Techno India NJR Institute of Technology

Course File

Neural Network (5EX3-01)

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For Techno India NJR Institute of Technology
पंकज पोरवाल
Dr. Pankaj Kumar Porwal
(Principal)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year - V Semester: B.Tech. (Electrical And Electronics Engineering)

5EX3-01: NEURAL NETWORK

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	HOURS
1.	**Introduction:** Objective, scope and outcome of the course.	01
2.	**Introduction to Neural Networks**: Biological basis for NN, Human brain, Models of a Neuron, Directed Graphs, Feedback, Network architectures, Knowledge representation, Artificial intelligence & Neural Networks.	06
3.	**Learning Processes:** Introduction, Error-Correction learning, Memory -based learning, Hebbian learning, Competitive learning, Boltzmann learning, Learning with a Teacher & without a teacher, learning tasks, Memory, Adaptation.	05
4	**Single Layer Perceptrons:** Introduction, Least-mean-square algorithm, Learning Curves, Learning rate Annealing Techniques, Perceptron, Perceptron Convergence Theorem.	06
5	**Multilayer Perceptrons:** Introduction, Back-Propagation Algorithm, XOR Problem, Output representation and Decision rule, Feature Detection, Back-Propagation and Differentiation, Hessian Matrix, Generalization.	06
6.	**Radial-basis function Networks & Self-organizing Maps:** Introduction to Radial basis function networks, Cover's Theorem on the Separability of Patterns, Interpolation Problem, Generalized Radial-Basis function networks, XOR Problem, Self-Organizing map, Summary of SOM Algorithm, Properties of the feature map.	03
	TOTAL	27

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Course Overview: The course has certain outcomes by virtue of which the students will get an idea of the subject Neural Networks.

Course Outcomes:

CO No	Course Outcome
1	Significance and role of neural networks
2	Ability to sense learning processes and do mathematical representations
3	Ability to realize Single layer perceptron
4	Ability to develop multilayer perceptron
5	Ability to estimate radial basis function and self-organizing map

Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcome											
CO No.	Domain-Specific					Domain-Independent						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	0	0	0	0	0	0	0	0	0	0	0
CO 2	2	2	0	0	0	0	0	0	0	0	0	0
CO 3	2	2	0	3	0	0	0	0	0	0	0	0
CO 4	2	3	0	3	0	0	0	0	0	0	0	0
CO 5	0	3	0	2	0	0	0	0	0	0	0	0
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (high)												

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Lecture plan based on Unit 1(Introduction - Introduction)

Lecture No.	Topic	Unit Mapping
1	Fundamental concepts, scope and applications of neural networks (NN)	1

Lecture plan based on Unit 2 (Introduction to Neural Networks)

Lecture No.	Topic	Unit Mapping
2	Biological basis for NN	2
3	Human brain and models of a neuron	2
4	Directed graphs	2
5	Network architecture and knowledge representation	2

Lecture plan based on Unit 3 (Learning processes)

Lecture No.	Topic	Unit Mapping
6	Learning processes	3
7	Error-correction learning	3
8	Memory based learning	3
9	Hebbian learning, competitive learning	3
10	Boltzmann learning	3
11	Memory adaptation	3

Lecture plan based on Unit 4 (Single layer perceptrons)

Lecture No.	Topic	Unit Mapping
12	Fundamental concepts	4
13	Least-mean square algorithm	4
14	Learning curves	4
15	Annealing techniques	4
16	Perceptron convergence theorem	4

Lecture plan based on Unit 5 (Multilayer perceptrons)

Lecture No.	Topic	Unit Mapping
17	Back-propagation	5
18	XOR problem	5
19	Output representation and decision rule	5
20	Feature detection	5
21	Back-propagation and Hessian matrix	5

Lecture plan based on Unit 6 (Radial-basis function networks and self-organizing maps)

Lecture No.	Topic	Unit Mapping
22	Radial basis concepts	6
23	Cover's theorem	6
24	Patterns and interpolation theorem	6
25	Self-organizing maps	6

