a central location for resource referrals related to food, housing, health insurance, managing finances, legal services, mental health, etc., any student experiencing difficulty with basic needs is encouraged to contact them. Drop into their office located in the Union basement or schedule with them online for an in-person or virtual visit through their webpage: <u>https://basicneeds.utah.edu/</u>.

   In compliance with ADA requirements, some students may need to record course content. Any recordings of course content are for personal use only, should not be shared, and should not be made publicly available. In addition, recordings should be destroyed at the conclusion of the course

2. ***University Safety Statement.*** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more

information regarding safety and to view available training resources, including helpful videos, visit https://safeu.utah.edu

3. *Addressing Sexual Misconduct*. Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 383 South University Street, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

   a. **Lauren's Promise**: Lauren's Promise is a vow that anyone – faculty, staff, students, parents, and community members – can take to indicate to others that they represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking. Anyone who makes Lauren's Promise vows to: 1.) listen to and believe those individuals who are being threatened or experiencing sexual assault, dating violence or stalking; 2.) represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking; and 3.) change campus culture that responds poorly to dating violence and stalking. By making Lauren's Promise, individuals are helping to change campus cultures that respond poorly to dating violence and stalking throughout the nation.

4. *Academic Misconduct Statement.* It is expected that students adhere to University of Utah policies regarding academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative artificial intelligence (AI) tools without citation, documentation, or authorization. Students are expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which they are preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for their profession/discipline may be subject to academic sanctions as per the University of Utah's Student Code: https://regulations.utah.edu/academics/6-410.php

5. *Diversity Statement .* I stand in support of compassion, dignity, value-of-life, equity, inclusion and justice for all individuals regardless of color, race/ethnicity, sexual orientation, religion, language, socioeconomic status, ability, gender, gender identity or expression, immigration status, or any type of marginalization. I stand in support of making our society more inclusive, just, and equitable for all individuals. I stand against individual and systemic racism in all its various forms.

6. *Undocumented Student Support Statement.* Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the

Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.

7. Other important information to consider including:
    a. Student Code: http://regulations.utah.edu/academics/6-400.php

       This means that I have a right to kick you out of the classroom. Please behave with respect toward the instructor and other students. I hope to never have to use this power.

    b. Accommodation Policy (see Section Q):
       http://regulations.utah.edu/academics/6-100.php

8. *Student Mental Health Resources*
   - *If you need help dealing with burnout, anxiety, depression, isolation, and loneliness, or other mental health issues please, reach out. Here are some campus mental health resources, including free counseling, trainings and other support.*

   - *Consider participating in a Mental Health First Aid or other wellness-themed training provided by our Center for Student Wellness and sharing these opportunities with your peers, teaching assistants and department colleagues*

9. *Diverse Supports for Students.* Your success at the University of Utah is important to all of us here! If you feel like you need extra support in academics, overcoming personal difficulties, or finding community, the U is here for you.

Student Support Services (TRIO)

TRIO federal programs are targeted to serve and assist low-income individuals, first-generation college students, and individuals with disabilities.

Student Support Services (SSS) is a TRIO program for current or incoming undergraduate university students who are seeking their bachelor's degree and need academic assistance and other services to be successful at the University of Utah.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Student Support Services (TRIO)
801-581-7188

trio.utah.edu
 Room 2075
    1901 E. S. Campus Dr.
    Salt Lake City, UT 84112

American Indian Students

The AIRC works to increase American Indian student visibility and success on campus by advocating for and providing student centered programs and tools to enhance academic success, cultural events to promote personal well-being, and a supportive "home-away-from-home" space for students to grow and develop leadership skills.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

American Indian Resource Center
 801-581-7019
diversity.utah.edu/centers/airc
Fort Douglas Building 622
    1925 De Trobriand St.
    Salt Lake City, UT 84113

Black Students

Using a pan-African lens, the Black Cultural Center seeks to counteract persistent campus-wide and global anti-blackness. The Black Cultural Center works to holistically enrich, educate, and advocate for students, faculty, and staff through Black centered programming, culturally affirming educational initiatives, and retention strategies.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Black Cultural Center
801-213-1441
diversity.utah.edu/centers/bcc
Fort Douglas Building 603
    95 Fort Douglas Blvd.
    Salt Lake City, UT 84113

Students with Children

Our mission is to support and coordinate information, program development and services that enhance family resources as well as the availability, affordability and quality of child care for University students, faculty and staff.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Center for Childcare & Family Resources
801-585-5897
childcare.utah.edu
408 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Students with Disabilities

The Center for Disability & Access is dedicated to serving students with disabilities by providing the opportunity for success and equal access at the University of Utah. They also strive to create an inclusive, safe, and respectful environment.

