CSCI 497 – Applied Machine Learning

SYLLABUS: Spring 2021

INSTRUCTOR INFORMATION

Instructor	Prof. Eman Hammad
Office Location	ACB2-308
Office Hours	Virtual (Zoom) and on campus by appointment only
Email	eman.hammad **at** tamuc **dot** edu (1-2 business days)

COURSE INFORMATION

Lectures (Time/Location):

- Tuesday / Thursday, 1:25 – 2:35 PM.
- Delivery Format: synchronously in-person at ACB1 314 and virtual at myLeo online D2L.
- Recorded sessions will be uploaded to the course module on myLeo online D2L.

Open Source Resources(s) Recommended:

Suggested readings are optional; but are recommend to help you better understand the course material. **All of the textbooks listed below are freely available online.**

Bishop = Pattern Recognition and Machine Learning, by Chris Bishop.
ESL = The Elements of Statistical Learning, by Hastie, Tibshirani, and Friedman.
MacKay = Information Theory, Inference, and Learning Algorithms, by David MacKay.
Barber = Bayesian Reasoning and Machine Learning, by David Barber.
Sutton and Barto = Reinforcement Learning: An Introduction, by Sutton and Barto.

Course Description

Machine learning has been essential to the success of many recent technologies, including autonomous vehicles, search engines, genomics, automated medical diagnosis, image recognition, and social network analysis, among many others. This course will introduce the fundamental concepts and algorithms that enable computers to learn from experience, with an emphasis on their practical application to real problems. This course will introduce supervised learning (decision trees, logistic regression, support vector machines, Bayesian methods, neural networks and deep learning), unsupervised learning (clustering, dimensionality reduction), and reinforcement learning. Additionally, the course will discuss evaluation methodology and recent applications of machine learning, including large scale learning for big data and network analysis.

Student Learning Outcomes

Upon completion of the course, students will be able to:

- Identify relevant real-world problems as instances of canonical machine learning problems (e.g. clustering, regression, dimensionality reduction, etc.)
- Design and implement an effective solution to a regression, binary classification, or multi-class classification problem, using available open-source libraries when appropriate and writing from-scatch code when necessary.
- Compare and contrast appropriate evaluation metrics for supervised learning predictive tasks (such as confusion matrices, receiver operating curves, precision-recall curves).
- Design and implement effective strategies for preprocessing data representations, partitioning data into training and heldout sets, and selecting hyper parameters.
- Identify relevant ethical and social considerations when deploying a supervised learning or representation learning method into society, including fairness to different individuals or subgroups.
- Describe basic dimensionality reduction and recommendation system algorithms.

COURSE REQUIREMENTS

Prerequisites

Familiarity with Python programming is preferred but not required. A good reference is the Python Data Science Handbook by Jake VanderPlas. It's online for free and available as a notebook at the link above.

Instructional Methods

During this course, we will be using traditional and active learning methods, and work together using:

- Lectures: using slides, supplementary materials, and hands-on exercises.
- Assignments that will be released via the Learning Management Systems.
- Individual projects: details of the project will be released during weeks 3.

Computing Resources

For the homework assignments, we will use Python 3, and libraries such as NumPy, SciPy, and scikit-learn. Details will be shared later in the class.

The *syllabus/schedule are subject to change.*

Student Responsibilities and Tips for Success in the Course

1. It is expected that you are the owner of your success in this course, including ensuring you understand the expectations, timelines, policies and learning objectives.
2. Baseline expectations:
    a. Check LMS frequently.
    b. Follow the material in the textbook frequently, and use the slides as your guideline.
    c. Start your homework assignments early.
    d. Check the feedback on homework assignments.
    e. Do your work independently: collaboration and participation in study groups is encouraged to improve your understanding and to develop problem-solving strategies. However, cheating and plagiarism will not be tolerated, i.e. do not copy other people's work.
    f. Communicate with the instructor when you are confused, or having difficulties with the course material / assignment / project.

