Mandsaur University

Bachelor of Technology (Computer Science and Engineering) (AI)
Semester-V

L-2 T-1 P-0 C-3

CSE766TR1 - Deep Learning

Course Objectives

- To learn the basics of neural networks and compare different deep learning models
- To Learn the Recurrent and Recursive networks in Deep Learning
- To learn the basics of deep reinforcement Learning models and types of Networks

Course Outcomes (COs)

1. Analyze the performance of deep learning models with respect to the bias-variance tradeoff, over fitting and under fitting, estimation of test error and understand the basic concepts of deep learning.
2. Analyze the main parameter such as activation function and hyperparameter of neural network and understand the concept and working of neural network.
3. Understand the basic architecture and working of convolution neural networks (CNN) with importance in Deep Learning models.
4. Understand the concept, types and working of recurrent and recursive neural networks.
5. Apply deep generative models and understand reinforcement learning process.

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	1	1	1	1	-	-	-	-	2	-	1	-
CO2	2	3	2	1	1	1	-	-	-	-	-	1	-	1	-
CO3	3	2	2	2	2	1	2	1	-	-	-	2	-	2	1
CO4	3	2	1	1	2	2	2	1	-	-	-	2	-	2	1
CO5	3	2	2	2	3	2	1	1	-	-	-	2	-	2	2

High-3 Medium-2 Low-1

UNIT I: Foundations of Deep Learning 9 Hours

Basic definition of machine learning and deep learning Basic Terms: bias, variance, tradeoff, hyper parameters, under/over fitting regularization. Limitations of machine learning, History of deep learning,Advantage and challenges of deep learning. Learning representations from data, Understanding how deep learning works in three figures, Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning

UNIT II: Introduction to Neural Networks 9 Hours

The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks, Training Neural Networks: Back propagation and Forward propagation Activation Functions: Linear, Sigmoid, Tannh, Hard Tanh, SoftMax, Rectified Linear, Loss Functions: Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Reconstruction. Hyper parameters: Learning Rate, Regularization, Momentum, Sparsity. Deep Feed forward Networks – Example of Ex OR, Hidden Units, cost functions, error back propagation, Gradient-Based Learning.

UNIT III: Convolution Neural Network (CNN) 9 Hours

Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network.

UNIT IV: Recurrent Neural Network (RNN) **9 Hours**

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 Generative Models **9 Hours**

Introduction to deep generative model, Boltzmann Machine,Deep Belief Networks, Generative adversarial network (GAN), Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning.

Total: 45 Hours

Reference(s):

1. Richard S. Sutton and Andrew G. Barto, ―Reinforcement Learning: An Introduction.
2. Deep Learning from Scratch: Building with Python from First Principles‖O'Reily by SethWeidman.
3. Francois Duval, ―Deep Learning for Beginners, Practical Guide with Python and Tensorflow.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/
3. http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf
4. https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col-dkrieselcom.pdf

Subject Tr. **Academic Coordinator** **HoD** **Sr. Faculty Nominated by DOAA**

Practical(s)

1. WAP to implement Union, Intersection and Complement operations.
2. WAP to implement Artificial Neural Network.
3. WAP forImplementation of different activation functions to train Neural Network.
4. WAP for implementation of different Learning Rules.
5. WAP forimplementation of Perceptron Networks.
6. WAP forimplementation of Pattern matching using different rules.
7. WAP related to application of deep learning in healthcare.
8. WAP related to application of deep learning in business analysis.