

M. Tech Ins. & Elec. Engineering 1st Year 1st Semester Examination 2018**Soft Computing-Theory and Application**

Time: 3 hours

Full Marks: 100

Attempt any five questions from the following

1.

- (a) x and y are two fuzzy linguistic variables in the same universe U . Two fuzzy relations are defined to represent 'x is close to y'.

$$R_1(x, y) = \exp(x - y)^2$$

$$R_2(x, y) = \exp|x - y|$$

Which of these two relations can represent a sharp estimation of CLOSENESS of x and y .

- (b) For two membership functions μ_A and μ_B , show that

$$\mu_A \cdot \mu_B \leq \min(\mu_A, \mu_B)$$

Does this indicate that the 'max-dot' inference tends to provide fuzzier inferences than the 'max-min' inferences? Discuss.

- (c) What do you understand by 'law of excluded middle' and 'law of contradiction' in connection to fuzzy logic? Explain with an example.
- (d) Define height and support set of a fuzzy set by means of example.

4+4+7+5

2.

- (a) For a fuzzy set A , prove that

$$\mu_A(x) = \sup_{\alpha \in [0,1]} [\alpha \mu_{A_\alpha}(x)]$$

Where $\mu_{A_\alpha}(x)$ is the α -cut of $\mu_A(x)$.

- (b) A fuzzy set B is defined in the universe $X = [0, 8]$ and its membership function is given by:

$$\mu_B(x) = \frac{x + 1}{x + 2}$$

Determine the fuzzy set C which is obtained through the crisp relation $y = x + 1$. What is the corresponding universe?

- (c) What is the significance of the 'composition' operation in fuzzy decision making?

6+10+4

3.

- (a) What are the limitations of a traditional production system?
- (b) Consider the fuzzy production rule with two antecedents:

'IF height is TALL and weight is MODERATE, THEN speed is HIGH'

Given:

$$\mu_{TALL}(height) = \left\{ \frac{0.5}{4'}, \frac{0.6}{5'}, \frac{0.8}{6'}, \frac{0.9}{7'} \right\}$$

$$\mu_{MODERATE}(weight) = \left\{ \frac{0.7}{45 Kg}, \frac{0.85}{50 Kg}, \frac{0.9}{55 Kg}, \frac{0.7}{60 Kg} \right\}$$

$$\mu_{HIGH}(speed) = \left\{ \frac{0.6}{5 ms^{-1}}, \frac{0.7}{10 ms^{-1}}, \frac{0.9}{15 ms^{-1}} \right\}$$

$$\mu_{MORE-OR-LESS-TALL}(height) = \left\{ \frac{0.6}{4'}, \frac{0.7}{5'}, \frac{0.85}{6'}, \frac{1}{7'} \right\}$$

$$\mu_{MORE-OR-LESS-MODERATE}(weight) = \left\{ \frac{0.75}{45 Kg}, \frac{0.9}{50 Kg}, \frac{0.95}{55 Kg}, \frac{0.75}{60 Kg} \right\}$$

Find out the membership distribution for $\mu_{MORE-OR-LESS-HIGH}(speed)$ using two different implication functions and make one comparative study between them.

5+15

4.

- (a) What is the difference between supervised and unsupervised learning algorithm? Explain briefly.
- (b) Describe the functional architecture of McCulloch-Pitts neuron.
- (c) Design a multi-layered perceptron classifier for an XNOR function.

6+7+7

5.

- (a) Describe the functional architecture of ADALINE neuron. Explain how minimum disturbance principle is used to train Widrow-Hoff's neural net.
- (b) A fragment of a neural network comprising of 4 neurons is shown in Fig. 1 below. N_1, N_2 and N_3 are three neurons at the penultimate layer and neuron N_4 is present in the output layer. Given $out(N_1) = 0.9$ units, $out(N_4) = 0.5$ units, error at neuron $N_4 = 0.3$ units, $w_{14} = 0.6$, $w_{24} = 0.4$, $w_{34} = 0.7$ and learning rate (α) = 0.03; update the value of w_{14} by Back-propagation algorithm. Compute also the back-propagated error at neuron N_1 .

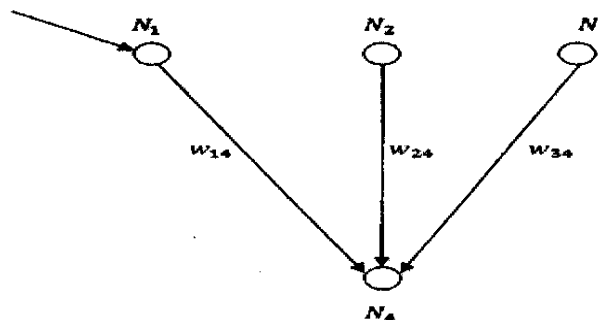


Fig. 1

12+8

6. Write short notes on:

- (a) Fuzzy C-means clustering algorithm
- (b) Genetic algorithm

10+10

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