

Devi Ahilya University, Indore, India Institute of Engineering & Technology				IVYear B.E. Computer Engineering (FullTime)				
SubjectCode&Name		Instructions Hours per Week			Credits			
7CERE1 Deep Learning		L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours		3	1	2	3	1	1	5

LearningObjectives:

- To understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.
- To understand CNN algorithms and the way to evaluate performance of the CNNarchitectures
- To apply RNN and LSTM to learn, predict and classify the real-world problems in the paradigms of Deep Learning.
- To understand, learn and design GANs for the selected problems.
- To understand the concept of Auto-encoders and enhancing GANs using auto-encoders

Prerequisites:Machine Learning.

Course Outcomes (CO) and Program Outcomes (PO) Mapping

CO No.	Course Outcome	Program Outcomes (PO)
CO1	Understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.	PO1, PO2, PO12
CO2	Understand CNN algorithms and the way to evaluate performance of the CNN architectures.	PO2, PO4, PO5, PO10
CO3	Apply RNN and LSTM to learn, predict and classify the real-world problems in the paradigms of Deep Learning.	PO2, PO4, PO5
CO4	Understand, learn and design GANs for the selected problems.	PO1, PO2, PO4, PO5, PO9, PO10, PO11, PO12
CO5	Understand the concept of Auto-encoders and enhancing GANs using auto-encoders.	PO3, PO4, PO9, PO12

CO-PO Relationship Matrix

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	-	3	-	3	3	-	-	-	-	-	-	-
CO4	3	3	-	3	3	-	-	-	2	2	2	3
CO5	-	2	3	3	-	-	-	-	3	-	-	3

COURSE OF CONTENTS

UNIT-I: INTRODUCTION TO DEEP LEARNING: Historical Trends in Deep Learning, Why DL is Growing, Artificial Neural Network, Single/Multiple Layer Perceptron, Feed Forward Network, Deep Feed-forward networks, Stochastic Gradient –Based learning, Back-Propagation, Deep learning frameworks and libraries (e.g., TensorFlow/Keras, PyTorch).

UNIT-II: CONVOLUTION NEURAL NETWORK (CNN): Introduction to CNNs and their applications in computer vision, CNN basic architecture, Activation functions-sigmoid, tanh, ReLU, Softmax layer, Types of pooling layers, Training of CNN in TensorFlow, various popular CNN architectures: VGG, GoogleNet, ResNet etc, Dropout, Normalization, Data augmentation

UNIT-III: RECURRENT NEURAL NETWORK (RNN): Introduction to RNNs and their applications in sequential data analysis, Backpropagation through time(BPTT), Vanishing Gradient Problem, gradient clipping Long Short TermMemory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

UNIT-IV: GENERATIVE ADVERSARIAL NETWORKS (GANs): Generative models, Concept and principles of GANs, Architecture of GANs (generator and discriminator networks), Comparison between discriminative and generative models, Generative Adversarial Networks(GANs), Applications of GANs

UNIT-V: AUTO-ENCODERS: Auto-encoders, Architecture and components of auto-encoders (encoder and decoder), Training an auto-encoder for data compression and reconstruction, Relationship between Autoencoders and GANs, Hybrid Models: Encoder-Decoder GANs.

RECOMMENDED BOOKS:

1. Deep Learning : An MIT Press Book by Ian Goodfellow and Yoshua Bengio Aaron Courville.
2. Michael Nielson, Neural Networks and Deep Learning, Determination Press, 2015.
3. Satish kumar, Neural networks: A classroom Approach, Tata McGraw-Hill Education.

Learning Outcomes:

After completing this course, the students will gain an understanding of the computational behavior of the area of deep learning in order to apply it in various complex problems including NLP, Image processing, game playing, robot learning, driverless cars etc.

List of Assignment in Deep Learning Lab:

- Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. Vary the activation functions used and compare the results
- Build a Deep Feed Forward ANN by implementing the Backpropagation algorithm and test the same using appropriate data sets. Use the number of hidden layers ≥ 4 .

- Design and implement an Image classification model to classify a dataset of images using Deep Feed Forward NN. Record the accuracy corresponding to the number of epochs..
- Design and implement a CNN model (with 2 layers of convolutions) to classify multi category image datasets. Record the accuracy corresponding to the number of epochs.
- Design and implement a CNN model (with 4+ layers of convolutions) to classify multi category image datasets. Use any suitable dataset. Set the No. of Epoch as 5, 10 and 20. Make the necessary changes whenever required. Record the accuracy corresponding to the number of epochs. Record the time required to run the program, using CPU as well as using GPU in Colab.
- Use the concept of Data Augmentation to increase the data size from a single image.
- Implement RNN for sentiment analysis on movie reviews
- Implement Bidirectional LSTM for sentiment analysis on movie reviews.
- Implement Generative Adversarial Networks to generate realistic Images. Use any human face datasets.
- Implement Auto encoders for image denoising on any suitable dataset.