Texas A&M University-Central Texas
Math 5380: Machine Learning
Online

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Office Hours: M W 5pm – 6pm online over Webex

Canvas access:
http://tamuct.instructure.com

Datacamp:
www.datacamp.com

UNILERT
Emergency Warning System for Texas A&M University – Central Texas

UNILERT is an emergency notification service that gives Texas A&M University-Central Texas the ability to communicate health and safety emergency information quickly via email, text message, and social media. All students are automatically enrolled in UNILERT through their myCT email account. Connect at www.TAMUCT.edu/UNILERT to change where you receive your alerts or to opt out. By staying enrolled in UNILERT, university officials can quickly pass on safety-related information, regardless of your location.

COURSE INFORMATION

1.0 Course Overview and description:

This class is designed to prepare the student to apply machine learning algorithms to real-world tasks and visualize data with the Shiny package in R/RStudio. Students will be required to finish a project using unsupervised machine learning techniques, in particular clustering (k-means clustering and dimensional reduction) to a data set. Students will also be required to create a portfolio on Github that can be used during future job interviews. Students will also be required to visualize data with the Shiny package by building web applications/widgets.
The material has an important hands-on component and student should have a computer running R 3.4.1 or later. Student should also have the Shiny package installed in RStudio.

Prerequisites

Machine Learning is a mathematical discipline, and students will benefit from a good background in probability, linear algebra and calculus. Programming experience in R or Python will be helpful.

2.0 Course Objective:

2.1 Student Learning Outcomes

After completing the course, students should be able to perform the following using R:

1. Use the console as a calculator
2. Assign variables
3. Create vectors in R
4. Name vectors in R
5. Select elements from the vectors
6. Compare different vectors
7. Create matrices in R
8. Perform basic computations with matrices
9. Store categorical data as factors
10. Create factors
11. Subset factors
12. Compare factors
13. Create data frames
14. Create lists
15. Name lists
16. Compare lists

Students should also be able to:

17. Explain what is machine learning
18. Build a basic prediction model
19. Explain the difference between classification, regression, and clustering
20. Explain the difference between supervised and unsupervised Machine Learning
22. Learn how the k-means algorithm works
23. Apply the k-means algorithm
24. Visualize data with shiny
25. Select the number of clusters when it is not known.
26. Understand Hierarchical Clustering
27. How to use Hierarchical Clustering
28. Learn how to use Principal Component Analysis for dimension reduction

### 2.2 Competency Goals Statements

The aim of this course is to equip students with the basic and advanced tools to be able to apply machine learning algorithms to a set of data. The course will use the software language R/RStudio and students will be able to use R to build a basic prediction model and become proficient in applying the k-means algorithms as an unsupervised technique. Students should also become proficient in Hierarchical clustering and understand Principal component analysis for dimension reduction.

### 3.0 Required Reading and Textbook(s):

No textbook is required for this course. Students are required to register in “Datacamp” to create an account and complete the following courses:

1. **Introduction to R by J. Cornelissen**
2. **Introduction to Machine Learning by Vincent Vankrunkelven**
3. **Unsupervised Learning in R by Hank Roark**

Instructions are below:

Navigate to:

[www.datacamp.com](http://www.datacamp.com)

Create an account and start on the above-mentioned courses.

### COURSE REQUIREMENTS

#### 4.0 Course Requirements:

- **Progress reports:**
  
  9 Progress reports due on Thursdays

- **Projects:**

  1 project due by the end of the course

**Technology requirements:**

Every student is required to have access to a laptop/desktop and download the webex application in order to have online meetings with the instructor. Students are also required to have the R/RStudio software downloaded to their laptops/computers. Students are required to have access to internet in order to sign up for two Datacamp courses.
The student is required to check Announcements on Canvas on a daily basis.

COURSE OUTLINE AND CALENDAR

6.0 Complete Course Calendar
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<th>Week 1</th>
<th>June 3</th>
<th>June 4</th>
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**SUMMER 2019**
7.0  Grading Criteria Rubric and Conversion
Progress Reports(9x100)  (900 points)  90%  90-100%=A
                                80-89%=B
                                70-79%=C
Final (1 x 100)             (100 points)  10%  60-69%=D
                                Below 60 %=F
TOTAL                     (1000 points)  100%

UNIVERSITY RESOURCES, PROCEDURES, AND GUIDELINES

Drop Policy.
If you discover that you need to drop this class, you must complete a Drop Request Form
[https://www.tamuct.edu/registrar/docs/Drop_Request_Form.pdf].

