Heaven's Light Is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year Even Semester Examination 2019

COURSE NO: CSE 4203 COURSE TITLE: Neural Networks and Fuzzy Systems
FULL MARKS: 72 TIME: 03 Hours

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Marks

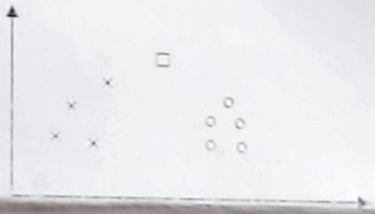
Q.1. (a) Mention some application areas where machine can better perform through pattern recognition. Explain the reasons. 3

(b) If a person loses his listening power due to auditory cortex problem, is it possible to recover? Can this behavior affect the computer algorithm that works on the concept of artificial neural network? 5

(c) How does effective coupling occur to transfer information from one neuron to other neurons? 4

Q.2. (a) Describe the significance of graceful degradation as a programming strategy. 3

(b) Given the following figure, how can you classify the unknown new pattern sample '□' using nearest neighbour approach? 5

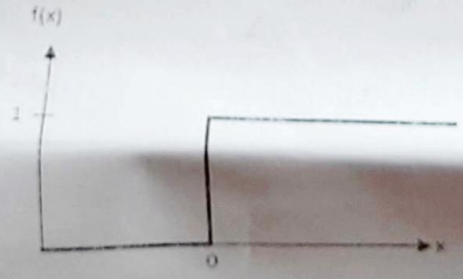


(c) Define (i) feature vector and (ii) discriminant function with examples. 4

Q.3. (a) While using nearest neighbour classification algorithm, how can you use the concept of cross validation to choose total neighbours to be considered to classify a pattern? Briefly explain with example. 5

(b) State the limitations of McCullach and Pitts model of artificial neuron. 3

(c) Given the following characteristics of an activation function, what are the limitations if this function is used for hidden and output layers of multiple perceptrons? 4



Q.4. (a) What are the relative advantages and limitations of 3-layer neural network algorithm over single-layer neural network algorithm? What are the reasons behind of that? 3

(b) Write the steps of multi-layer perceptron neural network algorithm with proper documentation. 6

(c) Which layer of multi-layer perceptron neural networks act as a feature detector? How? Explain with proper example. 3

SECTION : B

Q.5. (a) What are the requirements to reduce the error rate of Back-Propagation learning neural network algorithm? 2

(b) What is local minima problem? What are the alternative approaches to minimize the local minima problem? Explain each of them briefly. 4

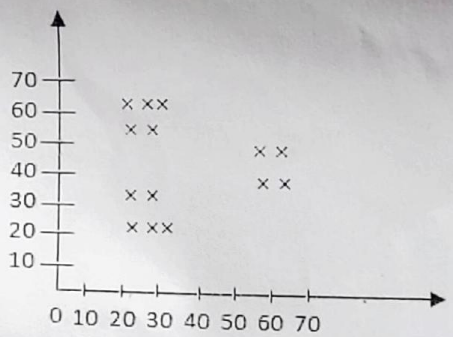
(c) What are the properties of self-organizing neural network over supervised neural network? 2

(d) Explain the working procedure of Kohonen self-organizing neural network. 4

Q.6. (a) Given following figure of data to design a self-organizing map 6

(i) How many nodes are required at the input layer?

(ii) What is the minimum number of nodes required to map these groups of patterns?



(b) Briefly discuss how to update the weights of nodes in a Kohonen self-organizing map? 3

(c) Briefly explain Hopfield network to store some patterns. 3

Q.7. (a) What is Genetic Algorithm? How does Genetic Algorithm differ from traditional methods? 3

(b) Write the working procedure of Genetic Algorithm with diagram. 4

(c) How can you use Genetic Algorithm to solve maximization problem? Write with an example by using reproduction, crossover and mutation operators. 5

Q.8. Suppose you are working in an organization where intelligent devices are produced. The authority has assigned you a job to design an air conditioner by using Fuzzy Logic Controller (FLC). For this design, you can consider two inputs. One of the current room temperature and other is the humidity of the room. By taking these two inputs, you have to maintain a heat-knob and cool-knob so that all of the process will be controlled automatically. Write the process to design it step by step with necessary diagram. In this design, you have to provide intelligence for the air conditioner. In which steps of the design, can you use intelligence algorithm? Specify those areas in details. Which intelligence algorithm do you want to introduce and why? Write the algorithmic steps according to the above design. 12

