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**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**

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| --- | --- | --- | --- |
| 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

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| --- | --- | --- | --- | --- |
| **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**