Professors cannot drop students; this is always the responsibility of the student. The Registrar’s Office will
provide a deadline on the Academic Calendar for which the form must be completed, signed and returned.
Once you return the signed form to the Registrar’s Office, you must go into Warrior Web and confirm that
you are no longer enrolled. If you still show as enrolled, FOLLOW-UP with the Registrar’s Office
immediately. You are to attend class until the procedure is complete to avoid penalty for absence. Should
you miss the drop deadline or fail to follow the procedure, you will receive an F in the course, which may
affect your financial aid and/or VA educational benefits.

Academic Integrity.
Texas A&M University -Central Texas values the integrity of the academic enterprise and strives for the
highest standards of academic conduct. A&M-Central Texas expects its students, faculty, and staff to
support the adherence to high standards of personal and scholarly conduct to preserve the honor and
integrity of the creative community. Academic integrity is defined as a commitment to honesty, trust,
fairness, respect, and responsibility. Any deviation by students from this expectation may result in a failing
grade for the assignment and potentially a failing grade for the course. Academic misconduct is any act
that improperly affects a true and honest evaluation of a student’s academic performance and includes, but is not limited to, cheating on an examination or other academic work, plagiarism and improper citation of sources, using another student’s work, collusion, and the abuse of resource materials. All academic misconduct concerns will be reported to the university’s Office of Student Conduct. Ignorance of the university’s standards and expectations is never an excuse to act with a lack of integrity. When in doubt on collaboration, citation, or any issue, please contact your instructor before taking a course of action.

For more information regarding the Student Conduct process, [https://tamuct.campuslabs.com/engage/organization/tamuct-student-conduct-panel].

If you know of potential honor violations by other students, you may submit a report, [https://cm.maxient.com/reportingform.php?TAMUCentralTexas&layout_id=0].

**Academic Accommodations.**
At Texas A&M University-Central Texas, we value an inclusive learning environment where every student has an equal chance to succeed and has the right to a barrier-free education. The Office of Access and Inclusion is responsible for ensuring that students with a disability receive equal access to the university’s programs, services and activities. If you believe you have a disability requiring reasonable accommodations please contact the Office of Access and Inclusion, WH-212; or call (254) 501-5836. Any information you provide is private and confidential and will be treated as such.

For more information please visit our Access & Inclusion Canvas page (log-in required) [https://tamuct.instructure.com/courses/717]

**Important information for Pregnant and/or Parenting Students.**
Texas A&M University-Central Texas supports students who are pregnant and/or parenting. In accordance with requirements of Title IX and related guidance from US Department of Education’s Office of Civil Rights, the Dean of Student Affairs’ Office can assist students who are pregnant and/or parenting in seeking accommodations related to pregnancy and/or parenting. Students should seek out assistance as early in the pregnancy as possible. For more information, please visit the Student Affairs web page [https://www.tamuct.edu/student-affairs/index.html]. Students may also contact the institution’s Title IX Coordinator. If you would like to read more about these requirements and guidelines online, please visit the website [http://www2.ed.gov/about/offices/list/ocr/docs/pregnancy.pdf].

Title IX of the Education Amendments Act of 1972 prohibits discrimination on the basis of sex and gender—including pregnancy, parenting, and all related conditions. A&M-Central Texas is able to provide flexible and individualized reasonable accommodation to pregnant and parenting students. All pregnant and parenting students should contact the Associate Dean in the Division of Student Affairs at (254) 501-5909 to seek out assistance. Students may also contact the University’s Title IX Coordinator.
Tutoring.
Tutoring is available to all A&M-Central Texas students, both on-campus and online. Subjects tutored on campus include Accounting, Advanced Math, Biology, Finance, Statistics, Mathematics, and Study Skills. Tutors are available at the Tutoring Center in Warrior Hall, Suite 111.

If you have a question regarding tutor schedules, need to schedule a tutoring session, are interested in becoming a tutor, or have any other question, contact Academic Support Programs at (254) 519-5796, or by emailing Dr. DeEadra Albert-Green at deeadra.albertgreen@tamuct.edu.