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RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year Even Semester Examination 2018

COURSE NO: CSE 4203 COURSE TITLE: Neural Networks and Fuzzy Systems
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Q.1. (a) What is synaptic cleft? How effective coupling occurs to transfer information from one neuron to other neurons? Ch-1 — 5

(b) Is it possible to learn different real world phenomena using some learning algorithm in different region of human brain? Why? Explain with necessary example. — 5

(c) Describe the significance of graceful degradation as a programming strategy. Ch. 1 — 2

Q.2. (a) Define pattern recognition. Draw the block diagram of a typical pattern recognition system. Ch-2 — 4

(b) What is feature extraction? Suppose you have to design a face recognition system. How how can you define the features for your system and how can you determine the dimensionality of the feature vector? What are the effects of various dimensions of feature vector in the mentioned face recognition system? Ch. 2 — 6

(c) Write the functions of discriminate function. Ch 2 — 2

Q.3. (a) What is hard limiting thresholding function? What are the limitations of it? Ch-3 — 3

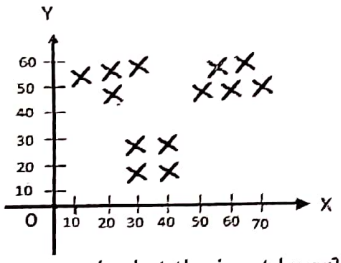
(b) What is sigmoidal thresholding function? What are the characteristics of sigmoidal function over hard limiting thresholding function? What will happen if you will use sigmoidal function on single layer perceptron learning algorithm? Explain with example. — 6

(c) What is credit assignment problem? What are the possible solutions of it? — 3

Q.4. (a) What are the problems of using a non-differentiable activation function for artificial neural network learning? — 2

(b) While fitting a neural network to some training data, how can a regularization term ensure balanced training? — 2

(c) Given following figure of data, to design a Self-Organization Map (SOM). — 8



(i) How many nodes are required at the input layer?
(ii) What is the minimum number of nodes required to map these group of patterns?
(iii) If you store all the properties required to define a node of the SOM grid using a structure (User defined data type), how many bytes be allocated for a single node? Why?

SECTION : B

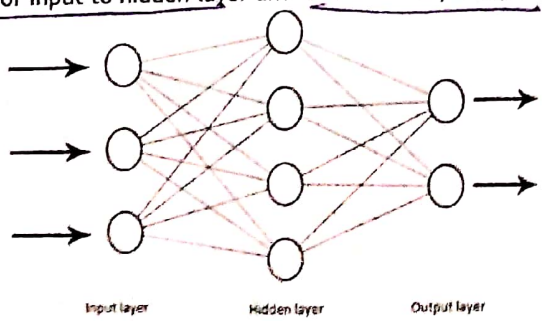
Q.5. (a) What is mean by self-organization learning? Write the relative advantages and disadvantages of supervised and un-supervised learning. — 4

(b) How can Self-Organization Map ensure dimensionality reduction? — 3

(c) Briefly discuss, how to update the weights of nodes in Kohonen Self-Organizing Map, so that the weight updates intensity of neighbor nodes in the map in inversely proportional to the distance from Best Matching unit. — 5

Q.6. (a) What is feature detector? Which layer acts as a feature detector in Multi-layer perceptron neural network algorithm? What are the importances of this layer in learning properly? Ch-4 — 5

(b) Consider the following Multi-layer perceptron neural network. Write the equations to adopt the weights of input to hidden layer and hidden to output layer and explain it. Ch-4 — 5



(c) What is re-learning? Write the process of re-learning in Multi-layer perceptron neural network algorithm. Ch-2 — 2

Q.7. (a) Why rank selection may outperform Roulette Wheel selection in some cases? Explain with necessary figure.

