The University of Texas at Tyler
Department of Electrical and Computer Engineering

CMPE 4333 Introduction to Machine Learning

Syllabus

Catalog Description:

Introduction to supervised and unsupervised learning algorithms. Design and evaluation of models to predict and extract patterns within data. Explanation of model results. Recommender systems using collaborative filtering; content-based learning techniques; reinforcement learning. Three hours of lecture per week.

Prerequisites: EENG 3308, MATH 3203, and PHIL 2306

Credits: (3 hours lecture, 0 hours laboratory)

Text(s): No textbook purchase required; the course draws on several textbooks freely available online: *Machine Learning – A First Course for Engineers and Scientists*, Lindholm, Wahlström, Lindsten, and Schön (2022); *An Introduction to Statistical Learning, with Applications in Python*, James, Witten, Hastie, Tibshirani, and Taylor (2023); *Deep Learning*, Goodfellow, Bengio, and Courville (MIT Press, 2016); and *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, Hastie, Tibshirani, and Friedman (2nd ed., Springer, 2009).

Additional Material: None

Course Coordinator: Dr. Vijayalakshmi Saravanan, Assistant Professor, Computer Engineering

Topics Covered:

Supervised learning: linear and logistic regression, k-nearest neighbors, decision trees, and support vector machines; unsupervised learning and clustering: k-means, hierarchical clustering, and dimensionality reduction; model evaluation and validation: train/test splitting, cross-validation, bias-variance tradeoff, and performance metrics; introduction to neural networks; data preprocessing and feature engineering; recommender systems using collaborative filtering and content-based techniques; fundamentals of reinforcement learning; ethical and societal considerations in machine learning.

Evaluation Methods: (only items in dark print apply):

1. Mid-term and Final Examinations
2. Assignments and quizzes
3. Report
4. Computer Programming
5. Project Presentation
6. Course Participation
7. Peer Review

Course Learning Objectives[1]: By the end of this course, students will be able to:

1. Apply supervised learning algorithms, including linear and logistic regression, decision trees, and support vector machines, to build predictive models from labeled data [1, 4, 5].
2. Apply unsupervised learning algorithms, including k-means and hierarchical clustering and dimensionality reduction, to discover structure in unlabeled data [1, 4, 5].
3. Evaluate and compare machine learning models using appropriate performance metrics, cross-validation, and techniques to manage the bias-variance tradeoff [1, 2, 4].
4. Design, implement, and test machine learning solutions using modern programming languages, libraries, and tools [4, 5].
5. Explain the predictions and results produced by a machine learning model in terms accessible to technical and non-technical audiences [3, 6].
6. Design recommender systems using collaborative filtering and content-based learning techniques [4, 5].
7. Describe the fundamental concepts and applications of reinforcement learning [1, 2].
8. Evaluate the ethical, societal, and professional implications of applying machine learning to real-world engineering problems [3, 6].
9. Apply appropriate engineering standards and data-handling practices in the design and deployment of machine learning systems [1, 3].

[1]*Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Student Outcomes (only items in dark print apply)[2]: This course supports the following Computer Engineering Student Outcomes, which state that our students will possess:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1, 2, 3].
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors [4, 6].
3. An ability to communicate effectively with a range of audiences [5].
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts [8].
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives [4, 6].
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to conclude [3, 7].
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies [7, 9].

2 *Numbers in brackets refer to Course Learning Objective(s) that address the Program Outcome.*

Criterion 5. Curriculum This course contributes engineering topics appropriate to the computer engineering discipline, building on the mathematics, science, and engineering fundamentals established in earlier course work through the application of data-driven modeling and machine learning to engineering problems.

Prepared By: Vijayalakshmi Saravanan Date: 8/9/2026