RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning, V-Semester

Departmental Elective AL 503 (B) Deep Learning

COURSE OBJECTIVES: Introduce deep learning fundamentals and major algorithms, the problem settings, and their applications to solve real world problems.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Describe in-depth about theories, fundamentals, and techniques in Deep learning.
2. Identify the on-going research in computer vision and multimedia field.
3. Evaluate various deep networks using performance parameters.
4. Design and validate deep neural network as per requirements.

Unit I: Introduction History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptions (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation, weight initialization methods, Batch Normalization, Representation Learning, GPU implementation, Decomposition – PCA and SVD.

Unit II: Deep Feedforward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, Adam, RMSProp, Auto-encoder, Regularization in auto-encoders, Denoising auto-encoders, Sparse auto-encoders, Contractive auto-encoders,Variational auto-encoder, Auto-encoders relationship with PCA and SVD, Dataset augmentation.Denoising auto encoders,

Unit III: Introduction to Convolutional neural Networks (CNN) and its architectures, CCN terminologies: ReLu activation function, Stride, padding, pooling, convolutions operations, Convolutional kernels, types of layers: Convolutional, pooling, fully connected, Visualizing CNN, CNN examples: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, RCNNetc. Deep Dream, Deep Art. Regularization: Dropout, drop Connect, unit pruning, stochastic pooling, artificial data, injecting noise in input, early stopping, Limit Number of parameters, Weight decay etc.

Unit IV: Introduction to Deep Recurrent Neural Networks and its architectures, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, Gated Recurrent Units (GRUs), Long Short Term Memory (LSTM), Solving the vanishing gradient problem with LSTMs, Encoding and decoding in RNN network, Attention Mechanism, Attention over images, Hierarchical Attention, Directed Graphical Models. Applications of Deep RNN in Image Processing, Natural Language Processing, Speech recognition, Video Analytics.

Unit V: Introduction to Deep Generative Models, Restricted Boltzmann Machines (RBMs), Gibbs Sampling for training RBMs, Deep belief networks, Markov Networks, Markov Chains, Auto-regressive Models: NADE, MADE, PixelRNN, Generative Adversarial Networks (GANs), Applications of Deep Learning in Object detection, speech/ image recognition, video analysis, NLP, medical science etc.

TEXT BOOKS RECOMMENDED:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville; Deep Learning, MIT Press.
2. Charu C. Aggarwal "Neural Networks and Deep Learning: A Textbook", Springer.
3. Francois Chollet, "Deep Learning with Python", Manning Publications.

REFERENCE BOOKS:

1. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow: Concepts, Tools, and Techniques to Build Intelligent Systems”, O'Reilly.
2. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly.
3. Adam Gibson, Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly.