COURSE-OUTLINE
Fall 2026
Machine Learning- CSCI 4350
Room: COB 255
Office Hours: T-R 10:30 AM -2:00 PM, M-W 11:00 AM -12:00 PM
Instructor: Arun Kulkarni, Ph.D. Professor of Computer Science
Office: COB 315.07

Course Description: The course will provide an overview of machine learning systems and describe algorithms for implementing various stages of a machine learning system. Various stages include preprocessing, classification, clustering, regression analysis, and post processing. These stages can be implemented using statistical methods, non-parametric methods, neural networks, fuzzy inference systems, fuzzy neural systems. Such techniques will be introduced in the course.

Couse Learning Objectives (CLOs)

By the end of this course, students will be able to:

1. **Explain foundational concepts:** Define core machine learning concepts, distinguish between supervised and unsupervised learning paradigms, and map real-world problems to appropriate machine learning tasks.
2. **Utilize development tools:** Write, debug, and execute modular code in MATLAB to manipulate datasets, implement algorithms, and visualize results.
3. **Analyze and pre-process data:** Conduct exploratory data analysis to understand data distributions, and apply appropriate pre-processing techniques—such as normalization, handling missing values, and feature scaling—to prepare raw data for modeling.
4. **Implement supervised models:** Build, train, and fine-tune supervised classification models (such as decision trees, k-nearest neighbors, or support vector machines) using structured datasets.
5. **Evaluate classifier performance:** Measure and analyze model performance using standard evaluation metrics, including accuracy, precision, recall, F1-score, and confusion matrices.
6. **Apply unsupervised learning:** Implement unsupervised classification and clustering techniques (such as k-means or hierarchical clustering) to discover patterns in unlabeled data.
7. **Design neural networks:** Explain the architecture of basic neural networks and implement multi-layer perceptron for classification tasks.
8. **Optimize outputs:** Apply post-processing techniques to refine model predictions, optimize decision thresholds, and interpret final model outputs.

TEXTBOOKS:

Stephen Marsland (2015). Machine Learning an Algorithmic Perspective. Second Edition, CRC Press, Boca Raton, FL.

REFERNCE BOOKS:

1) Kulkarni, A. D. (2001). Computer Vision and Fuzzy Neural Systems. Prentice Hall PTR, Upper Saddle River, NJ.
2) Sergios Theodoridis (2015). Machine Learning. Elsevier Academic Press.
3) Jiawei Han and Micheline (2011). Data Mining – Concepts and Techniques. Morgan Kaufmann, San Francisco, CA.

PRE-REQUISITES: Structured Programming, Linear algebra background

Tentative time allotment for the course will be as follows:

Topic	Hours
Introduction	3
Machine Learning Overview	3
MATLAB Programming	3
Know Your Data	3
Pre-processing Techniques	9
Supervised Classification Models	9
Classifier Evaluation	6
Unsupervised Classification	3
Neural Networks	3
Post Processing Techniques	3

EVALUATION:

90-100	A
80-89	B
70-79	C
60-69	D
0-59	F

SCHEDULE

		Evaluation
Test 1	Wednesday, 30-SEP-2026	70 %
Test 2	Wednesday, 11-NOV-2026	
Final	Wednesday, 7-DEC-2026	
Class Participation		10 %
Assignment 1	Friday, 25-SEP-2026	20 %
Assignment 2	Friday, 16-OCT-2026	
Assignment 3	Friday, 6-NOV-2026	
Assignment 4	Friday, 4-DEC-2026	

Academic Dishonesty: You are expected to do your own work. You may assist each other with general concepts, but direct assistance with a particular assignment or any attempts to gain an unfair academic advantage will not be tolerated. Cheating is considered a serious academic offense both by the department and the University. It may result in a failing grade from this course for all parties involved. The instructor reserves the right to ask you to explain any assignment that you turn in to judge if the work is yours.

Usage of AI tools: I expect all the work students submit for this course to be their own. I have carefully designed all assignments and class activities to support your learning. Doing your own work, without human or artificial intelligence assistance, is best for your efforts in mastering course learning objectives. For this course, I expressly forbid using ChatGPT or any other artificial intelligence (AI) tools for any stages of the work process, including brainstorming. Deviations from these guidelines will be considered a violation of UT Tyler's Honor Code and academic honesty values.

Disability/Accessibility Services: In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Tyler at Texas offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including non-visible a diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The **Student Accessibility and Resources** (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.