

## ECE 656 Machine Learning and Adaptive Systems

**Course Credits:** 03

**Prerequisites:** EE 512 or equivalent and ECE303 knowledge of Random Variables

**Class Hours:** 11:00a.m-12:15p.m. Tuesdays and Thursdays

**Place:** Wager 107B

**Textbook:** S. Haykin, "Neural Networks and Learning Machines", Prentice-Hall, 3<sup>rd</sup> Ed, 2008.

**Instructor:** Dr. M. R. Azimi, Professor  
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**Grader:** Yajing Liu

**Office Hours:** TBD

### **Objective:**

The objective of this course is to introduce the students to adaptive system theory and machine learning techniques. Particular emphasis will be placed on different adaptation algorithms, learning discriminants, statistical pattern recognition, supervised and unsupervised learning, kernel machines for classification, regression and information retrieval, generative classifiers, manifold learning, and applications in signal/image processing areas. Upon completion of this course students will:

- (a) Apply adaptive system theory and methods for various learning models,
- (a) Evaluate different machine learning and artificial neural network systems,
- (b) Gain exposure to a wide range of application areas,
- (c) Design and implement a machine learning system for a given problem,
- (d) Analyze the performance of the designed systems using different performance metrics.

### **Course Outline:**

1. Introduction to biological nervous systems
2. Fundamentals of artificial neural networks
3. Adaptive filter theory, algorithms and structures
4. Least mean squares (LMS) and recursive least squares (RLS) adaptive rules
5. Regularization theory and applications
6. Statistical pattern classification
7. Learning discriminants, Layered machines
8. Supervised and Unsupervised learning
9. Self-organization and Associative memories
10. Structural risk minimization and kernel machines
11. Radial Basis Functions and Probabilistic neural networks
12. Deep Learning and Deep NN
13. Manifold learning
14. Applications in pattern classification and recognition, signal/image processing

**Grading Criteria:**

Assignments:	20%
Computer Projects	*45%
Final Project	35%

\*There will be three computer projects using MATLAB toolboxes dealing with the various machine learning paradigms and application areas.