26	Properties of feature map	6

Textbook – "An Introduction to Neural Networks", K. Gurney, 1997 by UCL Press

MOOC courses -

https://www.mooc-list.com/tags/neural-networks

https://www.coursera.org/learn/neural-networks-deep-learning

Previous Year Question Paper

5E1371

Roll No. _____ [Total No. of Pages : 3

5E1371

B.Tech. V - Semester (Main) Examination, Nov. - 2019
ESC Electrical and Electronics Engg.
5EX3-01 Neural Network

Time : 2 Hours **Maximum Marks : 80**
Min. Passing Marks : 28

Instructions to Candidates:

*Attempt all **five** questions from **Part A**, **four questions** out of **six questions** from **Part B** and **two questions** out of **three** from **Part C**.*

(Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.) Units of quantities used / calculated must be stated clearly.

Part - A

(Answer should be given up to 25 words only)

All questions are compulsory

[5×2=10]

1. What is the Significance of weights used in artificial neural Network. **[2]**
2. Define Error-Correction Learning. **[2]**
3. What are the two types of learning in neural Network? **[2]**
4. How is the error back propagated in a back propagation Network? **[2]**
5. Define Hessian Matrix. **[2]**

Part - B

(Analytical/Problem solving questions)

Attempt any four questions

[4×10=40]

1. What are the various characteristics of an artificial Neural Network? Also Explain the development of artificial Neural Network in detail. **[10]**

2. Realise a Hebb net for the AND-NOT function with bipolar inputs and targets (upto 2 iterations) **[10]**

3. Using the perceptron Learning rule, find the updated weight for the given set of input vectors is as follows:-

$x_1 = \begin{bmatrix} 1 \\ -2 \\ 0 \\ -1 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 1.5 \\ -0.5 \\ -1 \end{bmatrix}, x_3 = \begin{bmatrix} -1 \\ 1 \\ 0.5 \\ -1 \end{bmatrix}$ and the initial weight W^1 is, $W^1 = \begin{bmatrix} 1 \\ -1 \\ 0 \\ 0.5 \end{bmatrix}$

The learning Constant C=0.1. The desired responses for x_1, x_2, x_3 are $d_1 = -1, d_2 = -1$ *and* $d_3 = 1$. **[10]**

4. Discuss in detail the training Algorithm used in Back propagation Net. **[10]**

5. Differentiate between Back propagation and Radial basis function Network in detail. **[10]**

6. Write short notes on:-
   i) Learning with a teacher and without a teacher.
   ii) Learning rate Annealing techniques. **[2×5=10]**

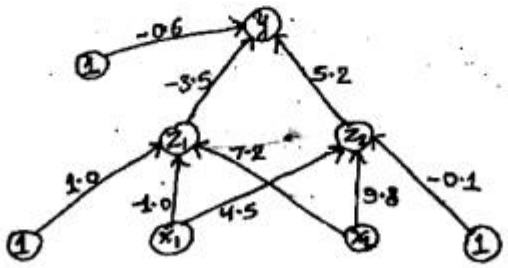
Part - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any two questions

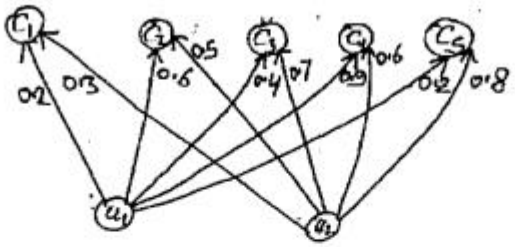
[2×15=30]

1. Generate a neural Net using back propagation Network algorithm for X-OR logic function. The architecture and the values of initial weights and biases are shown in figure. **[15]**



2. a) With the architecture, explain the training algorithm used in kohonen self organizing feature map. **[5]**

b) A kohonen self organizing map is shown in figure



i) Using the square of the Euclidean Distance find the cluster Unit C_j that is closest to the input vector (0.3,0.4)

ii) Using Learning rate of 0.3, find the new weights for unit C_j.

iii) Find new weights for C_{j-1} and C_{j+1}, if they are allowed to learn. **[10]**

3. Write short notes on :- **[3×5=15]**

a) Boltzmann Learning

b) Cover's Theorem on the separability of patterns.

c) Comparison between Artificial Neural N/W and Biological Neural Network.