Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Computer/IT)

(To be Proposed For: Academic Year 2020-21)

Subject Code: (CT803B-N)	**Subject Title: Neural Network and Deep Learning**
Pre-requisite	Cognitive science or artificial intelligence, introductory probability/statistics and linear algebra, Python programming

Teaching Scheme (Credits and Hours)

Teaching scheme				**Total Credit**	**Evaluation Scheme**					**Total Marks**
L	**T**	**P**	**Total**		**Theory**		**IE Marks**	**CIA Marks**	**Pract. Marks**	
Hrs	**Hrs**	**Hrs**	**Hrs**		**Hrs**	**Marks**				
4	0	2	6	5	3	70	30	20	30	150

Course Objective:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolutional neural networks. Upon successfully completing the course, the student will be able to understand generic machine learning terminology. understand motivation and functioning of the most common types of deep neural networks, Understand the choices and limitations of a model for a given setting, can apply deep learning techniques to practical problems and can critically evaluate model performance and interpret results. The course also requires students to implement programming assignments related to these topics.

Outline of the Course:

Sr. No	**Title of the Unit**	**Minimum Hours**
1	Introduction to machine learning and neural Networks	11
2	Feed forward and Deep neural network	11
3	Convolutional neural networks	11
4	Recurrent neural networks	11
5	Deep Neural Networks	10
6	Generative models and recent trends	10

Total hours (Theory): 64
Total hours (Lab): 32
Total hours: 96

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DETAILED SYLLABUS:

Sr. No	Topic	Lecture Hours	Weight age (%)
1	Introduction to machine learning and neural Networks Neuron, weights, bias, activation function, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm, different learning methods.	11	17
2	**Feed forward Networks:** Multilayer Perceptron, Gradient Descent, Back propagation, Batches, epochs, Empirical Risk Minimization, regularization : Drop out, learning rate, auto encoders : Regularized auto encoder and variational auto encoder	11	17
3	**Convolutional Neural Networks:** LeNet, AlexNet, ImageNet classification	11	17
4	**Recurrent Neural Networks:** Recurrent neuron, Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs	11	17
5	**Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layer wise training.	10	16
6.	**Generative models:** Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs. **Recent trends:** Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning	10	16
	TOTAL	**64**	**100**

INSTRUCTIONAL METHOD AND PEDAGOGY (CONTINUOUS INTERNAL ASSESSMENT (CIA) SCHEME)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-media projector, Green board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

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Textbooks

Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

References:

1. **Neural Networks: A Systematic Introduction, Raúl Rojas, 1996**
2. **Pattern Recognition and Machine Learning, Christopher Bishop, 2007**

List of Experiments

Sr.No.	Name of Experiment
1	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
2	Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3	Train the auto correlator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, - 1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
4	Train the hetrocorrelator using multiple training encoding strategy for given patterns: A1=(000111001) B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101) B3(101001010). Test it using pattern A2.
5	Introductions to Python Basics with Numpy and Logistic Regression with a neural network mindset
6	Introduction to TensorFLow
7	Planar data classification with a hidden layer and Building of Deep Neural Network: step by step in any appropriate tool.
8	Demonstrate the implementation of CNN
9	Building of a Recurrent Neural Network - Step by Step