CSCE 5215.501 Introduction to Machine Learning

Theory and practice of machine learning. Linear regression, logistic regression, decision trees, neural network learning, support vector machines, kernel methods, bagging, boosting, random forests, ensemble learning, deep learning, unsupervised learning including *k*-means and hierarchical agglomerative clustering, semi-supervised learning, active learning, and reinforcement learning. Practical applications of machine learning algorithms. Topics in experimental design and computational learning theory.

TOPICS, in approximate chronological order:

1. ML Overview
2. Designing a Learning System & ML Algorithms Overview

SUPERVISED LEARNING

3. Linear Regression
4. Perceptron and Classification
5. Logistic Regression and Classification
6. Decision Trees
7. Experimental Design
8. Evaluation
9. Artificial Neural Networks
10. Instance-based learning
11. Bias and Variance
12. Recurrent and Convolutional Neural Networks
13. Deep Learning
14. Deep Neural Networks
15. Support Vector Machines
16. Computational Learning Theory
17. Kernel methods
18. Ensemble methods and Bagging
19. Random Forests and Boosting

UNSUPERVISED LEARNING

20. K-means clustering
21. Hierarchical Agglomerative clustering
22. Expectation Maximization
23. Dimensionality Reduction, PCA

OTHER TOPICS

24. Active and Semi-Supervised Learning
25. Learning from large datasets
26. Reinforcement Learning Overview

Final Exam: Wednesday, March 7, 6:00pm-8:50pm, Room 121, Frisco Campus

ADA accommodation: UNT Policy 16.001: https://policy.unt.edu/policy/16-001

Academic Integrity Expectations: *Do the right thing!* UNT Policy 06.003 https://policy.unt.edu/policy/06-003

Learning Objectives:

Given a problem statement, have the skills to be able to:

- Recognize whether and where machine learning techniques are applicable,
- Determine which set of the ML algorithms covered in the course are applicable,
- Design a machine learning application component,
- Design and conduct appropriate machine learning experiments,
- Analyze and properly describe the outcome of ML experiments,
- Recognize the relevance of computational learning theory, and be able to extract key information from literature.

Major Assignments:

Major Project: You will need to find an appropriate significant problem, determine which ML algorithm(s) are well suited to apply to that problem, design and implement an ML application that contributes to the solution to the problem, design and conduct a statistically valid experiment to compare the results of your application to the results of another strong alternative system (others' or your own) and or to appropriate baseline systems, and analyze and properly describe the outcome of your experiment.

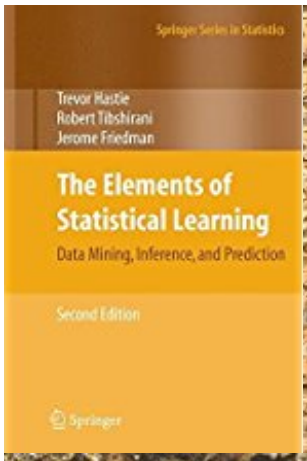
Final Exam: A final exam will assess your competency with regard to the learning objectives and topics covered throughout the semester.

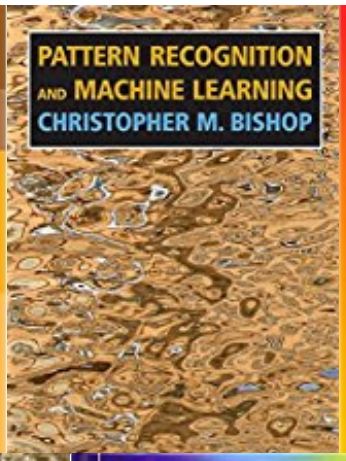
Instructor Information:

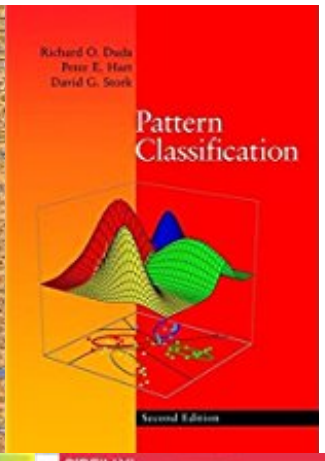
Rodney Nielsen
Discovery Park, office F246
Rodney.Nielsen@unt.edu

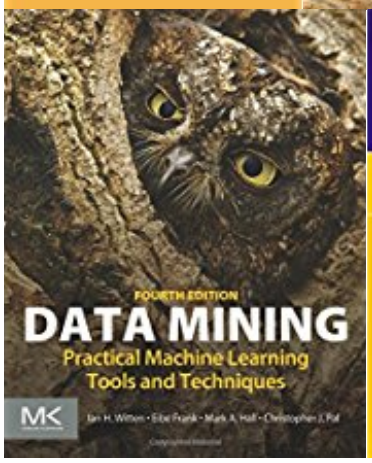
Office Hours: 11:30-12:30 Tuesday and Thursday or by appointment

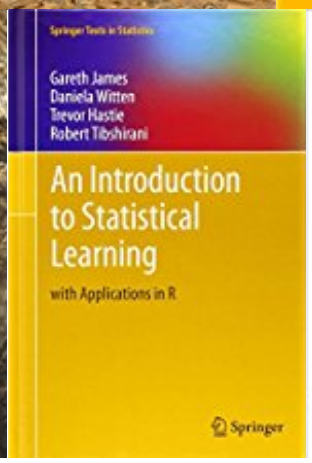
Recommended Reading:











Grading:

15%	Class participation (asking and answering thought provoking questions)
5%	Homework assignments
25%	Exams
40%	Project
15%	Significant constructive feedback on peer projects

Under extraordinary circumstances, late assignments might be accepted for partial credit if negotiated with the instructor.

Attendance is required and will be reflected as a component of the class participation grade.

Academic Integrity Expectations: *Do the right thing!*

Per UNT Policy 06.003: https://policy.unt.edu/policy/06-003 consequences of violations could include course failure, or in some repeat cases, expulsion.