EEL 6935
DEEP LEARNING (3)
Tuesday (2nd and 3rd periods) and Thursday (3rd period)
Larsen 239
SPRING 2017

Department of Electrical and Computer Engineering, University of Florida

Instructor: J.C. Principe, Distinguished Professor of Electrical Engineering.
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Goals: Understand and utilize neural network concepts in pattern recognition and deep learning. Neural networks models will be explained from the point of view of nonlinear adaptive models. Emphasis on time varying models and deep learning. Figures of merit for neural network design will also be covered.

Pre-requisites: Foundations of Machine Learning.

Graduate: Nonlinear modeling in neural networks and kernel spaces. Gradient descent learning in the additive neural model. Statistical Learning Concepts. Information theoretic cost functions. Convolution neural networks. Recurrent neural networks. Foundations of Deep Learning. Importance of Deep learning for representation. Current models for image and speech recognition. Challenges of Deep Learning.

Website: Canvas – https://ufl.instructure.com

Text Book: "Deep Learning" by Goodfellow, Bengio & Courville, MIT Press 2016
+ notes of the instructor.

References: Neural and Adaptive Systems: Fundamentals Through Simulation, Principe, Euliano and Lefebvre, Wiley, 2000.
Information Theoretic Learning, Principe, Springer, 2010.
Neural Networks for Pattern Recognition, Bishop, Oxford, 1998.

Grading: Several homeworks, and class projects involving neural solutions to real world problems.

Homework	40%
Project I	30%
Project II	30%

Projects: **Project 1:** Time series classification with neural networks. Report will be a 7 page IEEE format paper.

Project 2: Image recognition application using a deep learning architecture. Report will be a 7 page IEEE format paper.

Software: Homework and projects require access to a fast computer and MATLAB or Python.

Schedule: This is an approximate schedule

Week 1: Review of statistical learning

Week 2: Review of adaptive filters and LMS

Week 3: Neural Networks for regression and classification

Week 4: Information theory and statistical learning

Week 5: Information theoretic Cost Functions

Week 6: Kernel Adaptive Filters

Week 7: Kernel Learning

Week 8: Multilayer Perceptrons and Backpropagation

Week 9: Autoencoders and convolution neural network

Week 10: Recurrent neural networks

Week 11: Backpropagation through time algorithm

Week 12: Training deep architectures efficiently

Week 13: Unsupervised Deep learning

Week 14: Programming deep learning in GPUs

Week 15: Applications in image and voice recognition