Project Information:

As part of this course you will work on an individual course project that requires you to apply several algorithms to a challenge problem and to produce a report summarizing/analyzing the results. More details on the project requirements will be shared during week 3 of the course.

GRADING

Letter grades will be determined using a standard percentage of points scale:

A = 90%-100%, B = 80%-89%, C = 70%-79%, D = 60%-69%, F = 59% or Below

Class attendance, doing all your project work will help the borderline cases. Check your grades often. Any score may be disputed up to seven (7) days after the score is posted. After 7 days, the score remains as-is.

Assessments

Assessment Type	Weight of Final Grade
Homework Assignments	40%
Midterm Exam 1	15%
Midterm Exam 2	20%
Final Project	25%

All homework assignments are programming assignments and need to be submitted via myleooneline by 11:59pm on the due date.

COURSE OUTLINE / CALENDAR

Week	Course Subject	Important Dates
Week 1, 2	Review: Probability, Linear Algebra, Optimization	Homework #0 released

The *syllabus/schedule are subject to change.*

Week 3	Software infrastructure Introduction and Basic Concepts	Homework #0 due Homework #1 released Project details released
Week 4	Linear Methods for Regression, Optimization	
Week 5	Logistic Regression, Multiclass Classification, Optimization	
Week 6, 7	Neural Networks	Homework #1 due Homework #2 released
Week 8	Midterm Exam #1	
Week 9	Spring Break	
Week 10	Trees, Forests and Ensembles	
Week 11	Gradient Boosting, Calibration	Homework #2 due Homework #3 released
Week 12	Probabilistic Models	
Week 13	Principal Component Analysis	
Week 14	Matrix Completion; Autoencoders	Homework #3 due Homework #4 released
Week 15	k-Means, EM Algorithm	
Week 16	Reinforcement learning	Homework #4 due
Week 16	Final Project Midterm Exam #2	

*The schedule is **tentative** and may be adjusted to fit the actual class progress.

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements
LMS Browser Support:
https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm
YouSeeU Virtual Classroom Requirements:
https://support.youseeu.com/hc/en-us/articles/115007031107-Basic-System-Requirements

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu**.**

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student is expected to have a backup method to deal with these inevitable

problems. In case of extreme technology related circumstances, please communicate directly with the instructor to best manage your success in this course.

COMMUNICATION AND SUPPORT

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:
https://community.brightspace.com/support/s/contactsupport

Interaction with Instructor Statement

To communicate with me about this course, kindly use the email address included in this syllabus. During the week, you can generally expect a response to your emails within 1-2 business days. *If you do not receive my response in 2 business days, please send a second email to me*.
To ensure I get your email and respond within indicated timelines above, please make sure that:

- Your email message is sent from your Texas A&M student account.
- Your email message includes a descriptive subject with the indicated prefix:
  CSCI 497 – Spring 2021 --<CWID>: <descriptive subject>

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

Attendance is required but not graded. Students are expected to do the readings, attend class, and participate in class discussions. Each student is responsible for managing their own time and work-load. Emergency / extreme circumstances causing a student to miss deadlines/exams will need to be supported by official and university approved documentation.

Positive Learning Environment

Your commitment as a student to learning is evidenced by your enrollment at Texas A &M University-Commerce. "All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment." (See Student's Guide Handbook, Policies and Procedure, Conduct).

Late Policy

All work submitted electronically must be submitted by midnight of the due date. Late work will be deducted 10% for each day past the due date. Assignment will not be accepted after three days from the due date.

Makeup Policy

There will be no makeup exams or quizzes. If you shall miss a quiz/exam because of acceptable extreme circumstances (hospitalization, serious injury, death in the family etc.), you may be offered to choose to receive a grade based on your in-class ranking in the next quiz/exam.

Collaboration Policy

Students are encouraged to consult with each other, with the instructor, or anyone else about any assignments / project. However, this must be limited to the discussion of the problem and sketching general approaches to a solution. Each student is responsible for submitting their own independent solutions to the assignment / project. Consulting another student's or group's solution is prohibited, and submitted solutions may not be copied from any source. These and any other form of collaboration on assignments constitute cheating. If you have any question or doubts about whether some activity would constitute cheating, please feel free to ask.

