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Implementation of Hetroassociative Memory Neural Network for Pattern Classification

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ABSTRACT

Now a day's neural network is used for classification and clustering to improve the accuracy of result. The central idea of this paper is description of the theory, architecture, algorithm and implementation of Hetroassociative memory neural network. This paper represents what is Hebb rule and outer product rule? Hetroassociative memory neural network is useful in digital signal processing to remove the noise, classification, pattern recognition etc. In this paper we consider the pattern of letters 'A', 'E' for classification.

1. Introduction

At present ANN plays an important role in various areas. Most of the ANN algorithms are used for pattern association. Associative memory network can store a set of patterns a memory. It performs a parallel search within a stored data file. It will display the output from stored items as one or all which match the given search argument.

Associative memory net is categorized into two types. Auto associative memory net and Hetroassociative memory net. Both networks are single layer network and weights are calculated using input output vector pairs represented as s.t. of pattern association. If input vectors which are associated with output vectors are same then that network is said to be autoassociative memory net. If input vectors are different from output vectors the network is said to be hetroass ociative memory net. To train the associative net either Hebb rule or outer product rule is used. The number of mismatched components of input vectors is calculated by using Hamming distance (HD).

Hamming Distance(x,x')= $\sum| x_i-xi'|$ if xi,xi' € [0,1] For Binary data

OR

Hamming Distance(x,x')=1/2 $\sum| x_i-xi'|$ if xi,xi' € [-1,1] For Bipolar data

It is useful in digital signal processing: noise cancellation, echo cancellation (most long distance phone lines use it). It is used in classification. It is used to estimate the random concentration in soil associated with the environmental parameters.

Hebb Rule: It is used for finding the weights of an associative neural net. Here training vector pair is denoted as s.t.

Outer Product Rule: It is another method for finding weights of an associative net. Input vector and output vector is represented as

Input vector = s =(s_1,s_2,…….. s_n)

Output vector= t =(t_1,t_2,…….. t_m)

Outer product of input and output matrix is represented as .

$ST=s^T t$

2. Architecture

The architecture of hetro-associative neural network is as shown in Fig. 1. In this network input layer consists of n number of input neurons and output layer consists of k number of output units. Input and output layer units are interconnected with each other with weight matrix.

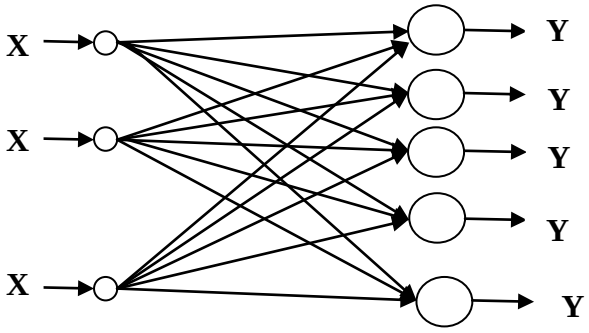

Fig. 1 Hetroassociative Network

3. Training Algorithm

Step 1: Initialize the weight as zero.
Step 2: For each training input Repeat step 3
Step 3: Set activations of output unit
Step 4: Update the weights

4. Testing Algorithm

Step 1 : Initialize the updated weights. Set n=No. of input and m=No. of output
Step 2 : Repeat step 2 to 4 for each testing input-output vector
Step 3 : Set the activations as
Step 4 : calculate the net input

For i=1 to n
For j= 1 to m
Yin = b + $\sum x_i w_{ij}$
For i=1 to n
Yin1=$\sum x_i w_{i1}$
Yin2=$\sum x_i w_{i2}$

Step 5 : Apply the activation over the net input to calculate the output.
Y1=f(Y_{in1})=f(0)=0

Y2=f(Y_{in2})=f(2)=1

5. Implementation

Here we use the patterns of alphabets 'A' and 'E' shown in Fig. 2. for training. We consider the binary input for these patterns. Input matrix and target output matrix used to train the hetroassociative neural network is as shown in Fig. 3. Initially we assign 0 to weight matrix and calculates the net input and weight changes. These calculations are carried out for all the input samples. It is implemented using Python.

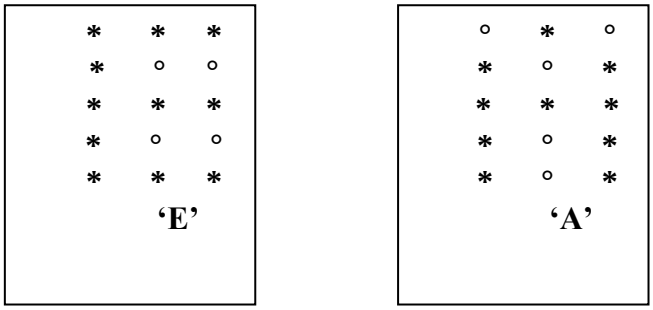

Fig. 2. Input Patterns of alphabet 'E' and 'A'

Pattern	Input vector	Target vector
'E'	1 1 1 1 0 0 1 1 1 1 0 0 1 1 1	0 1
'A'	0 1 0 1 0 1 1 1 1 1 0 1 1 0 1	1 1

Fig. 3 Input and Target vector for pattern 'E' and 'A'

6. Conclusion

This paper shows an implementation of hetroassociative memory neural network for pattern recognition. It is useful when input and output vectors are different. Hebb rule is used as learning algorithm to calculate the weight matrix by summing up outer product rule.

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