Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021-22
Course Handout Part II

20.08.2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CS F425

Course Title : Deep Learning

Instructor-in-Charge : Prof. N.L.Bhanu Murthy

1. Scope and Objectives

The objective of this course is to study deep learning so that competitive learning models can be built. This course will provide an understanding of feedforward deep neural networks, overfitting related issues and their resolution, various optimization algorithms such as Stochastic Gradient Descent, Nesterov Accelerated Gradient Descent, Adam, and RMSProp which are used for training deep neural networks. The intent of the course is to learn convolutional neural networks, recurrent neural networks and Generative deep learning models. There is an emphasis on applying these techniques in solving computer vision and NLP related problems.

This course aims to achieve the following goals:

- To provide an understanding of the deep learning models
- To introduce the overfitting related issues in deep learning and different techniques for their resolution
- To provide an understanding of various optimization algorithms that are used in training deep neural networks
- To provide an understanding of CNN, R-CNN and Faster CNN and their applications in solving computer vision related problems
- To provide an understanding of RNN, LSTM, attention mechanism, transformers and their applications in solving NLP related problems
- To provide an understanding of Generative Deep Learning models

2. Pre requisites: Programming in Java or C however programming in python will be an advantage.

3.a. Text Book

T1: Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning, First Edition, The MIT Press.

3.b. Reference Books

R1: Charu C Aggarwal: Neural Networks and Deep Learning, First Edition, Springer

R2: Christopher Bishop: Pattern Recognition and Machine Learning, Springer International Edition

R3: Eugene Charniak: Introduction to Deep Learning, MIT Press

4. Course Plan

Lecture No	Learning Outcomes	Topics to be covered	Chapter in the Text Book
1	• To Introduce Deep Learning	Introduction to Deep Learning	T1:Ch.5 / Class Noted
2-4	• To understand the advantages of Deep Learning models over traditional machine learning algorithms	Brief overview of traditional Machine Learning algorithms emphasizing the limitations of these approaches and motivation for building deep learning models.	T1:Ch.5 / Class Notes
5 – 8	• To understand the error functions, activation functions of neural networks and building models using back propagation algorithm	Building neural networks for classification and regression problems using back propagation algorithm	R1: Ch.5 / T1: Ch.6
9 – 10	• To introduce deep feedforward networks and understand the overfitting related issues	Deep feedforward networks and overfitting related issues	T1: Ch.6 and Ch. 7
11 – 13	• To understand the methods of resolving the overfitting related issues	L1 & L2 Regularization, Early Stopping, Parameter Sharing, Dropout etc.	T1: Ch.7
14 – 18	• To understand the various optimization algorithms that are used in training deep neural networks	Challenges in Neural Network Optimization, Stochastic Gradient Descent, Momentum Based GD, Parameter Initialization Strategies, AdaGrad, RMSProp, Adam	T1: Ch.8
19 – 24	• To understand Convolution Neural Networks and their application in solving computer vision related problems	Convolution Neural Networks, R-CNN, Faster R-CNN and with Computer Vision related case studies	T1: Ch.9
25 – 29	• To understand sequence modeling	Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks	T1:Ch.10
30 – 35	• To understand the issues related to long-term dependencies, and models like LSTM, Gated RNNs, attention mechanism and transformers	Vanishing and exploding gradient problems, LSTM, Gated RNNs, attention mechanism, transformers, BERT, NLP related case studies	T1:Ch.10
36 – 40	• To provide an understanding of Generative Deep Learning models	Boltzmann Machine, Restricted Boltzmann Machine, Deep Belief Machines, Generative Adversarial Networks (GANs)	T1:Ch.20

5. Evaluation Scheme

Component	Duration	Weightage	Date&Time	Nature of Component
Mid Sem	90 mins	**30%**	22/10/2021 9.00 - 10.30AM	Closed
Assignments (3 Nos.)	-	**30%**	TBA	Open
Comprehensive	120 mins	**40%**	22/12 FN	Closed

Note: 40% of the evaluation to be completed by midsem grading.

6. Consultation: Thursday 4PM – 5PM

7. Notices: All notices will be put up in CMS and students are strongly advised to log in to CMS and look for notices quite often.

8. Make-up Policy: Make-up will be granted only to genuine cases with prior permission only.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge