

ECE4332-002 / 5332-002: Machine Learning

Spring 2019
TR 12:30 – 1:50 pm
Education 350

Instructor Information

- Name: Hamed Sari-Sarraf
- Office: EE 230
- Office Hours: Tue/Thur 2:00 – 3:30 (appointments and walk-ins are welcome)
- E-mail: Hamed.Sari-Sarraf@ttu.edu
- Office Telephone: 806-834-6702

Course Objectives

Students will be introduced to a wide range of foundational as well as current topics in machine learning that include linear models for regression, kernel methods, neural networks, and deep learning.

Prerequisites by Topic

- Probability and Statistics; Advanced Mathematics; Linear Algebra
- Matlab or Python programming language

Recommended Books

- C. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006
- I. Goodfellow and Y. Bengio, and A. Courville, *Deep Learning*, MIT Press, 2016
- S. Theodoridis, *Machine Learning: A Bayesian and Optimization Perspective*, Elsevier, 2015

Grading Policy

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| • Quizzes (lowest grade will be dropped) | 45% |
| • Software Projects, including the capstone project | 55% |

Special Remarks

- This is a graduate-level class that is also offered to advanced undergraduate seniors. While the level of theoretical maturity of the undergraduates may not measure up to that of the graduate students, it is expected to be strong enough to absorb the material presented in class lectures.
- Unless prior arrangements have been made with the instructor, missing a quiz or a project will result in a grade of zero.
- All quizzes will be closed book and use of calculators, cell phones, etc. will not be allowed.
- Final grades will not be curved.

Course Schedule and Learning Outcomes (Subject to Change)

Upon completion of this course students will be knowledgeable in:

1. History of Machine Learning (**Week 1**)
2. Linear Models for Regression and Classification (**Weeks 1 and 2**)
3. Nonlinear Models for Regression (**Weeks 2 and 3**)
4. From Regression to Machine Learning: Test Error Estimation, Under and Overfitting, Model Complexity, Regularization (**Week 4**)
5. Probabilistic Approach to Regression: Maximum Likelihood Estimation and Bayes Approaches (**Weeks 5 and 6**)

ECE4332-002 / 5332-002: Machine Learning

6. Bias versus Variance (**Week 7**)
7. Sequential Learning: Gradient Descent, Minibatch, Stochastic Gradient Descent, Gradient Descent with Momentum (**Week 8**)
8. Logistic Regression, Bayes Classifier, Perceptron, Curse of Dimensionality (**Weeks 9 and 10**)
9. Practical Issues in Designing Machine Learning Systems: No Free Lunch, Data Normalization, Unbalanced Classes, Popular Optimizers, Dimensionality Reduction (**Week 10**)
10. Feed-Forward Networks (**Weeks 10 and 11**)
11. Regularization in Feed-Forward Networks (**Week 11**)
12. Deep Learning: Convolutional Neural Networks (**Week 12**)
13. Support Vector Machine Regression and Kernel Methods (**Week 13**)
14. Mixture Models and Expectation Maximization (**Week 13**)
15. Deep Learning: Recurrent and Recursive Networks (**Week 14**)

Assessment Methods of Learning Outcomes (Subject to Change)

Learning Outcomes	Assessment Methods
2 & 3	Programming Project 1 – Quiz 1
4 & 5	Programming Project 2
6 & 7	Programming Project 3 – Quiz 2
8 & 9	Programming Project 4
10 & 11	Programming Project 5 – Quiz 3
12	Programming Project 6
13, 14 or 15	Programming Project 7 – Quiz 4

Important Dates

- No Classes (Spring Break) 03/12/2019 & 03/14/2019
- Last Class 05/07/2019
- Capstone Project Presentations 05/14/2019; 1:30 PM – 4:00 PM

Audio/Video Recording

Unless with the instructor's prior knowledge and consent, all audio and video recordings during lectures are strictly prohibited.

Academic Integrity

It is the aim of the faculty of Texas Tech to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed will result in a failing grade for the course and referral to the University Student Judicial Services.

Civility in the Classroom

Students are expected to assist in maintaining a classroom environment that is conducive to learning. Inappropriate behavior in the classroom that leads to the distraction of others shall not be tolerated under any circumstances.

Religious Holy Day

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence.

ECE4332-002 / 5332-002: Machine Learning

Students with Disabilities

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.