Indian Institute of Technology Kharagpur

Department of Mechanical Engineering

Instructions: Answer all the questions. Each question carries two marks. There is no negative marking for wrong answer. There is no part marking for the questions.

Third Test (2020-2021) ; Total Marks: 20

Subject: MF41601: Soft Computing; Maximum Time: 1 hour; Date: 11.11.2020

Name:	Roll No.

Q. Fig. A shows a multi-layer feed-forward neural network to be used to model input-output relationships of a process having two inputs and one output. The neurons lying on the input, hidden and output layers have the transfer function represented by $y = x,\quad y = \dfrac{1}{1+e^{-a_1 x}}$ and $y = \dfrac{e^{a_2 x} - e^{-a_2 x}}{e^{a_2 x} + e^{-a_2 x}}$, respectively. The connecting weights between the input and hidden layers are represented by [V] and those between the hidden and output layers are denoted by [W].
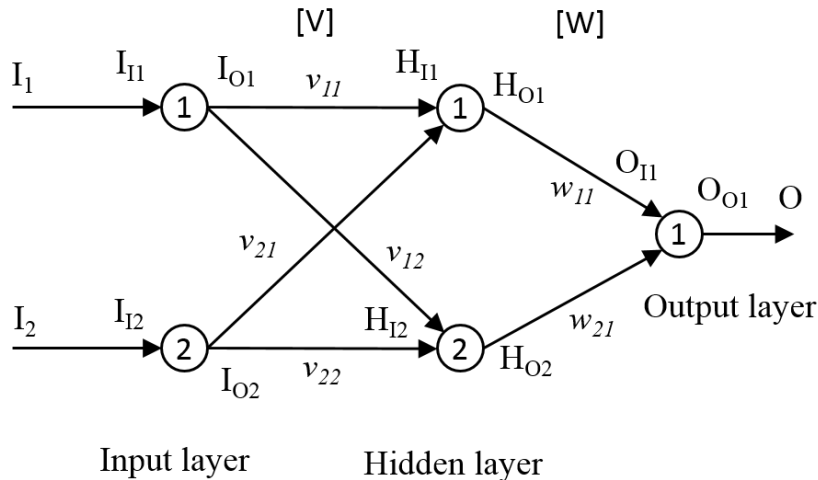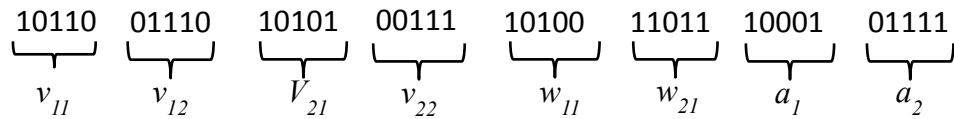

Fig. A: A multi-layer feed-forward neural network.

A binary-coded genetic algorithm will be used to evolve this optimized neural network, in which five bits will be utilized to represent each of the real variables. A typical GA-string is shown below.

$$10110 \quad 01110 \quad 10101 \quad 00111 \quad 10100 \quad 11011 \quad 10001 \quad 01111$$

$$v_{11} \qquad v_{12} \qquad V_{21} \qquad v_{22} \qquad w_{11} \qquad w_{21} \qquad a_{1} \qquad a_{2}$$

The connecting weights [V] and [W] vary in the range of (0.0, 1.0) and the coefficients: a_1 and a_2 will lie in the range of (0.5, 2.0). Let us consider a training scenario as follows: I_1=0.6, I_2=0.4 and target output T_O=0.9. Answer the following five questions (Q1 to Q5).

Q1. Input of first neuron lying on hidden layer H_{I1} becomes approximately equal to

(a) 0.9997
(b) 0.6968
(c) 0.2359
(d) 0.3127

Q2. Output of first neuron lying on hidden layer becomes approximately equal to

(a) 0.11127
(b) 0.21257
(c) 0.71528
(d) 0.10258

Q3. Input of neuron lying on the output layer O_{I1} comes out to be approximately equal to

(a) 0.1925
(b) 0.2867
(c) 0.2256
(d) 0.9987

Q4. Output of neuron lying on the output layer O_{O1} becomes approximately equal to

(a) 0.841
(b) 0.234
(c) 0.355
(d) 0.123

Q5. Error in prediction $E = |T_o - O_{O1}|$ is found to be approximately equal to

(a) 1.505
(b) 0.059
(c) 0.450
(d) 0.670

Q. 6 Human brain, most of the times, follows the principle of

(a) Multi-layer feed-forward neural network trained by back-propagation algorithm.

(b) Recurrent neural network.

© Radial basis function neural network.

(d)Self-organizing map.

Q. 7 A genetic-neuro-fuzzy system is basically

(a) a neural network.

(b) a genetic algorithm.

© a fuzzy reasoning tool.

(d) neither a neural network nor a genetic algorithm nor a fuzzy reasoning tool.

Q. 8 Synapse of a biological neuron is copied in the artificial neuron in the form of

(a) activation/transfer function.

(b) bias value.

© summing junction.

(d) connecting weights.

Q. 9 A recurrent neural network (RNN) has

(a) feed-forward connections only.

(b) feed-back connections only.

© both feed-forward and feed-back connections.

(d) neither feed-forward nor feed-back connection.

Q. 10 Back-propagation neural network and Self-Organizing Map are efficient tools for

(a) clustering and regression analysis, respectively.

(b) regression analysis and clustering, respectively.

© clustering only.

(d)regression analysis only.

Name: Roll No.

ANSWER KEYS

Q. 1   ; Q. 2   ; Q. 3   ; Q. 4   ; Q. 5

Q. 6   ; Q. 7   ; Q. 8   ; Q. 9   ; Q. 10