Neural Networks

1. (UGCNET-June2016-III-64) Let R and S be two fuzzy relations defined as:

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0.6 & 0.4 \\ 0.7 & 0.3 \end{bmatrix} \end{array} \text{ and } S = \begin{array}{c} \\ y_1 \\ y_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.8 & 0.5 & 0.1 \\ 0.0 & 0.6 & 0.4 \end{bmatrix} \end{array}$$

Then, the resulting relation, T, which relates elements of universe x to the elements of universe z using max-min composition is given by:

(1) $$T = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.4 & 0.6 & 0.4 \\ 0.7 & 0.7 & 0.7 \end{bmatrix} \end{array}$$

(2) $$T = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.4 & 0.6 & 0.4 \\ 0.8 & 0.5 & 0.4 \end{bmatrix} \end{array}$$

(3) $$T = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.6 & 0.5 & 0.4 \\ 0.7 & 0.5 & 0.3 \end{bmatrix} \end{array}$$

(4) $$T = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.6 & 0.5 & 0.5 \\ 0.7 & 0.7 & 0.7 \end{bmatrix} \end{array}$$

Answer: 3

2. A neuron with 3 inputs has the weight vector $[0.2\ -0.1\ 0.1]^T$ and a bias θ = 0. If the input vector is $X = [0.2\ 0.4\ 0.2]^T$ then the total input to the neuron is:

(1) 0.20
(2) 1.0
(3) 0.02
(4) -1.0

Answer: 3

3. (UGCNET-DEC2016-III-73) Which of the following neural networks uses supervised learning?

(A) Multilayer perceptron
(B) Self organizing feature map
(C) Hopfield network

(1) (A) only
(2) (B) only
(3) (A) and (B) only
(4) (A) and (C) only

Answer: 1

4. (UGCNET-DEC2016-III-71) Let R and S be two fuzzy relations defined as

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0.7 & 0.5 \\ 0.8 & 0.4 \end{bmatrix} \end{array}$$

$$\text{and} \quad S = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.9 & 0.6 & 0.2 \\ 0.1 & 0.7 & 0.5 \end{bmatrix} \end{array}$$

Then, the resulting relation, T, which relates elements of universe of X to elements of universe of Z using max-product composition is given by

(A) $T = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.68 & 0.89 & 0.39 \\ 0.76 & 0.72 & 0.32 \end{bmatrix} \end{array}$

(B) $T = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.68 & 0.89 & 0.39 \\ 0.72 & 0.76 & 0.32 \end{bmatrix} \end{array}$

(C) $T = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.63 & 0.42 & 0.25 \\ 0.72 & 0.48 & 0.20 \end{bmatrix} \end{array}$

(D) $T = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.05 & 0.35 & 0.14 \\ 0.04 & 0.28 & 0.16 \end{bmatrix} \end{array}$

Answer: C

5. (UGCNET-June2016-III-64) Let R and S be two fuzzy relations defined as:

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0.7 & 0.5 \\ 0.8 & 0.4 \end{bmatrix} \end{array}$$

$$\text{and} \quad S = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 0.9 & 0.6 & 0.2 \\ 0.1 & 0.7 & 0.5 \end{bmatrix} \end{array}$$

Then, the resulting relation, T, which relates elements of universe x to elements of universe z using max-min composition is given by

(A) $T = \begin{matrix} & z_1 & z_2 & z_3 \\ x_1 & .5 & .7 & .5 \\ x_2 & .8 & .8 & .8 \end{matrix}$

(C) $T = \begin{matrix} & z_1 & z_2 & z_3 \\ x_1 & .5 & .7 & .5 \\ x_2 & .9 & .6 & .5 \end{matrix}$

(B) $T = \begin{matrix} & z_1 & z_2 & z_3 \\ x_1 & 0.7 & 0.6 & 0.5 \\ x_2 & 0.8 & 0.6 & 0.4 \end{matrix}$

(D) $T = \begin{matrix} & z_1 & z_2 & z_3 \\ x_1 & 0.7 & 0.6 & 0.5 \\ x_2 & 0.8 & 0.8 & 0.8 \end{matrix}$

