[Total No. of Questions - 8] [Total No. of Printed Pages - 3] (2125)

15631

M. Tech 3rd Semester Examination

Neural Networks and Fuzzy Logics

EC-311

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions.

1. (a) Explain working of biological neuron and draw the mathematical model put forward by Mc Cullock and Pitts. (10)

   (b) It is required to memorize two opposite states $Y_1 = [1\ 1\ 1]^T$ and $Y_2 = [-1\ -1\ -1]^T$ by Hopfield network operating in auto-associative memory mode. Design the network and show that it is capable of retrieving the fundamental memories. (10)

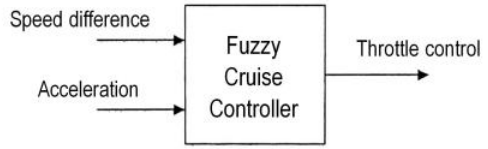
2. Apply delta-learning rule to learn the relation between input and output patterns. $X[1] = [1\ -2\ 0\ 1]^T$; $X[2] = [0\ 1.5\ -0.5\ -1]^T$; $X[3] = [-1\ 1\ 0.5\ -1]^T$ and $Y[1] = [-1]$; $Y[2] = [-1]$ and $Y[3] = 1$. Weight vector, $W = [1\ -1\ 0\ 0.5]$.
   Perform two iteration of learning. Take bipolar sigmoidal ($\lambda = 1$) activation function and learning constant $\eta = 0.1$. (20)

3. Use Kohonen self-organizing feature map (SOFM) to cluster four vectors into two classes.
   $X[1] = [1\ 1\ 0\ 0]^T$; $X[2] = [0\ 0\ 0\ 1]^T$; $X[3] = [1\ 0\ 0\ 0]^T$ and $X[4] = [0\ 0\ 1\ 1]^T$ whereas initial weight vectors are $W1 = [0.2\ 0.6\ 0.5\ 0.9]^T$ and $W2 = [0.8\ 0.4\ 0.7\ 0.3]^T$. Perform two iterations (epochs) of learning. Take learning rate $\eta(0) = 0.6$ and $\eta(t+1) = 0.5\ \eta(t)$. Use Euclidian distance as measure of proximity. (20)

[P.T.O.]

4. Draw architecture of multi-layer perceptron model (MLP). Write procedural steps to train the network by error back propagation and finally how testing is carried out. Also suggest suitable training termination criterion to ensure generalization. (20)

5. It is desired to maintain the Cruise at a desired speed. A Fuzzy Cruise Controller is designed with rule base and term-sets as under



Fuzzy rule base governing the cruise control is given below:

Rule 1 If (speed difference is NL) and (acceleration is ZE) then (throttle control is PL)

Rule 2 If (speed difference is ZE) and (acceleration is NL) then (throttle control is PL)

Rule 3 If (speed difference is NM) and (acceleration is ZE) then (throttle control is PM)

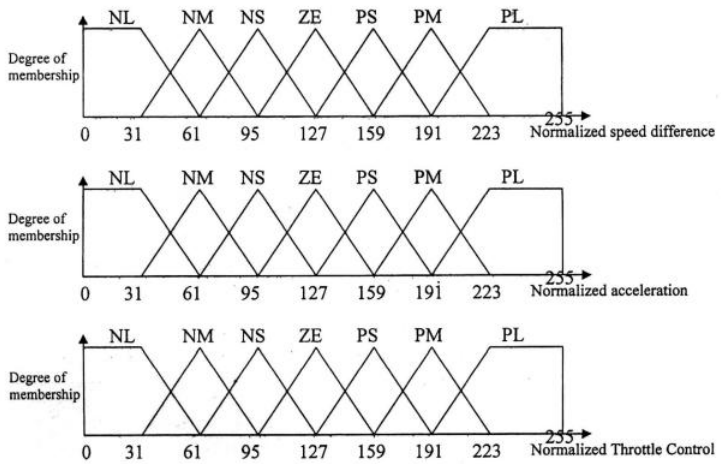
Rule 4 If (speed difference is NS) and (acceleration is PS) then (throttle control is PS)

Rule 5 If (speed difference is PS) and (acceleration is NS) then (throttle control is NS)

Rule 6 If (speed difference is PL) and (acceleration is ZE) then (throttle control is NL)

Rule 7 If (speed difference is ZE) and (acceleration is NS) then (throttle control is PS)

Rule 8 If (speed difference is ZE) and (acceleration is NM) then (throttle control is PM)



Calculate the throttle control for a speed difference of 100 and acceleration of 70. (20)

6. (a) Define and explain the followings:
   (i) Compliment of fuzzy subset.
   (ii) Union of fuzzy subsets.
   (iii) Intersection of fuzzy subsets.
   (iv) Normal fuzzy subset.
   (v) Core of fuzzy subset. (10)

   (b) How PD-like FLC (fuzzy logic controller) is realized? Also list the associated rule base. (10)

7. Describe the application of artificial neural network for the following implementations:
   (i) Function approximation.
   (ii) Blind source separation. (10×2=20)

8. Write short note on any TWO of the followings:
   (i) ART Networks.
   (ii) LVQ.
   (iii) Fuzzy design of anti-lock braking (ABS). (10×2=20)