CSBD 4004	Deep Learning	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	a. Calculus, Linear Algebra b. Probability & Statistics c. Basics of Machine Learning				
Co-requisites	--				

Course Objectives

This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. Learner will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.

Course Outcomes

After completion of this course, students will be able to:-

CO1. Define features of Deep Learning Tools and Techniques.
CO2. Differentiate between Supervised and Un-Supervised learning.
CO3. Understand CNN and RNN.
CO4. Construct relationship among data for expected outcomes.
CO5. Apply advanced deep learning techniques for prediction.

Catalog Description

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

The course covers basic neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning, and applications to problem domains like speech and image processing.

Course Content

Unit I: Introduction to Deep Learning (9 Lecture Hours)

Deep Learning Introduction, Building blocks of deep neural networks, Parameters vs Hyperparameters, Gradient descent, stochastic gradient descent, logistic regression, Probability, continuous and discrete distributions; maximum likelihood.

Unit II: Neural Networks **(9 Lecture Hours)**

Neural Networks Overview, Neural Network Representation, Computing a Neural Network's Output, Activation functions, Derivatives of activation functions, Backpropagation intuition, Random Initialization

Unit III: Convolutional Neural Networks (CNN) **(10 Lecture Hours)**

Invariance, stability. Variability models (deformation model, stochastic model). Scattering networks, Group Formalism , Supervised Learning: classification, Properties of CNN representations: invertibility, stability, invariance, covariance/invariance: capsules and related models, Connections with other models: dictionary learning, Dynamical systems: LeNet, AlexNet.

Unit IV: Recurrent Neural Networks (RNN) **(8 Lecture Hours)**

RNN, LSTM, GRU ,Language modeling Image captioning, visual question answering Soft attention.

Text Books

Deep Learning , Ian Goodfellow, Yoshua Bengio, Aaron Courville.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	MSE	Presentation/Assignment/etc.	ESE
Weightage (%)	20	30	50

Table: Correlation of POs and PSOs v/s COs

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1		1							1	2	1	3
CO2	2	2	1		1							1	2	1	2
CO3	2	2	2	2	1	1						1	2	1	2
CO4	2	2	1	2	2	1		1				1	2	1	2
CO5	2	2	2	2	2	1		1				1	2	1	3
AVG	2	2	1.4	2	1.4	1		1				1	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	System and application programming	Software Project Management	Applying Big Data
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1 3	PSO1 4	PSO1 5
	Deep learning	2	2	1. 4	2	1.4	1		1				1	2	1	2