Deep Learning
(H15)

Lectures	:	3 Hours / Week	Tutorial	:	1	Practical	:	0
CIA Marks	:	30	SEE Marks	:	70	Credits	:	4

Prerequisites:

Machine Learning(20IT602)

Course Outcomes:

By the end of the course student will be able to

CO1: Train and test an Artificial neural network with appropriate optimization method, loss function and activation functions.

CO2: Design a Convolutional neural network by selecting the number of filters, stride and pooling for image classification and extend pre-trained models for computer vision applications.

CO3: Classify, POS-tag the input language samples using LSTM and GRU.

CO 4: Model the probability distribution in the existing data to generate new data samples.

Mapping of Course Outcomes with POs and Program Specific Outcomes(PSOs):

CLO/OCs	Program Outcomes(POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	2	3	-	3	2	-	-	-	-	-	1	3	3	3
CO2	3	2	3	-	3	2	-	-	-	-	-	1	3	3	3
CO3	3	2	3	-	3	2	-	-	-	-	-	1	3	3	3
CO4	3	2	3	-	3	2	-	-	-	-	-	1	3	3	3

UNIT - I **(15 Periods)**

Artificial Neural Networks: Perceptron Learning algorithm, Feedforward neural networks, activation functions, backpropagation algorithm, loss functions, Gradient Descent - Stochastic Gradient Descent (SGD), Mini Batch Stochastic Gradient Descent (MB-SGD), Optimization methods - SGD with momentum, Adaptive Gradient (AdaGrad), RMSprop, Adam, Regularization - L2 regularization, L1 regularization and dropout. Implementation of ANN using TensorFlow.

UNIT - II **(15 Periods)**

Convolutional Neural Networks: Convolution, filters, stride, padding, feature maps, Architecture of

CNNs - input layer, convolutional layers, activation functions, pooling layers, fully connected layers, output layer, training, pre-trained CNN models, transfer learning, image classification. TensorfFow implementation.

UNIT - III (15 Periods)

Sequence Models: Introduction to Sequence Modeling, word embeddings, Recurrent Neural Networks (RNNs) - Basic architecture of RNNs, Language model and sequence generation, Sentiment analysis, Vanishing and exploding gradient problems in RNNs, Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) architectures to address the vanishing gradient problem, Training RNNs.

UNIT - IV (15 Periods)

Generative Models: Autoencoders, Architecture and training of autoencoders for unsupervised representation learning, Variants of autoencoders - Denoising autoencoders, sparse autoencoders, and contractive autoencoders, Variational Autoencoders (VAEs), The encoder-decoder framework and the reparameterization, The role of the latent space in VAEs for generating new samples, Generative Adversarial Networks (GANs) - Understanding the GAN architecture with generator and discriminator networks.

TEXT BOOKS:

1. Francois Chollet. *Deep Learning with Python*. Manning Publishers, 2 edition, 2021. ISBN 9781617296864

2. Aurelien Geron. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly publishers, 2 edition, 2019b. ISBN 9781492032649

REFERENCES:

1. Mitesh M Khapra. *NPTEL Course on Deep Learning*. IIT Madras, 2018. URL `https://archive.nptel.ac.in/courses/106/106/106106184/`

2. Ian Goodfelllow, Yoshua Benjio, and Aaron Courville. *Deep Learning*. The MIT Press, 1 edition, 2020. ISBN 9780321564085. URL `http://www.deeplearningbook.org`

3. Michael Nielsen. *Neural Networks and Deep Learning*. URL `http://neuralnetworksanddeeplearning.com`