Answer: C

6. (UGCNET-June2016-III-65) Compute the value of adding the following two fuzzy integers:
A = {(0.3,1), (0.6,2), (1,3), (0.7,4), (0.2,5)}
B = {(0.5,11), (1,12), (0.5,13)}
Where fuzzy addition is defined as
$\mu_{A+B}(z) = \max_{x+y=z} (\min(\mu_A(x), \mu_B(x)))$
Then, f(A+B) is equal to
(A) {(0.5,12), (0.6,13), (1,14), (0.7,15), (0.7,16), (1,17), (1,18)}
(B) {(0.5,12), (0.6,13), (1,14), (1,15), (1,16), (1,17), (1,18)}
(C) {(0.3,12), (0.5,13), (0.5,14), (1,15), (0.7,16), (0.5,17), (0.2,18)}
(D) {(0.3,12), (0.5,13), (0.6,14), (1,15), (0.7,16), (0.5,17), (0.2,18)}
Answer: D

7. A perceptron has input weights W_1 = -3.9 and W_2 = 1.1 with threshold value T = 0.3. What output does it give for the input x_1 = 1.3 and x_2 = 2.2?
(A) -2.65 (B) -2.30
(B) 0 (D) 1
Answer: C

8. Consider a standard additive model consisting of rules of the form of
If x is A_i AND y is B_i THEN z is C_i.
Given crisp inputs $x=x_0$, $y=y_0$, the output of the model is :

(A) $z = \sum_i \mu_{A_i}(x_0)\, \mu_{B_i}(y_0)\, \mu_{C_i}(z)$

(B) $z = \sum_i \mu_{A_i}(x_0)\, \mu_{B_i}(y_0)$

(C) $z = \text{centroid}\left(\sum_i \mu_{A_i}(x_0)\, \mu_{B_i}(y_0)\, \mu_{C_i}(z)\right)$

(D) $z = \text{centroid}\left(\sum_i \mu_{A_i}(x_0)\, \mu_{B_i}(y_0)\right)$

66. A bell-shaped membership function is specified by three parameters (a, b, c) as follows:

(A) $\dfrac{1}{1+\left(\dfrac{x-c}{a}\right)^{b}}$ (B) $\dfrac{1}{1+\left(\dfrac{x-c}{a}\right)^{2b}}$

(C) $1+\left(\dfrac{x-c}{a}\right)^{b}$ (D) $1-\left(\dfrac{x-c}{a}\right)^{2b}$

Answer: B

71. Let A and B be two fuzzy integers defined as:
A={(1,0.3), (2,0.6), (3,1), (4,0.7), (5,0.2)}
B={(10,0.5), (11,1), (12,0.5)}
Using fuzzy arithmetic operation given by

$$\mu_{A+B}(z) = \underset{x+y=z}{\oplus} (\mu_A(x) \otimes \mu_B(y))$$

f(A+B) is ________ . $\left[\text{Note : } \begin{matrix} \oplus \equiv \max \\ \otimes \equiv \min \end{matrix}\right]$

(A) {(11,0.8), (13,1), (15,1)}
(B) {(11,0.3), (12,0.5), (13,1), (14,1), (15,1), (16,0.5), (17,0.2)}
(C) {(11,0.3), (12,0.5), (13,0.6), (14,1), (15,1), (16,0.5), (17,0.2)}
(D) {(11,0.3), (12,0.5), (13,0.6), (14,1), (15,0.7), (16,0.5), (17,0.2)}
Answer: D

72. Suppose the function y and a fuzzy integer number around -4 for x are given as
$y=(x-3)^2+2$
Around -4={(2,0.3), (3,0.6), (4,1), (5,0.6), (6,0.3)} respectively. Then f(Around -4) is given by:
(A) {(2,0.6), (3,0.3), (6,1), (11,0.3)}
(B) {(2,0.6), (3,1), (6,1), (11,0.3)}
(C) {(2,0.6), (3,1), (6,0.6), (11,0.3)}
(D) {(2,0.6), (3,0.3), (6,0.6), (11,0.3)}
Answer: C

