B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Seventh Semester

Biomedical Engineering

15UBM703 – NEURAL NETWORKS AND PATTERN RECOGNITION

(Regulation 2015)

Duration: Three hours — Maximum: 100 Marks

Answer ALL Questions

PART – A (10 x 1 = 10 Marks)

1. Which of the following is disadvantages pattern recognition? CO1-R
   (a) Syntactic Pattern recognition approach is complex to implement
   (b) It is very slow process
   (c) Sometime to get better accuracy, larger dataset is required
   (d) All of the above

2. Error correction learning is type of _____. CO1-R
   (a) Supervised learning   (b) Unsupervised learning
   (c) Can be supervised or unsupervised   (d) None of the mentioned

3. The recalled output in pattern association problem depends on CO2-U
   (a) Nature of input-output   (b) Design of network
   (c) Both input and design   (d) None of the mentioned

4. What is the minimum no. of variables/ features required to perform clustering? CO2-U
   (a) 0   (b) 1   (c) 2   (d) 3

5. Below are the 8 actual values of target variable in the train file [0,0,0,1,1,1,1,1]. What is the entropy of the target variable? CO3 - U
   (a) $-\{5/8 \log(5/8) + 3/8 \log(3/8)\}$ (b) $5/8 \log(5/8) + 3/8 \log(3/8)$
   (c) $3/8 \log(5/8) + 5/8 \log(3/8)$ (d) $5/8 \log(3/8) - 3/8 \log(5/8)$

6. Applications of Karhunen - Loeve transform CO3-U
   (a) Data compression   (b) Image processing
   (c) Pattern recognition   (d) All the above

7. 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. The output will be: CO4-Ap
   (a) 238   (b) 76   (c) 119   (d) 123

8. Back propagation is a learning technique that adjusts weights in the neural network   CO4-U
   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 sink to hidden nodes

9. Fuzzy logic is usually represented as _____ .   CO5-R
   (a) IF-THEN-ELSE rules   (b) IF-THEN rules
   (c) Both IF-THEN-ELSE rules & IF-THEN rules   (d) None of the mentioned

10. How many types of random variables are there in Fuzzy logic?   CO5-R
    (a) 2   (b) 4   (c) 3   (d) 1

PART – B (5 x 2 = 10 Marks)

11. Distinguish between parametric and non parametric decision making.   CO1-Ana

12. Distinguish between classification and clustering.   CO2-Ana

13. Difference between feature extraction and feature selection   CO3-Ana

14. Draw the network for solving Exclusive OR problem.   CO4-Ap

15. Mention the limitations of fuzzy system.   CO5-U

PART – C (5 x 16 = 80 Marks)

16. a) (i) Briefly explain the various processes involved in a pattern recognition   CO1-U   (8)
             system.
        (ii) Explain least mean square error estimation with neat diagram.   CO1-U   (8)

                                    (OR)

    b) (i) Explain in detail about linear discriminant function.   CO1-U   (8)
        (ii) Explain the perceptron algorithm with geometrical approach.   CO1-U   (8)

17. a) Describe the C-means algorithm in unsupervised classification with   CO2-U   (16)
        architecture and flow chart.

                                    (OR)

    b) Explain the concept of clustering. Which are the two schemes of hierarchical   CO2-U   (16)
        clustering algorithm? Give brief descriptions.

18. a) Explain the Karhunen – Loeve transformation with equations. How this   CO3-U   (16)
        transformation is different from principal component analysis?

                                    (OR)

    b) Explain Feature selection through Entropy Minimization.   CO3-U   (16)

19. a) (i) Explain in brief the back propagation training algorithm with neat architecture and flowchart.   CO4-U   (8)

(ii) Determine the weights after one iteration for hebbian learning of a single neuron network starting with initial weights w=[1, -1, 0, 0.5], inputs as X1=[1, -2, 1.5, 0] , X2=[1, -1.5, -2, 1.5], X3=[0, -1, 1, 1.5] and C=1. Use bipolar activation function.   CO4-Ap   (8)

(OR)

b) (i) Explain in brief about the Bi-directional associate memory and derive its energy function.   CO4-U   (8)

(ii) Perform one training step of the back propagation network with single neuron using delta learning rule. Use the following two input and output patterns for training. Assume the initial weight $W_0 = [2 \quad 3 \quad 5]^T$ and η=0.6. Use bipolar sigmoid function. Normalize the inputs and output by a factor of 10.   CO4-Ap   (8)

$$\left\{ X_1 = \begin{bmatrix} 2 \\ 1 \\ -1 \end{bmatrix}, d_1 = 2 \right\}, \left\{ X_2 = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}, d_1 = 3 \right\}$$

20. a) (i) Discuss the steps involved in the development of fuzzy logic system with suitable example.   CO5-U   (8)

(ii) I = { 0.3, 0.1,1,0.5, 0.2} V={0.3,0.6 , 1,0.2,0.9} C = {0.5, 1,0.3}. Find P and T using Fuzzy Cartesian Product P = V * I and T = I*C. Using Max-Min and Max-Average composition find E = P*T.   CO5-Ap   (8)

(OR)

b) (i) Discuss in detail about various defuzzification methods with examples.   CO5-U   (8)

(ii) Design a fuzzy logic controller for any one of the biological application of your choice with a case study.   CO5-Ap   (8)

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