

Objectives: To get insights of image and video analysis task using deep learning. To get the students aware about building blocks used in deep learning based solutions.

Unit I: Introduction: What is Deep Learning?, Why Deep Learning?, What is a neural network?, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptron, Perceptron Learning Algorithm

Unit II: Deep Feedforward Networks and Regularization in Deep Learning: Example: Learning XOR, Gradient-based learning, Hidden units, Backpropagation and other differentiation algorithms, Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping, Parameter Tying and Parameter Sharing, Bagging and Other Ensemble Methods, Adversarial Training

Unit III: Convolutional Networks: The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks

Unit IV: Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory

Unit V: Deep Learning Applications, Platforms and Software Libraries: Large-scale deep learning, Computer vision, Speech recognition, Natural language processing, H2O.ai, Dato GraphLab, Theano, Caffe

Reference Books

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron An MIT Press book
2. Neural Networks and Deep Learning by Michael Nielsen
<http://neuralnetworksanddeeplearning.com>
3. Pattern Classification by Richard O. Duda, Peter E. Hart, David G. Stork John Wiley & Sons Inc