Code	Course Title	CHs	Pre-Req
DS505	Deep Learning	3(3+0)	Machine Learning

Recommended Texts

1. Deep Learning, 1st Edition, Yoshua Bengio, Ian Goodfellow, Aaron Courville, Neural networks and deep learning, 1st Edition, Michael A. Nielsen (2016)
2. Hands-On Machine Learning with Scikit Learn and Tensor Flow, 1st Edition, Aurélien Géron (2017)

Course Description

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions, and self-driving cars.

Course Objectives

- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines, Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

Week Wise Topics to be Covered

W1	Introduction to Deep learning, Review of Linear classification
W2	Multi-class Support Vector Machines, Softmax, and Regularization
W3	Gradient Descent & Stochastic, Gradient Descent (SGD)
W5, W6	Backpropagation (Intuitions, back propagation as flow graph), Introduction to Neural Networks (model of a biological neuron, activation functions, neural net architecture, representational power, etc.), Building Neural Networks (data preprocessing, loss functions, weight initialization, regularization, dropout, batch normalization),
W7	Learning Neural Networks (Learning and Evaluation gradient checks, sanity checks), Variants of SGD (momentum, Adagrad/RMSprop, ADAM),
W8	Introduction to Convolutional Neural Networks (CNN) and its components (Convolution and Pooling Layers),
W9	Convolutional Neural Network case studies (AlexNet/ZDNet/VGGNet),
W10	Understanding and Visualizing Convolutional Neural Networks, Convolutional networks for other visual Recognition Tasks (Localization, Detection, Segmentation, etc.),
W11	Transfer Learning and Fine-tuning Convolutional Neural Networks
W12	Introduction to Natural Language Processing (NLP)
W13	Learning word and sentences embedding (wordvec, glove, sentvec),
W14	Introduction to recurrent networks (RNNs, LSTMS, etc.), Applications of Recurrent neural networks to different NLP tasks (e.g. sentiment analysis, parsing, NER tagging, etc.),
W15, W16	Introduction to Reinforcement Learning and Q- Learning, Deep Q-Networks (DQN) and Game playing using DQN, Introduction to Policy gradients and their applications.,