CSE4121: Deep Learning

Programme: B. Tech. (CSE,CCE) Year: 4 Semester: 7
Course: Program Elective Credits: 3 Hours: 40

Course Context and Overview (100 words):
This course covers the most successful form of artificial intelligence, deep learning. We will be starting with the basics of linear algebra and calculus and go all the way until the Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs). The course will focus on optimization techniques like gradient descent and Adam. Programming will be an important component of the course. We will be using Python as our primary language. For implementation of algorithms, we will be using Tensorflow and Keras. The course will be equally inclined towards theory and programming assignments.

Prerequisites Courses:
Computer Programming, Data Structures

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 Prioritize the collection and usefulness of data for a particular deep learning task
C02 Relate the real world problems with the theory and implementation learnt in the course so as to apply their knowledge in their own problems at hand
C03 Judge whether a particular problem can be solved using deep learning or not
C04 Critically analyze when to use CNNs and when to use RNNs
C05 Design, analyze and implement their own deep learning algorithms

Course Topics:

Topics	**Lecture Hours**	
UNIT – I 1.1 Basics related to Calculus and Linear Algebra 1.2 Introduction to Python 3, probability and optimization.	2 2	4
UNIT – II 2.1 Gradient descent, cost function 2.2 Stochastic gradient descent, Adam, Momentum 2.3 Neural Networks, Deep Neural Networks 2.4 Hyperparameter tuning, Regularlization.	3 3 4 2	12

UNIT – III 3.1 Basics of CNNs. 3.2 Detailed understanding of LeNet and Alexnet Architectures 3.3 ResNet, VGG-16, VGG-19. Their implementations.	2 4 6	12
UNIT – IV 4.1 Basics of RNNs. 4.2 Detailed understanding of sequence models, text generation 4.3 Neural machine translation, speech.	3 3 6	12

Text Book:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "*Deep Learning*", MIT Press. 2016. Online available at http://www.deeplearningbook.org/ (We will be mainly covering Part II of the book)

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

1. Stanford CS230: Deep Learning
2. MIT 6.S191 Introduction to Deep Learning (January-March 2018)
3. Stanford CS224d: Deep Learning for Natural Language Processing (January-March, 2018)
4. Stanford CS231n: Convolutional Neural Networks for Visual Recognition (Spring 2018)
5. Coursera specialization on Deep Learning

Evaluation Methods:

Component	Weightage (%)
Midterm	20
Assignments/Project/ Presentation	40
Endterm	40

Prepared By: Kshitiz Verma
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