Savitribai Phule Pune University
Third Year of Artificial Intelligence and Data Science (2019 Course)
317531: Artificial Neural Network

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week[##]	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks

Prerequisite Courses, if any: Basic knowledge of computer architecture, Artificial Intelligence and Statistics

Companion Course, if any: NIL

Course Objectives:
1. To provide students with a basic understanding of the fundamentals and applications of artificial neural networks
2. To identify the learning algorithms and to know the issues of various feed forward and feedback neural networks.
3. To Understand the basic concepts of Associative Learning and pattern classification.
4. To solve real world problems using the concept of Artificial Neural Networks.

Course Outcomes:
> On completion of the course, learner will be able to–

CO1: Understand the basic features of neural systems and be able to build the neural model.
CO2: Perform the training of neural networks using various learning rules.
CO3: Grasping the use of Associative learning Neural Network
CO4: Describe the concept of Competitive Neural Networks
CO5: Implement the concept of Convolutional Neural Networks and its models
CO6: Use a new tool /tools to solve a wide variety of real-world problems

Course Contents

Unit I	Introduction to ANN	(07 Hours)

Introduction to ANN,History of Neural Network, Structure and working of Biological Neural Network,Neural net architecture, Topology of neural network architecture, Features,Characteristics,Types, Activation functions,Models of neuron-Mc Culloch & Pitts model, Perceptron, Adaline model,Basic learning laws, Applications of neural networks,Comparison of BNN and ANN.

#Exemplar/Case Studies	Controlling Water Reservoirs, Rule Extractions
Mapping of Course Outcomes for Unit I	CO1

Unit II	Learning Algorithms	07(Hours)

Learning and Memory, Learning Algorithms,Numbers of hidden nodes, Error Correction and Gradient Decent Rules, Perceptron Learning Algorithms, Supervised Learning Backpropagation, MultilayeredNetwork Architectures, Back propagation Learning Algorithm, Feed forward and feedback neural networks,example and applications.

#Exemplar/Case Studies	Medical diagnosis, Automated trading systems
Mapping of Course Outcomes for Unit II	CO2

Unit III	Associative Learning	07(Hours)

Introduction, Associative Learning, Hopfield network, Error Performance in Hopfield networks, simulated annealing, Boltzmann machine and Boltzmann learning, State transition diagram and false minima problem, stochastic update, simulated annealing.
Basic functional units of ANN for pattern recognition tasks: Pattern association, pattern classification and pattern mapping tasks.

#Exemplar/Case Studies	Understanding catastrophic, Interference in neural nets

Mapping of Course Outcomes for Unit III	CO3

Unit IV	Competitive learning Neural Network	07(Hours)

Components of CL network, Pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification

#Exemplar/Case Studies	A Translation System for Face-to-Face Dialog and Intelligent Help Systems
Mapping of Course Outcomes for Unit IV	CO4

Unit V	Convolution Neural Network	07(Hours)

Building blocks of CNNs, Architectures, convolution / pooling layers, Padding, Strided convolutions, Convolutions over volumes, SoftMax regression, Deep Learning frameworks, Training and testing on different distributions, Bias and Variance with mismatched data distributions, Transfer learning, multi-task learning, end-to-end deep learning, Introduction to CNN models: LeNet – 5, AlexNet, VGG – 16, Residual Networks

#Exemplar/Case Studies	Large scale handwritten digit recognition problem
Mapping of Course Outcomes for Unit V	CO5

Unit VI	Applications of ANN	06(Hours)

Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation

#Exemplar/Case Studies	Automating language translation
Mapping of Course Outcomes for Unit VI	C06

Learning Resources

Text Books:
1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
2. Laurene Fausett: Fundamentals of Neural Networks: Architectures, Algorithms & Apps, Pearson, 2004.
3. An introduction to neural networks, Gurney, Kevin, CRC press.

Reference Books:
1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd ,2005
2. Neural Networks in Computer Inteligance- Li Min Fu, MC GRAW HILL EDUCATION, 2003
3. Neural Networks -James A Freeman David M S Kapura, Pearson Education, 2004.
4. Introduction to Artificial Neural Systems- Jacek M. Zurada, JAICO Publishing House Ed.,2006.

e-Books:
1.https://www.pdfdrive.com/neural-networks-a-comprehensive-foundationpdf-e18774300.html
2.https://www.pdfdrive.com/elements-of-artificial-neural-networks-e17103719.html
3.https://www.pdfdrive.com/neural-networks-methodology-and-applications-e38107895.html

MOOC Courses:
1.https://nptel.ac.in/courses/117105084
2. https://www.coursera.org/projects/predicting-weather-artificial-neural-networks

@The CO-PO mapping table

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	-	-	1	1	1	2	-	2	1
CO2	3	2	3	2	1	1	1	-	3	1	2	1
CO3	2	1	2	1	3	1	-	1	2	-	1	2
CO4	1	1	1	1	-	-	-	1	-	2	-	1
CO5	2	2	3	2	2	1	1	1	2	1	3	1
CO6	3	3	3	2	3	2	1	1	3	1	2	1