FIRST SEMESTER 2020-21
Course Handout

Date: 12-08-2020

Course No.   : *MEL G622*
Course Title   : Introduction to Artificial Neural Networks
Instructor-in-Charge   : Dr. Rajesh Kumar Tripathy

Description : Fundamentals and definitions; Perceptrons, backpropagation and counterpropagation Networks; Statistical methods for network training; Hopfield nets; Associative memories; Optical neural networks; Applications of neural networks in speech processing, computer networks and visual processing

1.**Scope and Objective of the Course:**
This course introduces several fundamental concepts of artificial neural network. The objective is to familiarize the students with some basic learning algorithms and techniques and their applications, as well as general questions related to analyzing and handling large data sets. Several software libraries and datasets publicly available will be used to illustrate the application of these algorithms. In this course, the various supervised learning algorithms such as logistic regression, multiclass logistic regression, multilayer perceptron, radial basis function neural network, extreme learning machine will be discussed. By the end of this course, students will have a strong understanding of artificial neural network based techniques for various real-time applications.

2. Textbooks:
   T1. Simon Haykin, "*Neural Networks – A comprehensive Foundation",* Pearson Education, 1999.
   T2: AK, Suykens Johan. *Least squares support vector machines.* World Scientific, 2002.

3.Reference books/Materials
   R1: CS229 Lecture notes: Stanford University
   R2: CS231 Convolutional neural networks for visual recognition: Stanford University
   R3: http://gyan.iitg.ernet.in/handle/123456789/833
   R4: https://www.sciencedirect.com/science/article/pii/S0925231206000385

4. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	Pattern recognition and Machine learning introduction	Introduction to machine learning, Supervised, unsupervised and semi-supervised learning,	T1 (ch 2)
2-4	To understand classification and regression	Classification and regression problems, Linear regression, gradient descent (Batch gradient descent and stochastic gradient descent)	R1

	problems and linear regression		
5-8	To understand Binary and Multiclass classifications	Logistic regression, multiclass extension of logistic regression (One Vs One and One Vs All Multiclass coding schemes)	R1
9	To understand measures for classifiers	Performance Measures for Classifiers (binary class and multiclass), Probabilistic classifiers	R3 (2.9.5)
10-11	To understand neural network	What is Neural Network?, Human Brain and Biological Neuron, Model of an Artificial Neuron, Activation functions, Neural Network Architectures.	T1 (ch 1)
12-13	To understand mathematical model of a single neuron	Single Layer Perceptron, Linear Separability, XOR Problem, Perceptron Learning rules	T1 (ch 3)
14-16	To understand multilayer perceptron	Multilayer Perceptron, Back-propagation Algorithm and parameters selection and tuning	T1 (ch 4)
17-19	To understand RBFN	Radial-Basis Function Networks, various kernel functions used in RBFN	T1 (ch5)
20-24	To understand Autoencoder and deep neural network	Autoencoder, Sparse autoencoder, Denoising autoencoder, Deep neural network based on stacking of autoencoders	R1
25-27	To understand ELM and its kernel extension	Extreme learning machines, Kernel Extreme learning machine	R4
28-31	To understand CNN for solving classification problems	Convolutional neural network, Convolutional Layer, Pooling Layer, and Fully-Connected Layer	R2
32-34	To understand SVM	Support vector machine (SVM), Hyperplane, Multiclass SVM, Applications of neural Network	T2

5. Evaluation Scheme:

Component	Duration	Weightage	Marks	Date	Remarks
Test 1	30 min	15%	45	September 10 –September 20 (During scheduled class hour)	OB
Test 2	30 min	15%	45	October 09 –October 20 (During scheduled class hour)	OB
Test 3	30 min	15%	45	November 10 – November 20 (During scheduled class hour)	OB
Lab/Assignment	To be announced	30%	90	To be announced	OB
Comprehensive Exam.	2 hours	25%	75	01/12 AN	OB

6. Chamber Consultation Hour: Through Google meet

7. Notices: Notices concerning this course will be on CMS.

8. Make–up Examination: Make-up will be given on genuine grounds only. Prior application should be made for seeking the make- up examination.

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.

Rajesh Kumar Tripathy
INSTRUCTOR-IN-CHARGE