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**Problem three**

Suppose the output of each neuron in a multilayer quadratic perceptron (MLQP) network is

For k=2,3,…,M number of layer and j=1,2…

where both and are the weights connecting the(ith) unit in the layer (k-1) to the (jth) unit in the layer (k), is the bias of the (jth) unit in the layer (k), is the number of units in the k(1 <=k<=M), and f(.) is the sigmoidal activation function.

The structure of the unit is shown as the following gure.

1. Please derive the back-propagation algorithms for MLQPs in both on-line

learning and batch learning ways

**Solution**

Provided training dataset are ｛p1,t1｝,｛p2,t2｝,…,｛pQ,tQ｝,the value of teacher singnal tq  are 1 or 0. We will use the LMS(least mean square) algorithm, where is the error

Set X=],

Like LMS, we will use the repleace the error .

set

(1)

(2)

The linear LMS is

(3)

(4)

(5)

For (1),

(6)

(7)

(8)

From (2),we can get that

(9)

(10)

(11)

Set (12)

So

(13)

(14)

(15)

For the last layer(output layer k=M),

(16)

Express in matrix methord

(17)

(18)

(19)

(20)

(21)

Now we can update the(3),(4),(5) by(16),(21).