EEC 289Q – Data Analytics for Computer Engineers

Instructor: Soheil Ghiasi
Spring 2018

Lecture: 4 hours
Prerequisites: EEC172, "EEC180B or ECS122A"

Description:
Advances in computing, and the ability to accumulate, process and extract application-dependent information from massive amounts of data have revolutionized scientific and engineering disciplines. Just as one example, large-scale deep convolutional neural networks have led to remarkable advances in image and speech recognition, problems that have been under active research for about half a century.
The goal of this special topics course is to provide an overview of machine learning techniques for students with computer engineering background. The course will introduce some theoretical concepts as well as algorithms from statistical data analysis and predictive modeling, with an emphasis on topics that are most relevant to computer engineering researcher and practitioners, such as integration of algorithms within a complete system (the interplay between data acquisition, processing, visualization, etc.), implementation tradeoffs and scaling considerations. Examples from different application domains, such as healthcare, e-commerce and finance will be discussed. An integral part of the course is a student-led seminar series (discussion of several key papers), and a course project on either collection or analysis of interesting data.

Grading: Letter based on homework %30, class participation 20%, and course project 60%

Textbook:

Yaser S. Abu-Mostafa, Malik Magdon-Ismail, Hsuan-Tien Lin, 'Learning from Data (a short course)', AMLbooks.com, 2012
Yoshua Bengio, Ian Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2016

Expanded Course Outline

1. Introduction
    a. How can we automatically learn from data?
        i. Example applications
        ii. Supervised learning vs. other machine learning paradigms
        iii. Classification vs. regression vs. logistic regression
        iv. Data analytics pipeline (acquisition, preprocessing, segmentation, feature extraction, classification and visualization)
    b. Overview of linear algebra
    c. Software environment and setup (Matlab, R, Caffe/TensorFlow)

2. Linear Models
    a. Multi-variate linear regression
    b. Linear classification
    c. Space transformation

3. Logistic Regression
    a. Model and learning algorithm
    b. Multiclass classification
    c. Overfitting and regularization

4. Neural Networks
    a. Model and applications
    b. Cost function and backpropagation algorithm
    c. Regularization for neural networks
    d. Practical considerations for backpropagation

5. Convolutional Neural Networks and Deep learning
    a. Model and applications
    b. Auto-encoders
    c. Fine-tuning of deep neural networks

6. Large scale machine learning
    a. Gradient decent for large models and/or large datasets
    b. GPU vs. FPGA implementation