For more information about what support they provide and links to other resources, view their website or contact:

Center for Disability & Access
801-581-5020
disability.utah.edu
162 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Students across Intersectional Identities and Experiences

The Center for Equity & Student Belonging (CESB) creates community and advocates for academic success and belonging for students across inter-sectional identities and experiences among our African, African American, Black, Native, Indigenous, American Indian, Asian, Asian American, Latinx, Chicanx, Pacific Islander, Multiracial, LGBTQ+, Neurodiverse and Disabled students of color.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Center for Equity and Student Belonging (CESB)
801-581-8151
diversity.utah.edu/centers/CESB/
 235 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

English as a Second/Additional Language (ESL) Students

If you are an English language learner, there are several resources on campus available to help you develop your English writing and language skills. Feel free to contact:

Writing Center
801-587-9122
writingcenter.utah.edu
2701 Marriott Library
  295 S 1500 E
  Salt Lake City, UT 84112

English Language Institute
801-581-4600
continue.utah.edu/eli
540 Arapeen Dr.
  Salt Lake City, UT 84108

Undocumented Students

Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles that prevent you from engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center.

Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families.

For more information about what support they provide and links to other resources, view their website or contact:

Dream Center
801-581-3470
dream.utah.edu
 1120 Annex (Wing B)
   1901 E. S. Campus Dr.
   Salt Lake City, UT 84112

LGBTQ+ Students

The LGBTQ+ Resource Center acts in accountability with the campus community by identifying the needs of people with a queer range of [a]gender and [a]sexual experiences and responding with university-wide services.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

LGBTQ+ Resource Center
801-587-7973
[lgbt.utah.edu (Links to an external site.)](lgbt.utah.edu)
409 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Veterans & Military Students

The mission of the Veterans Support Center is to improve and enhance the individual and academic success of veterans, service members, and their family members who attend the university; to help them receive the benefits they earned; and to serve as a liaison between the student veteran community and the university.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Veterans Support Center
801-587-7722
veteranscenter.utah.edu (Links to an external site.)
418 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Women

The Women's Resource Center (WRC) at the University of Utah serves as the central resource for educational and support services for women. Honoring the complexities of women's identities, the WRC facilitates choices and changes through programs, counseling, and training grounded in a commitment to advance social justice and equality.

For more information about what support they provide, a list of ongoing events, and links to other resources, view their website or contact:

Women's Resource Center
801-581-8030
womenscenter.utah.edu
411 Union Building
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Food Pantry

The University of Utah food pantry provides non-perishable, nourishing food for our students, their families, faculty, and staff.

For more information about what support they provide and links to other resources, view their website:

Feed U Pantry
feedufoodpantry@gmail.com
union.utah.edu/resources-spaces/feed-u-pantry/hours-about-us/
Union Building (Pantry is located on the basement level)
   200 S. Central Campus Dr.
   Salt Lake City, UT 84112

Tutoring

The Learning Center offers free services to currently-enrolled University of Utah students.

For more information about what support they provide and links to other resources, view their website.

Learning Center
801-581-5153
learningcenter.utah.edu
1705 J. Willard Marriott Library
   295 S. 1500 E
   Salt Lake City, UT 84112

Other Student Groups at the U

To learn more about some of the other resource groups available at the U, check out:

getinvolved.utah.edu/

Copyright statement: The recordings and all course material are the intellectual property of the instructor and may not be shared or reproduced without the explicit and written consent of the instructor. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern. Students may not share any of the course content with individuals not enrolled in the class or upload them to any other online environment.