

COURSE CODE	COURSE TITLE	L	T	P	C
1152IT152	DEEP LEARNING	3	0	0	3

OBJECTIVES:

This course covers the basics of machine learning, neural networks and deep learning, present the mathematical, statistical and computational challenges of building neural networks, to introduce dimensionality reduction techniques so enable the students to know deep learning techniques to support real-time applications and to examine the case studies of deep learning techniques.

OUTCOMES:

Upon completion of the course, the students will be able to:

1. Understand basics of deep learning
2. Implement various deep learning models
3. Realign high dimensional data using reduction techniques
4. Analyse optimization and generalization in deep learning
5. Explore the deep learning applications

UNIT I INTRODUCTION

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Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS

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History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENSIONALITY REDUCTION

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Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT IV OPTIMIZATION AND GENERALIZATION

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Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT V CASE STUDY AND APPLICATIONS

9

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

REFERENCES:

1. Cosma Rohilla Shalizi, *Advanced Data Analysis from an Elementary Point of View*, 2015.
2. Deng & Yu, *Deep Learning: Methods and Applications*, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, 2016.
4. Michael Nielsen, *Neural Networks and Deep Learning*, Determination Press, 2015.