71. A .... point of a fuzzy set A is a point x□X at which $\mu_A(x) = 0.5$
(A) core (B) support
(C) crossover (D) □-cut
Answer: C

8. Consider a fuzzy set old as defined below

Old = {(20, 0.1), (30, 0.2), (40, 0.4), (50, 0.6), (60, 0.8), (70, 1), (80, 1)}

Then the alpha-cut for alpha = 0.4 for the set old will be

(A) {(40, 0.4)}

(B) {50, 60, 70, 80}

(C) {(20, 0.1), (30, 0.2)}

(D) {(20, 0), (30, 0), (40, 1), (50, 1), (60, 1), (70, 1), (80, 1)}

Answer: D

9. Perceptron learning, Delta learning and LMS learning are learning methods which falls under the category of

(A) Error correction learning – learning with a teacher

(B) Reinforcement learning – learning with a critic

(C) Hebbian learning

(D) Competitive learning – learning without a teacher

Answer: A

28. If A and B are two fuzzy sets with membership functions

$\mu_A(X) = \{0.2, 0.5, 0.6, 0.1, 0.9\}$
$\mu_B(X) = \{0.1, 0.5, 0.2, 0.7, 0.8\}$
Then the value of $\mu_{A\cap B}$ will be
(A) {0.2, 0.5, 0.6, 0.7, 0.9}
(B) {0.2, 0.5, 0.2, 0.1, 0.8}
(C) {0.1, 0.5, 0.6, 0.1, 0.8}
(D) {0.1, 0.5, 0.2, 0.1, 0.8}
Answer: D

Explanation:
$\mu_{A\cap B}(x) = \min [\mu_A(x), \mu_B(x)]$
$\mu_{A\cup B}(x) = \max [\mu_A(x), \mu_B(x)]$
$\mu_{A'}(x) = 1 - \mu_A(x)$

29. The height of h(A) of a fuzzy set A is defined as

$$h(A) = \sup_{x \in A} A(x)$$

Then the fuzzy set A is called normal when
(A) h(A) = 0
(B) h(A) < 0
(C) h(A) = 1
(D) h(A) < 1
Answer: C

30. An artificial neurons receives n inputs $x_1, x_2,\ldots,x_n$ with weights $w_1,w_2,\ldots,w_n$ attached to the input links. The weighted sum .... is computed to be passed on to a non-linear filter ϕ called activation function to release the output.

(A) $\Sigma\ w_i$
(B) $\Sigma\ x_i$
(C) $\Sigma\ w_i + \Sigma\ x_i$
(D) $\Sigma\ w_i \,.\, \Sigma\ x_i$
Answer: D

27. Support of a fuzzy set

$$A = \left\{\frac{x_1}{0.2}, \frac{x_2}{0.15}, \frac{x_3}{0.9}, \frac{x_4}{0.95}, \frac{x_5}{0.15}\right\}$$

within a universal set X is given as

(A) $\left\{\frac{x_1}{0.15}, \frac{x_2}{0.15}, \frac{x_3}{0.15}, \frac{x_4}{0.15}, \frac{x_5}{0.15}\right\}$

(B) $\left\{\frac{x_1}{0.95}, \frac{x_2}{0.95}, \frac{x_3}{0.95}, \frac{x_4}{0.95}, \frac{x_5}{0.95}\right\}$

(C) $\{x_3, x_4\}$

(D) $\{x_1, x_2, x_3, x_4, x_5\}$

Answer: D

28. In a single perceptron, the updation rule of weight vector is given by
(A) w(n + 1)=w(n)+η[d(n)-y(n)]
(B) w(n + 1)=w(n)–η[d(n)-y(n)]
(C) w(n + 1)=w(n)+η[d(n)-y(n)]* x (n)
(D) w(n + 1)=w(n)–η[d(n)-y(n)]* x (n)
Answer: C

9. You are given an OR problem and a XOR problem to solve. Then, which one of the following statements is true?

(A) Both OR and XOR problems can be solved using single layer perception.

(B) OR problem can be solved using single layer perception and XOR problem can be solved using self organizing maps.

(C) OR problem can be solved using radial basis function and XOR problem can be solved using single layer perception.

(D) OR problem can be solved using single layer perception and XOR problem can be solved using radial basis function.

