EEE 6504 MACHINE LEARNING FOR SIGNAL PROCESSING
SPRING 2019

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TextBook: *Knowledge Discovery from Data Streams, Joao Gama, CRC Press, 2010, ISBN 978-1-4398-2611-9*

References:

Adaptive Signal Processing, Widrow and Stearns, Prentice Hall,
Fundamentals of Adaptive Filtering, Ali Sayed, Wiley, 2003
Kernel Adaptive Filtering, Liu, Principe and Haykin, Wiley 2010
Information Theoretic Learning, Principe, Springer 2010

Course Goals:

The goal is to present the theory of on-line learning and cover several engineering applications in filtering and classification under stationary / nonstationary conditions including concept drift. The major topics will be the concept of on-line adaptation, change detection, novelty detection, and how to include them both in time series models and also clustering and classification. Both the LMS and RLS will be covered in detail for model building as well as decision trees. These concepts will be extended to functional spaces, specifically, reproducing kernel Hilbert Spaces (RKHS). Information theoretic measures will also be covered.

Topics with Approximate Schedule:

Week 1:	Adaptation as function approximation. Types of optimization problems
Week 2:	The linear model in functional spaces: Wiener theory
Week 3:	Least Squares and iterative algorithms
Week 4:	LMS and RLS Algorithms and quantification of the solution
Week 5:	ARMA model adaption
Week 6:	Hilbert Spaces and RKHS
Week 7:	Algorithms for Linear Functional models **Project 1**
Week 8:	Change Detection in streaming data
Week 9:	Clustering for data streams
Week 10:	Decision trees for Data Streams
Week 11:	Concept Drift
Week 12:	Novelty Detection
Week 13:	Information Theoretic Loss Functions
Week 14:	Correntropy **Project 2**
Week 15:	Entropy
Week 16:	Divergences

Grading:		
	Homework	30%
	Project I	35%
	Project II	35%

Computer Projects: Students will have the opportunity to apply the algorithms to real world data using Matlab/Python.