SPRING END SEMESTER EXAMINATION-2018

6th Semester B.Tech

COMPUTATIONAL INTELLIGENCE

CS-3030

[For 2016(L.E.) & 2015 Admitted Batch]

Time: 3 Hours | Full Marks: 60

Answer any SIX questions including question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. (a) How does ANN differ from Biological Neural Networks? [2 × 10]

   (b) Obtain $A_{0.4}$ and $A'_{0.4}$ for the following fuzzy set –

   $A = 0.3/x_1 + 0.5/x_2 + 0.9/x_3 + 0.7/x_4 + 0.4/x_5 + 0.2/x_6$

   (c) Explain projections and cylindrical extensions in relation to fuzzy sets.

   (d) Define 3 types of universes of discourse with suitable examples.

   (e) Differentiate between artificial intelligence and computational intelligence.

   (f) Mention the characteristics of derivative-free optimization.

   (g) Define supervised and unsupervised learning with examples.

   (h) Write the four fuzzy implication functions for the interpretation "A entails B" of the rule A→B.

   (i) What do you mean by fuzzy singleton? Explain in brief.

(j) Define elitism approach in Genetic Algorithm with the help of an example.

2. (a) What is Fuzzy Inference System (FIS)? What are its conceptual components? Draw a block schematic diagram of a FIS. [4]

(b) Define the following terms with reference to fuzzy logic- [4]

(i) Core (ii) α – cut (iii) Symmetry (iv) Bandwidth (v) Support (vi) Normality (vii) Convexity (viii) Crossover point

3. (a) Diagrammatically explain the structure of an artificial neuron. Mention eight types of activation functions. [4]

(b) Let two relations be defined as, R_1 : "x is close to y" on X × Y and R_2 : "y is close to z" on Y × Z. R_1 and R_2 are given as [4]

$$R_1 = \begin{vmatrix} 0.2 & 0.5 & 0.1 \\ 0.7 & 0.3 & 0.4 \end{vmatrix} \text{ and } R_2 = \begin{vmatrix} 0.8 & 0.3 \\ 0.1 & 0.9 \\ 0.6 & 0.4 \end{vmatrix}$$

Find the relation R_3 : "x is close to z" as $R_1 \in R_2$, where $\in$ is defined as the max-product composition.

4. (a) Prove the following inequality – [4]
$S_{max}(a,b) \leq S_{as}(a,b) \leq S_{bs}(a,b) \leq S_{ds}(a,b)$
S represents the S-norm operator.

(b) Explain the Mamdani Fuzzy model with *max* as T-norm and *min* as S-norm operators. Mention five defuzzification techniques. [4]

5. (a) Define a linguistic variable as a quintuple. Give the expressions for CON(A), DIL(A), INT(A) and DIM (A). [4]

(b) Given, $\mu_{young}(x)$= bell(x;20,2,0) and $\mu_{old}(x)$ = bell(x; 30,3,100), construct the linguistic expression for the terms – [4]

(i) old but not too old

(ii) extremely old

(iii) not young and not old

(iv) more or less old

6. (a) Explain the concept of GA and its components. Mention its basic steps. [4]

(b) What is the significance of back-propagation algorithm for a feed – forward neural network. [4]

7. (a) What is a perceptron? Explain its limitation and how it can be overcome using a multi-layer perceptron by taking the XOR example. [4]

(b) Graphically explain fuzzy reasoning for the following cases – [4]

(i) Single rule with single antecedents

(ii) Single rule with multiple antecedents

(iii) Multiple rules with multiple antecedents

8. Write short notes on (any two) - [4×2]

(a) Types of Universe of discourse

(b) Composite and Non-composite MFs

(c) Simulated Annealing

(d) Characteristics of Neuro-Fuzzy and Soft Computing

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