(b) Why do you think that fuzziness is required to enhance the performance of some prediction or decision making system which is based solely on artificial neural network algorithm? Explain briefly. 4

(c) Draw the block diagram of a fuzzy inference system. Explain the center of gravity method of de-fuzzification. 3

Q.8. (a) What is fuzzy-membership function? How can you represent and use it? 3

(b) Write some commercial applications of fuzzy logic. 2

(c) Suppose you have to design a Fuzzy Logic Control (FLC) to control a room cooler to maintain a certain temperature of that room. You have to provide intelligence of the FLC. In which step(s) of the FLC, you will provide intelligence algorithm and how? For this design you have to consider two inputs such as room temperature and humidity and one output to control the cool_knob. 7

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year Even Semester Examination, 2017

COURSE NO: CSE 4203 COURSE TITLE: Neural Networks and Fuzzy Systems
FULL MARKS: 72 TIME: 3 HRS

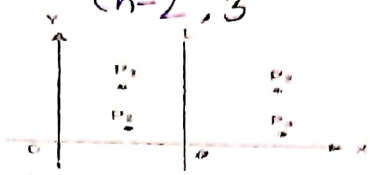
N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Q.1. (a) Describe the significance of graceful degradation from the perspective of neural computing. Ch-1 3

(b) Is it possible to use parallel programming while solving some problem with any algorithm of neural network? Explain briefly. 3

(c) Given pattern P_1, P_2, P_3, and P_4 in $\Re^2$ feature space. How the following linear classifier line L can be formed from a neural network model? Derive the mathematical model in terms of hard limiting threshold. Ch-2, 3 4



Q.2. (a) Suppose a network has one input, one hidden and one output layer. If squared error is used in the output layer, derive the gradients for updating weights using the chain rule of differentiation. 6

(b) Discuss the impact of the following over Back-propagation training of multilayer perception. 4
(i) Weight initialization (ii) Local minima (iii) Stochastic versus Batch learning

Q.3. (a) How can you model a biological neuron into machine? Write with example. Ch-3 4.5

(b) Write the steps of perceptron learning algorithm. Ch-3 4

(c) What is gain term? What are the importances of it in neural network algorithm? 3.5

Q.4. (a) What is credit assignment problem? How can you solve it? 3

(b) What are the advantages of using sigmoidal thresholding function over hard limiting thresholding function? 3

(c) What is feature detector? Which layer acts as a feature detector of multi-layer perceptron algorithm? How? 3

(d) Which layer of multi-layer perceptron neural network produces convex region? How? 3

SECTION : B

Q.5. (a) What is local minima problem? How can you recover your multi-layer perceptron neural network from local minima problem? 4

(b) How can you define error rate for multi-layer perceptron neural network algorithm? 2

(c) What is vector quantization? Is it possible to apply vector quantization using Kohonen Self-Organizing neural network algorithm? If so, why? 4

(d) In an unsupervised learning algorithm there are no target output values. So, what does unsupervised learning learn? 2

Q.6. (a) Given the height, weight, CGPA, study duration and class test average of 70 students, the Self-Organizing map used 5 nodes to map the 10 students. Answer the following questions from above perspective: 6

(i) What is the dimension of the input vector? 70 x 5

(ii) If the Self-Organizing map is stored into a 3 dimensional array like data structure, what will be it's dimensions? 70 x 5 x 5

(iii) Can this concept be used for dimension reduction? Yes

(b) "A Neuro-fuzzy system can be used to increase the accuracy of multi-layer perceptron network having fuzzy class probability outputs"- Explain with necessary figure. 6

Q.7. (a) Define Genetic Algorithm. Explain how Genetic Algorithm can be used to solve a constrained optimization problem. 4

(b) Why mutation operator is required in Genetic Algorithm? Explain with necessary example. 3

(c) Briefly discuss different crossover operations that are used in Genetic Algorithm for generating offspring from initial set of population. 3

(d) Write the importances of fitness function of Genetic Algorithm. 2

Q.8. (a) What is fuzzy membership function? 1.5

(b) What is the relation exists between no. of classified pattern and no. of nodes for Hopfield neural network. Pattern = 0.15 N 1.5

(c) Suppose you have a room cooler and you want to cool the room temperature automatically. You have to design a fuzzy logic controller for controlling the cool knob of the room cooler in order to maintain a constant temperature of 26 degree Celsius. The input of the FLC will be the current room temperature and humidity. The output will be the crisp value for setting the cool knob to a desired position. Describe the design phase step by step and assume humidity is proportional to temperature. 9

2-Input Cool & Temp

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Heaven's Light Is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year 8th Semester Examination 2016

