

ANURAG UNIVERSITY

Pre-Ph.D

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Advanced Deep Learning Techniques and Applications

Course Objectives:

- Understand the fundamental concepts and basic principles of deep learning, including neural network structure, forward and backward propagation, and training techniques.
- Understand the concept of Convolutional Neural Networks (CNNs) and apply them to solve image classification and object detection problems.
- Analyze the working of various Recurrent Neural Network (RNN) methods, including LSTM and GRU, and apply them to sequence prediction and time-series analysis tasks.
- Explore and analyze different Autoencoder architectures and their applications, including denoising, sparse, and variational autoencoders.
- Use advanced CNN models and Transfer Learning techniques to solve problems in high-dimensional data, particularly for image and speech processing tasks.

UNIT-I

Introduction to Deep Learning: Introduction to Deep Learning, Structure of a neuron, Building Block of Neural Networks, Single and Multilayer, Forward propagation, back propagation, Difference between the Deep Learning and Machine Learning, Applications of Deep Learning, Loss functions, Gradient descent, Vanishing gradient descent, Regularization, Batch Normalization, Dropout, Activation functions

UNIT-II

Convolutional Neural Network (CNN): Introduction, architecture of CNN, striding and padding, pooling layers, structure, operations and prediction of CNN with layers, Applications: Object detection, Image segmentation

UNIT-III

Recurrent Neural Networks (RNNs): Introduction, architecture of RNN, Types of RNN, Applications, and Advantages, LSTM, GRUs, LSTM vs GRU, Recurrent Neural Networks (RNNs) for Video Sequence Analysis.

UNIT-IV

Autoencoders and Generative Adversarial Networks (GANs): Introduction to Autoencoders: types, applications, denoising, sparse, deep, and variational autoencoders, Generative Adversarial Networks (GANs): Architecture, types (e.g., Cycle GAN), applications, Comparison of GANs with Autoencoders, Generative Adversarial Networks (GANs) for Image Synthesis.

UNIT-V

Advanced CNN Models: Introduction, need of advanced models, InceptionV3, ResNet-50, DenseNet, VGG 16, YOLO (You Only Look Once), introduction to Transfer Learning

Text Books:

- Seth Weidman, "Deep Learning from Scratch", O'Reilly Media, Inc.,2019
- Ian Goodfellow, Yoshua Bengio and Aaron Courville,"Deep Learning", MIT Press, 2015
- Dipanjan Sarkar,Raghav Bali, "Transfer Learning in Action", Manning Publications,2021

Reference Books:

- Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
- Antonio Gulli, Sujit Pal, "Deep Learning with Keras", Packt Publishers, 2017.
- Francois Chollet, "Deep Learning with Python", Manning Publications, 2017.