- Lecture Hours	TOPICS
Unit – I	
1-2	Introduction to Neural Networks – Biological NN Vs ANN
3-4	Computational Models in NN, Neurons Interconnection, ANN Architecture
4-5	Activation functions & ANN, Perceptron -Single Layer Perceptron and Multi Layer Perceptron
6-8	Forward and Back propagation, Training Neural Network
Unit – II	
1	Improving NN- Hyperparameter Tuning, Overfitting and Underfitting
2	Regularization and Optimization
3-4	Dropout, Batch Normalization
5-7	Data Augmentation
Unit – III	
1-3	Introduction to Convolution Neural Networks (CNNs), Mathematical Intuitions, Terminology, Activation Functions in CNNs, Training Aspects of CNNs , Overview of CNN architecture
4-5	Image Classification (Ex: LeNet, AlexNet, VGG, GoogleNet, ResNet)
5-6	Common challenges in training deep CNNs (vanishing gradients, overfitting)
Unit - IV	
1	Introduction to Sequential Data and Deep Learning
2-3	Recurrent Neural Networks (RNNs)- Overview of RNNs, RNN architecture- Recurrent layers, hidden states, and loops, Limitations of vanilla RNNs: Vanishing and exploding gradient problems,
4-7	Introduction to LSTMs, LSTM architecture: Forget gate, input gate, and output gate , Training RNNs and LSTMs, Gated Recurrent Units (GRU), Unsupervised Learning: Auto-encoders
Unit – V	
1-7	Applications of Deep Learning- Time Series Forecasting, Natural Language Processing (NLP), Speech Recognition, Video Processing, Computer Vision for Object detection(Faster R-CNN, YOLO, SSD), Instance Segmentation, Semantic Segmentation (Mask RCNN, DeepLabV3) ,Emerging Trends in Deep Learning

Textbooks

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville,“ Deep Learning “ , MIT Press , 2017
2. Charu. C. Aggarwal, “Neural Networks and Deep Learning”, Springer, Second Edition, 2023
3. Nikhil Buduma and Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, (1st. ed.), O'Reilly Media, Inc 2017

References

1. Christopher M. Bishop, “Neural Networks for Pattern Recognition”, Oxford Press,2008
2. R. J. Schalkoff,Artificial Neural Networks,McGraw Hill Education, New York, USA, 2011. ISBN 12-5900-237-3.
3. B.Yegnanarayana,Artificial Neural Networks,Prentice Hall India Learning Private Limited publishers,Mumbai, India,1998. ISBN81-2031-253-8.