Machine Learning
Fall 2019

Instructor:
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Meeting times and place:
MW 1:30-2:50 in CCSB 1.0702

Course Description:
Machine Learning studies the development of programs that can improve in the performance of a task with experience. For many difficult problems, solutions based on machine learning outperform all other solutions proposed to date. Examples of these problems include speech recognition, classification of objects in images, weather prediction, fraud detection, robot navigation, and many others. In this course we will study several of the most commonly used machine learning algorithms and their application to problems in several areas of interest. We will also discuss current research issues in Machine Learning and each student will do a research project related to a problem of his/her interest.

Outcomes:
On successful completion of this course, students will:

1. Understand and implement a variety of machine learning algorithms.
2. Evaluate strengths and weaknesses of different classes of learning algorithms given an application problem.
3. Evaluate quantitatively the performance of a learning algorithm in an application.

Graduate-level vs. Undergraduate Level Expectations:
Graduate students are given additional and more advanced assignment and exam questions when graduate and undergraduate versions of this course are cross-listed. The course includes an individual project; in the case of undergraduate students, implementation of well-known algorithms is usually sufficient, for graduate students, projects are expected to include advanced algorithms, analyses, and/or applications.

Course Contents:
1) Introduction
   b) Machine Learning tasks: classification, regression and reinforcement learning
   c) Basic tools
2) Evaluating Performance
   a) Metrics
   b) Cross-validation
      i) Training and test sets
      ii) N-fold cross validation
      iii) Leave-one-out cross validation
3) Supervised Learning algorithms
   a) K-nearest neighbors
   b) Naïve Bayes classifier
   c) Logistic regression
   d) Decision trees
   e) Decision forests
f) Evolutionary algorithms
g) Support vector machines
h) Neural networks

4) Unsupervised Learning and preprocessing
   a) Principal component analysis
   b) k-means

5) Applications
   a) Natural language processing
   b) Computer vision

Pre-requisites:
CS 2302 Data Structures, MATH 3323 Matrix Algebra, and STAT 3320 Probability and Statistics, or permission from instructor. Knowledge of Python is helpful.

Grading:
Labs and homework 25%
Class participation, quizzes and in-class exercises 10%
Partial exams (2) 25%
Final Exam 20%
Final Project 20%

Textbook:

Standards of Conduct and Academic Dishonesty:
A fundamental principle for any educational institution, academic integrity is highly valued and seriously regarded at The University of Texas at El Paso. More specifically, students are expected to maintain absolute integrity and a high standard of individual honor in scholastic work undertaken at the University. See https://www.utep.edu/student-affairs/osccr/student-conduct/academic-integrity.html for additional information.

Faculty, staff and students are expected to conduct yourself in a professional and courteous manner, as prescribed by the UTEP Standards of Conduct Guide: