

## **ECE 44901 – Machine Learning**

### **Type of Course**

Elective for CmpE and EE programs

### **Catalog Description**

The purpose of this course is to provide a broad introduction to theoretical foundations, fundamental methods, techniques and algorithms as well as the latest progresses in machine learning with an emphasis on real-world problem solving. It covers learning theory, supervised learning, unsupervised learning, reinforcement learning and best practices in machine learning. Students will learn how to apply machine learning techniques to research or industry applications through interdisciplinary case studies and applications in machine learning.

### **Credits**

3

### **Contact Hours**

3

### **Prerequisite Courses**

ECE 30200 or equivalent (Probability and Statistics)

Programming skills in Matlab or Python

### **Recommended Textbooks**

J. Watt, R. Borhani, A. K. Katsaggelos. Machine Learning Refined: Foundations, Algorithms, and Applications. Cambridge University Press. 1st Edition.

I. Goodfellow, Y. Bengio, A. Courville. Deep Learning. The MIT Press.

### **Course Objectives**

The course will introduce a variety of topics in machine learning including parametric and non-parametric algorithms, support vector machines, neural networks, boosting, clustering, dimensionality reduction, deep learning and reinforcement learning.

### **Course Outcomes**

On successful completion of this course, students should be able to:

1. Understand theoretical foundations of machine learning. (1)
2. Implement a variety of machine learning algorithms. (1)
3. Develop effective learning models and evaluate their performances. (6)
4. Map and apply machine learning principles, methods and algorithms to real-world problems. (1)

**Lecture Topics**

1. Predictive learning with regression and classification
2. Numerical optimization, gradient descent and convergence
3. Linear regression and learning
4. Nonlinear regression and support vector machines
5. Multiclass classification
6. Kernels, back propagation and cross validation
7. Dimension reduction methods: K-means, principal component analysis and recommender systems
8. Deep learning: Convolutional Neural Networks and Recurrent Neural Networks
9. Reinforcement learning

**Computer Usage**

High

**Laboratory Experience**

High

**Design Experience**

High

**Coordinator**

Bin Chen

**Date**

October, 2019