



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: <ol style="list-style-type: none"> 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 Descent Rules, Perceptron Learning Algorithms, Supervised Learning Backpropagation, Multilayered Network 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	CO6	
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		