Answer: D

46. Back propagation is a learning technique that adjusts weights in the neural network by propagating weight changes.
(A) Forward from source to sink
(B) Backward from sink to source
(C) Forward from source to hidden nodes
(D) Backward from since to hidden nodes
Answer: B

56. Match the following knowledge representation techniques with their applications:

List-I	List-II
(a) Frames	(i) Pictorial representation of objects, their attributes and relationships
(b) Conceptual dependencies	(ii) To describe real world stereotype events
(c) Associative networks	(iii) Record like structures for grouping closely related knowledge
(d) Scripts	(iv) Structures and primitives to represent sentences

Codes:
(a) (b) (c) (d)

(A) (iii) (iv) (i) (ii)
(B) (iii) (iv) (ii) (i)
(C) (iv) (iii) (i) (ii)
(D) (iv) (iii) (ii) (i)
Answer: A

70. Consider the following statements about a perception :
I. Feature detector can be any function of the input parameters.
II. Learning procedure only adjusts the connection weights to the output layer.
Identify the correct statement out of the following :
(A) I is false and II is false. (B) I is true and II is false.
(C) I is false and II is true. (D) I is true and II is true.
Answer: D

2. In Delta Rule for error minimization

(A) weights are adjusted w.r.to change in the output

(B) weights are adjusted w.r.to difference between desired output and actual output

(C) weights are adjusted w.r.to difference between input and output

(D) none of the above

Answer: B

73. A fuzzy set A on R is .... iff $A(\lambda x_1 + (1 - \lambda)x_2) \geq \min [A(x_1), A(x_2)]$ for all $x_1, x_2 \in R$ and all $\lambda \in [0, 1]$, where min denotes the minimum operator.
(A) Support
(B) α-cut
(C) Convex
(D) Concave
Answer: C

74. If A and B are two fuzzy sets with membership functions
$\mu_A(x) = \{0.6, 0.5, 0.1, 0.7, 0.8\}$
$\mu_B(x) = \{0.9, 0.2, 0.6, 0.8, 0.5\}$
Then the value of $\mu_{(A\cup B)'}(x)$ will be
(A) {0.9, 0.5, 0.6, 0.8, 0.8}
(B) {0.6, 0.2, 0.1, 0.7, 0.5}
(C) {0.1, 0.5, 0.4, 0.2, 0.2}
(D) {0.1, 0.5, 0.4, 0.2, 0.3}
Answer: C
Explanation:
$\mu_{(A\cup B)}(x) = \max\{ \mu_A(x), \mu_B(x)\}$
$\mu_{(A\cup B)'}(x) = 1- \mu_{(A\cup B)}(x)$

64. Consider the two class classification task that consists of the following points :
Class C_1: [-1, -1], [-1, 1], [1, -1]
Class C_2: [1, 1]
The decision boundary between the two classes C_1 and C_2 using single perceptron is given by :
(A) $x_1-x_2-0.5=0$ (B) $-x_1+x_2-0.5=0$
(C) $0.5(x_1+x_2)-1.5=0$ (D) $x_1+x_2-0.5=0$
Answer: D

13. Consider a fuzzy set A defined on the interval X=[0,10] of integers by the membership function $\mu_A(x)=x/(x+2)$
Then the α cut corresponding to α=0.5 will be
(A) {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

(B) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
(C) {2, 3, 4, 5, 6, 7, 8, 9, 10}
(D) { }
Answer: C

Explanation:

An alpha-cut of the membership function A (denoted aA) is the set of all x such that A(x) is greater than or equal to alpha. Similarly, a strong alpha-cut (denoted a+A) is the set of all x such that A(x) is strictly greater than alpha.

A = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
$\mu_A(x)=x/(x+2)$
μ_A = {0, 1/3, 2/4, 3/5, 4/6, 5/7, 6/8, 7/9, 8/10, 9/11, 10/12}
= {0, .33, .5, .6, .66, .71, .75, .77, .8, .81, .83}
Hence, α cut where α =0.5 is membership value greater or equal to 0.5
= {2, 3, 4, 5, 6, 7, 8, 9, 10}