Assignment 8

1. What do you mean by a feed-forward neural network ? How does it differ from a recurrent neural network ?
2. Explain the principle of a back-propagation algorithm. State its advantages and disadvantages.
3. Do you prefer a radial basis function network to a conventional multi-layer feed-forward network ? Explain it.
4. Make comments on the role of a self-organizing map as a dimensionality reduction technique.
5. Explain the principle of counter-propagation neural network. How does it differ from a back-propagation neural network?
6. Explain briefly the principles of Elman and Jordan networks.
7. Fig. 10.20 shows the schematic view of an NN consisting of three layers, such as input, hidden and output layers. The neurons lying on the input, hidden and output layers

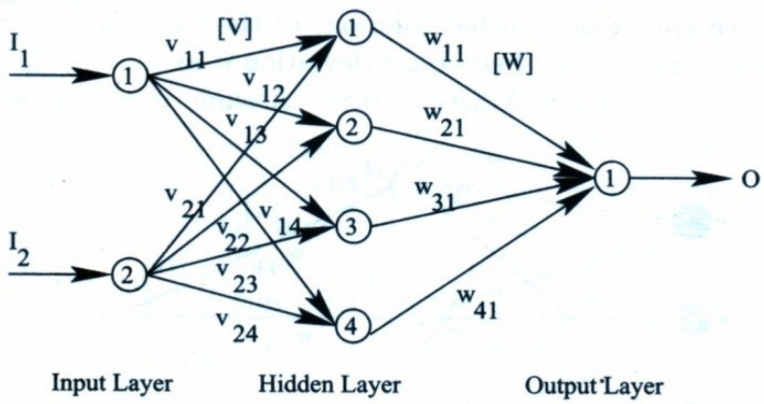

Figure 10.20: Schematic view of a neural network.

have the transfer functions represented by $y = x$, $y = \frac{1}{1+e^{-x}}$, $y = \frac{1}{1+e^{-x}}$, respectively. There are two inputs, namely I_1 and I_2 and one output, that is, O. The connecting weights between input and hidden layers are represented by $[V]$ and those between hidden and output layers are denoted by $[W]$. The initial values of the weights are assumed to be as follows:

$$\begin{bmatrix} v_{11} & v_{12} & v_{13} & v_{14} \\ v_{21} & v_{22} & v_{23} & v_{24} \end{bmatrix} = \begin{bmatrix} 0.2 & 0.3 & 0.2 & 0.4 \\ 0.6 & 0.3 & 0.5 & 0.2 \end{bmatrix};$$

$$\begin{bmatrix} w_{11} \\ w_{21} \\ w_{31} \\ w_{41} \end{bmatrix} = \begin{bmatrix} 0.4 \\ 0.7 \\ 0.3 \\ 0.2 \end{bmatrix}.$$

Using an incremental mode of training for the case shown in Table 10.2, calculate the changes in V (that is, ΔV) and W (that is, ΔW) values during back-propagation of error, assuming a learning rate $\eta = 0.4$. Show only one iteration.

Table 10.2: Training cases.

Sl. No.	I_1	I_2	O
1	0.6	0.4	0.9
2	-	-	-
⋮	⋮	⋮	⋮

8. A radial basis function network (RBFN) is to be used to model input-output relationships of a manufacturing process having three inputs and one output. Fig. 10.21 shows the RBFN with one hidden layer containing three neurons. The hidden neurons are assumed to have Gaussian transfer functions of the form: $y = f(x) = exp[-\frac{(x-\mu)^2}{2\sigma^2}]$ with the values of mean μ and standard deviation σ as follows: ($\mu_1 = 4.0, \sigma_1 = 0.4$); ($\mu_2 = 4.5, \sigma_2 = 0.6$); ($\mu_3 = 5.0, \sigma_3 = 0.8$). Assume initial weights as $w_{11} = 0.2$,

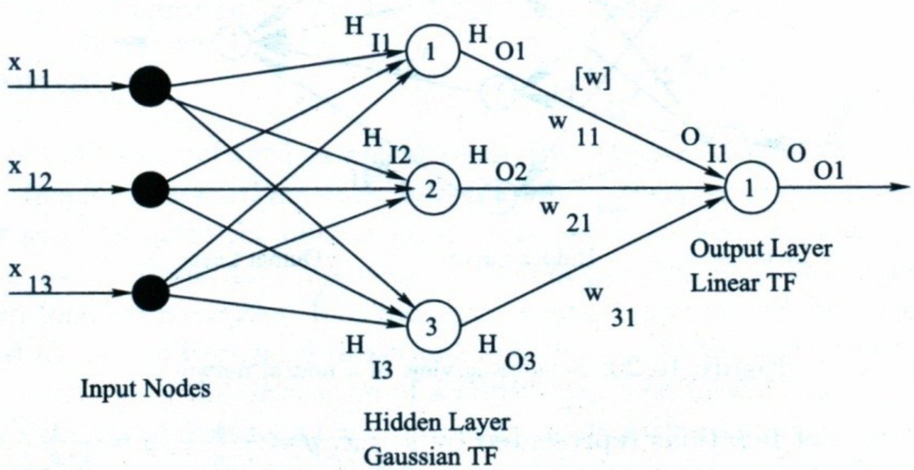

Figure 10.21: A radial basis function neural network.

$w_{21} = 0.1$, $w_{31} = 0.3$. Use incremental training scheme with the help of a scenario: $x_{11} = 0.8$, $x_{12} = 1.5$, $x_{13} = 2.5$ and output $O = 0.5$. Use back-propagation algorithm with a learning rate $\eta = 0.2$. Calculate the updated values of w_{11}, w_{21}, w_{31}, μs, σs. Show only one iteration.