COURSE NO: CSE 809 COURSE TITLE: Neural Networks & Fuzzy Systems
FULL MARKS: 70 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Q.1. (a) Mention three application domains where machine can perform better through pattern recognition. Why techniques excluding pattern recognition have lower performance in this area? Ch-1 — 3

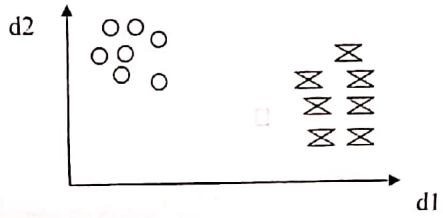
(b) If a person loses his listening power due to auditory cortex problem during his childhood, is it possible to recover? Explain briefly. — 4

(c) How effective coupling occurs to transform information from one biological neuron to other neuron? Ch-1 — 2

(d) Describe the significance of graceful degradation as a programming strategy. Ch-1 — $2\frac{2}{3}$

Q.2. (a) Define (i) feature vector (ii) discriminate function with example. Ch-2 — 4

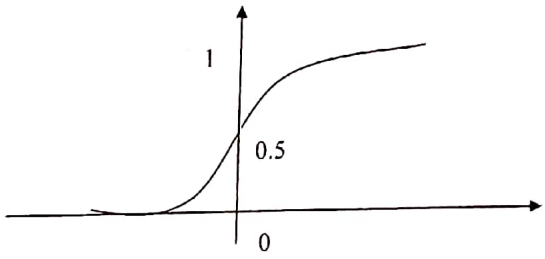
(b) Given the following figure, how can you classify the unknown new pattern sample using nearest neighbor approach? Ch-2 — 4



(c) While using nearest neighbor techniques how can you use the concept of cross validation to choose total neighbors to be considered to classify a pattern? Briefly explain with example. Ch-2 also method — $3\frac{2}{3}$

Q.3. (a) State the limitations of McCulloch and Pitts model of artificial neuron. Ch-3 — 3

(b) Given the following characteristics of an activation function, What are the limitations if this function is used for hidden and output layers of multilayer perceptions? — 2



(c) Explain the following concepts of activation functions: (i) Rectified Linear Unit (ReLU) (ii) Maxout. Why are they better then logistic function? — $3\frac{2}{3}$

(d) To classify some patterns a convex hull like shape is required to be generated by the neural network algorithm. How many layers should you use in multi-layer perceptron? Why? Explain with necessary figure. — 3

Q.4. (a) Write the generalization property of Back-propagation learning neural network algorithm. — $2\frac{2}{3}$

(b) What is re-learning? Why re-learning is necessary? — 3

(c) What is local minima problem? How can you minimize local minima problem for Back-propagation learning neural network algorithm? — 4

(d) What is gain term? What are the impacts of it in BPN algorithm? — 2

SECTION : B

Q.5. (a) What is vector quantization? How is it occurred in Kohonen self-organizing neural network algorithm? $3\frac{2}{3}$

(b) How can you reduce the neighbor size of Kohonen self-organizing neural network algorithm? What are the effects of it? 3

(c) How can you update the connection weights between nodes in Hopfield neural network algorithm? Write with equations. 3

(d) Write the major differences between supervised and un-supervised neural network algorithm. 2

Q.6. (a) What are the importances of hidden layer for multi-layer perceptron neural network? Explain with example. 4

(b) What are the basins for attractions for energy function? 2

(c) What is Kolmogrove theorem? What are the importances of it for real life complex [illegible] problem? 3

(d) [illegible] multi-layer perceptron neural network algorithm, arbitrary region is formed? Why? $2\frac{2}{3}$

Q.7. (a) Why Neuro-Fuzzy systems may perform better than a multi-layer perceptron network which is using Back-propagation algorithms? Explain briefly. 4

(b) Draw the architecture of a generic homogeneous Neuro-fuzzy system. 3

(c) How can you implement the concept of learning in a fuzzy system that is used for controlling purpose? 3

(d) Briefly discuss the center of gravity method for de-fuzzification using suitable example. $1\frac{2}{3}$

Q.8. (a) How are genetic algorithms differ from traditional methods? What are the regions of it? $3\frac{2}{3}$

(b) What is mutation operator? Why is it necessary for genetic algorithm? 3

(c) What is string cross-over? Write with example. 3

(d) What is fitness function? What are the impacts of it? 2

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