EEL 5840
FUNDAMENTALS OF MACHINE INTELLIGENCE (3)
Tuesday (1st period) and Thursdays (1st and 2nd periods)
New Eng Bdg NEB 201
Fall 2017

Department of Electrical and Computer Engineering, University of Florida

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Office hours: Thu 10:00-12:00

Description  Overview of machine intelligence and the role of machine learning in
variety of real-world problems in areas such as remote sensing and
adaptive filtering. Probability and statistics to handle uncertain data.
Learning models from data in both a supervised and unsupervised fashion.
Linear models (e.g., linear discriminant analysis) and non-linear models
(e.g., neural networks) for classification. Linear dimensionality reduction
(e.g., principal components analysis) and non-linear dimensionality
reduction (e.g., manifold learning techniques and self-organizing maps).

Pre reqs:  Basic knowledge of probability, calculus, and linear algebra. Familiarity
with at least one programming language will be crucial. Helpful, but not
required, courses to have taken include: STA 3032 (Engineering
Statistics), STA 4321 (Introduction to Probability), MAS 3114
(Computational Linear Algebra), MAS 4105 (Linear Algebra), and EEL
3834 (Programming for Electrical and Computer Engineers).

Objectives: Understand and utilize the concepts of machine learning for data science
and electrical engineering. Focus on tools for multivariate data analysis
and how to handle uncertain data with probability models. Both static and
time varying data fitting and classification problems will be covered. Neural network implementations will also be used in the course.

Website:


Schedule: This is an approximate schedule
Week 1: Introduction to machine learning problems and methodologies
Week 2: Review of linear algebra
Week 3: Linear projections to subspaces (PCA)
Week 4: Filtering and Least Squares
Week 5: Searching for the optimum- least means squares (LMS)
Week 6: Properties of LMS Exam 1
Week 7: Review of Probability theory and statistics
Week 8: Maximum likelihood, MAP, Regularization & Bayesian Prior Equivalence
Week 9: Bayesian hypothesis testing (classification)
Week 10: Quadratic Classifiers
Week 11: Neural Networks and delta rule Exam 2
Week 12: Backpropagation Algorithm
Week 13: Feature selection and mixture modeling
Week 14: Clustering with K-means
Week 15: Clustering
Week 16: Clustering Validation and Evaluation

Grading:

<table>
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<th>Assignment</th>
<th>Total Points</th>
<th>Percentage of Final Grade</th>
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<tbody>
<tr>
<td>Homework Sets (8)</td>
<td>10 (each)</td>
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<td>Exam Part1</td>
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<td>Exam Part2</td>
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<tr>
<td>Project 1</td>
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<td>Project 2</td>
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<tr>
<td>Project 3</td>
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Hw1: Linear algebra
Hw2: PCA
Hw3: Least square
Hw4: LMS
Hw5: Bayesian classifiers
Hw6: Neural Networks
Hw7: Feature Selection
Hw8: Clustering

Project 1: Noise cancellation
Project 2: Remote sensing
Project 3: MNIST digit recognition

Policy:

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<tr>
<th>Percent</th>
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Software: Homework and projects will be a mixture of programming and write-ups of your results and analyses. You are free to use any programming language for these assignments. You will need access to a fast personal computer to develop and run your code on real-world datasets that we provide.