Academic Integrity

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments / project are to be completed by the individual student unless otherwise specified. Any student cheating will receive a zero on the work they are doing, and subsequent cheating will result in a failing grade and potential academic sanctions.

Basic Tenets of Common Decency

"All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment." (Student's Guide Handbook, Policies and Procedures, Conduct.). This means that rude and/or disruptive behavior will not be tolerated.

Disclaimer

This syllabus is meant to provide general guidance of what to expect from this course. The instructor reserves the right to make changes as appropriate based on the progress of the class. All changes made to this syllabus during the semester will be announced. This document has been posted electronically. If you print a copy of it, please be sure to consult the last modified date of the online version to verify that your printed copy is current.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx
Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: https://www.britannica.com/topic/netiquette

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01.
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf
Graduate Student Academic Dishonesty 13.99.99.R0.10
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

Texas A&M University-Commerce
Gee Library- Room 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu

Website: Office of Student Disability Resources and Services

http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Coronavirus Safety Measures

Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, transitioning to and between classes, study spaces, academic services, etc.)

Self-monitoring

Before you return to campus you should review the self-monitoring CDC recommendations that are available and hyperlinked below:

Self-monitoring CDC Recommendations

Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction or visit campus.

Face Coverings

Face coverings (cloth face covering, surgical mask, neck gaiters, etc.) must be properly worn in all common areas including classrooms, lobbies and hallways, and offices.

The *syllabus/schedule are subject to change.*

- To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student to leave and join the class remotely. If the student does not leave the class, the faculty member should report the incident to Carlos Pinkerton (cpinkerton@rellis.tamus.edu). Carlos will follow-up with the student and initiate the student conduct process. Additionally, the faculty member may choose to teach that day's class remotely for all students.
- Students who refuse to wear face coverings may be subject to possible sanctions for violations including failure to comply with university official, failure to comply with federal, state and local laws, disorderly conduct, and disruptive activity.

Physical Distancing

Physical distancing must be maintained between students, instructors, and others in course and course-related activities.

Within the building, we ask that you

- Follow marked pathways for entering and exiting classrooms.
- Leave classrooms promptly after course activities have concluded.
- Avoid congregating in hallways and maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.

Outside of the building we ask that you:

- Practice physical distancing of at least 6 feet
- Wear a mask unless you can maintain an appropriate physical distance of 6 feet

Quarantine

Students required to quarantine must participate in courses and course-related activities remotely and **must not attend face-to-face course activities**. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities.

Remote Learning

Every face-to-face class will have a remote learning option. The remote learning will be enabled using the following guidelines:

- Lectures: will be delivered synchronously during class time, and the recordings shall be uploaded afterwards on the LMS
- Remote learning students would be able to participate in the class discussions live via the chat feature or offline via the discussion threads on the LMS.
- Assignments and assessments would all be accessible online on the LMS.
- Students can always communicate with the instructor via email or through the discussion threads to request additional help.

Excused Absence

Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence.

https://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

COVID-19 Reporting Process

If you are exhibiting signs of COVID-19, we ask that you do not come to class. Instead you should complete the following steps:

Visit with a medical professional for evaluation and possible testing. Any upper-division student at RELLIS can visit the Texas A&M Physicians Health Community Clinic. The clinic is located in the Bryan Medical Center at:

2900 East 29th Street, Suite #1010,
Bryan, Texas 77802.

Report your signs and/or testing outcome using the A&M System Portal available and hyperlinked below:

Texas A&M University System Portal

You should utilize the portal if:

- You tested positive for COVID-19
- You are experiencing COVID-19 symptoms
- You have been in close contact (within 6 feet for more than 15 minutes) of someone who has or is suspected to have COVID-19
- Someone in your household (including roommate or housemate) has tested positive for COVID-19