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Paper Code : PE-EC702C   Neural Network and Fuzzy Logic Control

Full Marks :70

Time Allotted : 3 Hours

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

[1 x 10 = 10]

1. Answer any ten of the following :

(I) Fuzzy logic is : Used to respond to questions in a _____ way

(II) The activation is bipolar in McCulloch-Pitts neurons–state true or false

(III) In auto-associative networks, the diagonal elements of the weight matrix are set to 0s in order to prevent
   a) Reproducing the input rather than the associated pattern
   b) Self-loops in the auto-associative networks
   c) Both (a) and (b)
   d) None of the above

(IV) In ART1 nets, the bottom-up interconnections are directed From the _____ layer to the recognition layer

(V) Let (a, b) and (c, d) be the pre-images of an element p under a function f. The fuzzy membership values of a, b, c, and d in a fuzzy set are 0.5, 0.4, 0.7 and 0.2 respectively. What is the fuzzy membership of p when f is extended to its fuzzy domain?

(VI) A 4-input neuron has weights 1, 2, 3 and 4. The transfer function is linear with the constant of proportionality being equal to 2. The inputs are 4, 10, 5 and 20 respectively. What will be the output?

(VII) During learning, if a Perceptron misclassifies a training data positively, i.e., erroneously yields an output +1 instead of –1, the interconnection weights are _____.

(VIII) Which of the following neural nets can have inequal number of input and output units?
   a) Auto-associative nets
   b) Hetero-associative nets
   c) Both (a) and (b)
   d) None of the above

(IX) During the learning phase of a backpropagation net, direction of flow of errors is From _____ to _____.

(X) Let R : If 'x is A' Then 'y is B' be a fuzzy rule. In a fuzzy reasoning process employing Generalized Modus Ponens, A1, a modified version of A, is used as the premise. Moreover, let B1 be the conclusion where B1 is probably a modified version of B. If B1 = A1 op R, then according to Zadeh's interpretation, op is :
   a) Fuzzy Cartesian product
   b) Max-min composition
   c) Fuzzy implication
   d) None of the above

(XI) Which ANN learning methods use Euclidean distance between the weight vector and the input vector to compute the output ?

(XII) What is the highest number of patterns an n-input n-output auto-associative net can store ?

Group-B (Short Answer Type Question)
Answer any three of the following

[5 x 3 = 15]

[5]

2. Define Weights, bias, threshold and learning rate parameter.   [5]

3. Define Winner-takes-all or Clustering principle or Competitive learning.   [5]

4. Describe supervised and Unsupervised learning.   [5]

5. List the application and important features of Kohonen Self Organizing Maps.   [5]

6. List various interpretations of Fuzzy If-Then rule.

Group-C (Long Answer Type Question)
Answer any three of the following

[15 x 3 = 45]

7. (a) Illustrates the training process of an auto-associative net to store a single pattern with example. [7]

(b) Explain the perceptron training algorithm with flowchart. [8]

8. (a) Explain the architecture of m-input and n-output Kohonen's Self Organizing Map (SOM) with neat diagram [7]

(b) Illustrate the training algorithm or Flow chart for Kohonen's SOM learning. [8]

9. (a) Draw the structure of a 3-3-2 multi-layered feed forward neural net. Also, present the matrix algebraic expression for the net inputs and the outputs of each layer. [5]

(b) Apply an ADALINE to realize the AND function. Consider Bipolar Data [5]

(c) Illustrates the training process of an hetero-associative net to store a single pattern with example. [5]

10. (a) Explain the architecture of Learning Vector Quantization (LVQ) with neat diagram. [7]

(b) Illustrate the training algorithm or flow chart of Learning Vector Quantization (LVQ) Learning [8]

11. (a) For Speed control of DC motor, the membership functions of series resistance (Rse), Armatrure current(Ia) and Speed (N) are given as follows. Compute relation T for relating series resistance to motor speed, i.e. : Rse to N. Perform max-min composition only. [8]

$$R_{\sim} = \left\{ \frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120} \right\}$$

$$I_{\sim} = \left\{ \frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120} \right\}$$

$$N_{\sim} = \left\{ \frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800} \right\}$$

(b) Explain the centroid or Centre-of-Sums (CoS) or Mean-of-Maxima (MoM) method of defuzzification with suitable diagram. [7]

*** END OF PAPER ***