Unit 6 - Week 4 :

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-25, 23:59 IST.

To model input-output relationships of a process having two inputs and one output, let us use a fuzzy reasoning tool with Mamdani approach. Let us also assume three linguistic terms, namely Low (L), Medium (M) and High (H) to represent each of two inputs: I_1, I_2 and one output O. The initial membership function distributions of the inputs and output are shown in Fig. A, which are assumed to be symmetrical triangles.

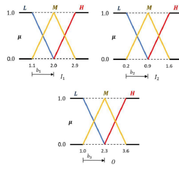

Fig. A: Initial membership function distributions of the variables.

A binary-coded genetic algorithm (BCGA) will be used to evolve the optimized data base (DB) and rule base (RB) of the fuzzy reasoning tool. The base-widths of the triangles are decided by the b values. A typical GA-string is shown below, where five bits are used to represent each of the b values and nine bits are utilized to represent the RB (where 1 and 0 represent the presence and absence of the rules, respectively).

$$\underbrace{11001}_{b_1}\ \underbrace{10001}_{b_2}\ \underbrace{10101}_{b_3}\ \underbrace{100111101}_{\text{RB}}$$

The RB of the fuzzy reasoning tool is shown below.

I_1 \ I_2	L	M	H
L	L 1	L 0	M 0
M	L 1	M 1	H 1
H	M 1	H 0	H 1

Corresponding to the above GA-string, the modified RB is given below.

I_1 \ I_2	L	M	H
L	L 1		
M	L 1	M 1	H 1
H	M 1		H 1

Take the ranges of b_1, b_2 and b_3 as follows:

$$0.4 \le b_1 \le 1.7$$
$$0.2 \le b_2 \le 1.2$$
$$0.9 \le b_3 \le 2.3$$

Let us consider a training scenario as follows: $I_1 = 1.5$, $I_2 = 1.0$, and target output $T_0 = 3.05$. Answer the following five questions **(Q1 to Q5)** by considering the modified DB and RB, according to the above GA-string. Use the Center of Area method for defuzzification.

1) $I_1 = 1.5$ corresponds to L and M, respectively, with approximate membership values of — 2 points

(a) 0.9333, 0.0667
(b) 0.2759, 0.7241
(c) 0.7241, 0.2759
(d) 0.0667, 0.9333

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

2) $I_2 = 1.0$ corresponds to M and H, respectively, with approximate membership values of — 2 points

(a) 0.9333, 0.0667
(b) 0.2759, 0.7241
(c) 0.7241, 0.2759
(d) 0.0667, 0.9333

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

3) Firing strength of the first fired rule present in the rule base (i.e., if I_1 is M AND I_2 is M then Output O is M) is approximately calculated as — 2 points

(a) 0.9333
(b) 0.7241
(c) 0.0667
(d) 0.2759

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

4) Firing strength of the second fired rule present in the rule base (i.e., if I_1 is M AND I_2 is H then output O is H) is approximately calculated as — 2 points

(a) 0.9333
(b) 0.7241
(c) 0.0667
(d) 0.2759

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

5) Crisp output corresponding to the set of inputs (I_1=1.5, I_2=1.0) is found to be approximately equal to — 2 points

(a) 2.96
(b) 5.95
(c) 8.25
(d) 3.87

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

6) Select the correct order of operations used in the working cycle of a Genetic Algorithm (GA) after the population initialization of the random solutions. — 2 points

(a) Reproduction, Assigning Fitness, Mutation, Crossover
(b) Assigning Fitness, Reproduction, Crossover, Mutation
(c) Assigning Fitness, Reproduction, Mutation, Crossover
(d) Crossover, Assigning Fitness, Reproduction, Mutation

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

7) An artificial neuron (j^{th}) receives n inputs $x_1, x_2, x_3, \ldots\ldots, x_n$ with the weights $w_{1j}, w_{2j}, w_{3j}, \ldots\ldots, w_{nj}$ and bias b is attached to this neuron. Find the correct way to compute the weighted sum of inputs to be passed on to an activation function to determine the output. — 2 points

(a) $\sum_{i=1}^{n} w_{ij} b + x_i$
(b) $\sum_{i=1}^{n} x_i w_{ij} + b$
(c) $\sum_{i=1}^{n} x_i b + w_{ij}$
(d) $\sum_{i=1}^{n} w_{ij} x_i\, b$

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

8) Identify the nature of this activation function. — 2 points

$O = \frac{1}{1+e^{-au}}$, where a represents the coefficient of transfer function and u denotes the input.

(a) Hard Limit Transfer Function
(b) Linear Transfer Function
(c) Tan-Sigmoid Transfer Function
(d) Log-Sigmoid Transfer Function

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

9) Synapse of a biological neuron is copied in the artificial neuron in the form of — 2 points

(a) connecting weights
(b) summing junction
(c) bias value
(d) activation/transfer function

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

10) The value of Tan-sigmoid transfer function used in Neural Networks varies in the range of — 2 points

(a) (0.0, +1.0)
(b) (-1.0, +1.0)
(c) (-2.0, +2.0)
(d) (-3.0, +3.0)

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)