Chat live with a tutor 24/7 for almost any subject from on your computer! Tutor.com is an online tutoring platform that enables A&M-Central Texas students to log in and receive FREE online tutoring support. This tool provides tutoring in over 40 subject areas. Access Tutor.com through Canvas.

University Writing Center.
Located in Warrior Hall 416, the University Writing Center (UWC) at Texas A&M University–Central Texas (TAMUCT) is a free workspace open to all TAMUCT students from 10:00 a.m.-4:00 p.m. Monday thru Thursday with online only hours Monday thru Thursday from 6:00-9:00 p.m.

Tutors are prepared to help writers of all levels and abilities at any stage of the writing process. While tutors will not write, edit, or grade papers, they will assist students in developing more effective composing practices. By providing a practice audience for students’ ideas and writing, our tutors highlight the ways in which they read and interpret students’ texts, offering guidance and support throughout the various stages of the writing process. In addition, students may work independently in the UWC by checking out a laptop that runs the Microsoft Office suite and connects to WIFI, or by consulting our resources on writing, including all of the relevant style guides. Whether you need help brainstorming ideas, organizing an essay, proofreading, understanding proper citation practices, or just want a quiet place to work, the UWC is here to help!

Students may arrange a one-on-one session with a trained and experienced writing tutor by visiting the UWC during normal operating hours (both half-hour and hour sessions are available) or by making an appointment via WCONline. In addition, you can email Dr. Bruce Bowles Jr. at bruce.bowles@tamuct.edu if you have any questions about the UWC and/or need any assistance with scheduling.

University Library.
The University Library provides many services in support of research across campus and at a distance. We offer over 200 electronic databases containing approximately 250,000 eBooks and 82,000 journals, in addition to the 85,000 items in our print collection, which can be mailed to students who live more than 50 miles from campus. Research guides for each subject taught at A&M-Central Texas are available through our website to help students navigate these resources. On campus, the library offers technology including cameras, laptops, microphones, webcams, and digital sound recorders.

Research assistance from a librarian is also available 24 hours a day through our online chat service, and at
the reference desk when the library is open. Research sessions can be scheduled for more comprehensive assistance, and may take place on Skype or in-person at the library. Assistance may cover many topics, including how to find articles in peer-reviewed journals, how to cite resources, and how to piece together research for written assignments.

Our 27,000-square-foot facility on the A&M-Central Texas main campus includes student lounges, private study rooms, group work spaces, computer labs, family areas suitable for all ages, and many other features. Services such as interlibrary loan, TexShare, binding, and laminating are available. The library frequently offers workshops, tours, readings, and other events. For more information, please visit our Library website [http://tamuct.libguides.com/index].

**OPTIONAL POLICY STATEMENTS:**

**A Note about Sexual Violence at A&M-Central Texas**

Sexual violence is a serious safety, social justice, and public health issue. The university offers support for anyone struggling with these issues. University faculty are mandated reporters, so if someone discloses that they were sexually assaulted (or a victim of Domestic/Dating Violence or Stalking) while a student at TAMUCT, faculty members are required to inform the Title IX Office. If you want to discuss any of these issues confidentially, you can do so through Student Counseling (254-501-5955) located on the second floor of Warrior Hall (207L).

Sexual violence can occur on our campus because predators often feel emboldened, and victims often feel silenced or shamed. It is incumbent on ALL of us to find ways to actively create environments that tell predators we don’t agree with their behaviors and tell survivors we will support them. Your actions matter. Don’t be a bystander; be an agent of change. For additional information on campus policy and resources visit the Title IX webpage [https://www.tamuct.edu/departments/compliance/titleix.php].

**Behavioral Intervention**

Texas A&M University-Central Texas cares about the safety, health, and well-being of its students, faculty, staff, and community. If you are aware of individuals for whom you have a concern, who are exhibiting behaviors that pose a threat to safety, or individuals causing a significant disruption to our community, please make a referral to the Behavioral Intervention Team. You can complete the referral online [https://cm.maxient.com/reportingform.php?TAMUCentralTexas&layout_id=2].

Anonymous referrals are accepted. Please see the Behavioral Intervention Team website for more information [https://www.tamuct.edu/student-affairs/bat.html]. If a person’s behavior poses an imminent threat to you or another, contact 911 or A&M-Central Texas University Police at 254-501-5800.
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