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Implementation of Bidirectional Associative Memory Neural network for Character Recognition

[1]Mrs. Rashmi Lad & [2]Mrs. Vaishali Kherdekar

[1,2]MIT ACSC, Alandi (D), Pune (India)

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***Corresponding Author**
Email: rylad[at]mitacsc.ac.in
vakherdekar[at]mitacsc.ac.in

ABSTRACT

In Pattern recognition we can identify the symbol, character, image and any signal. Pattern recognition is one of the applications of neural network. Neural network are mainly work for finding patterns of images, brain etc. Many algorithms are working on that but Bidirectional associative memory has limited storage pattern, limited noise. So for small pattern we can use this algorithm easily. In this paper we used two patterns 'E' & 'F' and try to find the pattern based on the target changed.

1. Introduction

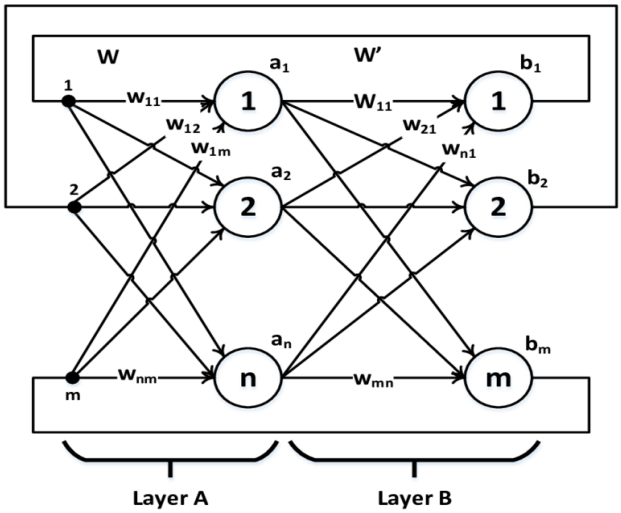
Artificial neural network play an important role in character or pattern recognition, pattern association and prediction. There are many supervised algorithms presents in neural for finding pattern association like Autoassociative & hetroassociative network.

It is single layer network. In auto-associative network the training input and target output vector both are identical but in hetro-assocative network the training input and target both are different.

The Bidirectional associative memory (BAM) introduced by Kosko in 1988 as a multilayer neural network. It is mainly used for forward and backward associative searches. The Bidirectional Associative memory is a recurrent hetero-associative pattern matching network accepts both binary and bipolar pattern. For training the network it is used Hebbian & Delta learning rule.

2. Architecture of BAM

It consists of two layers of neurons which are connected by directed weighted path interconnections. The network sending the signal backward and forward between two layers until all the neurons reaches equilibrium. The weights associated with the network are bidirectional.



Let the input vector be denoted by s(p) and target vector by t(p), p=1,2 …..P then the weight matrix to store a set of input and target vectors, where

S(p) = T(p)

S(p) = $S_1(p)$ ……$S_n(p)$

T(p) = $t_1(p)$……$T_n(p)$

In case of binary input weight matrix can be calculated

$W_{ij} = \Sigma_{p=1}[2S_i(p) - 1][2t_j(p) - 1]$

In case of bipolar input weight matrix can be calculated

$W_{ij} = \Sigma_{p=1}[S_i(p).t_j(p)]$

3. Activation functions for BAM

1. With binary input & Output vector is for X & Y

1) if x or y > 0 then 1
2) if x or y = 0 then X_i or Y_i

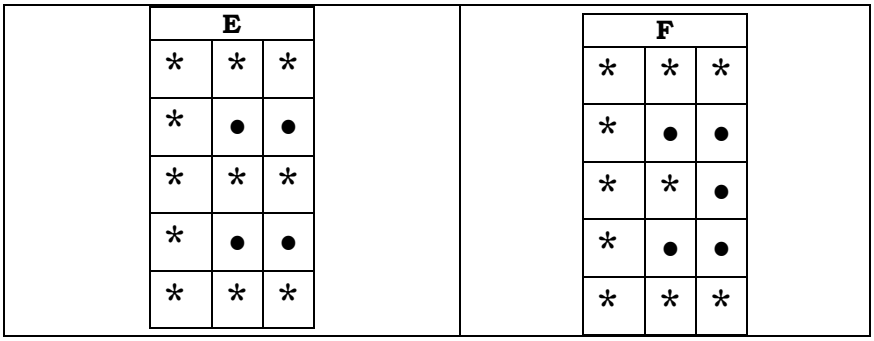
3) if x or y < 0 then 0

2. With bipolar vector is

1) if x or y > 0 then 1
2) if x or y = 0 then X_i or Y_i
3) if x or y < 0 then -1

4. Computational Analysis

In this paper we take input vector as pattern of E & F



Input vector for

E - [1, 1, 1, -1, 1, -1, -1, 1, -1, -1, 1, -1, -1, 1, -1]
F – [1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]
Target vector t is [-1, 1] & [1, 1]

Step 1 – After taking the input and target, first we have to calculate the weight vector for both input pattern

$W_i = \Sigma s^t(p)*t(p)$

Step 2 – then find w = w1+w2

Step 3 – for test pattern E & F, compute net input and apply activation functions and get the result.

Step 4 – Now transpose the weight matrix and Test the pattern E & F with net input result. After calculating the matrix applies activation function on matrix and gets the train matrix.

Step 5- Now check the test & train pattern that both are similar or not.

5. Result

We have two pattern E & F for this network & check the pattern result for changes in target pattern.

	Training		Testing		Result
Target Vector	**E**	**F**	**E**	**F**	
[-1,1][1,1]	[1, 1, 1, -1,1,-1, -1,1,1, -1,1,-1, -1,1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	**100% Recognize**
[1,-1][1,1]	[1, 1, 1, -1,1,-1, -1,1,-1, -1,1,-1, -1,1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	**100% Recognize**
[1,1][-1,1]	[1, 1, 1, -1,1,-1, -1,1,-1, -1,1,-1, -1,1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	**50% Recognize**
[1,1][1,-1]	[1, 1, 1, -1,1,-1, -1,1,-1, -1,1,-1, -1,1,-1]	[1, 1, 1, 1, -1, 1, 1, -1, 1, 1, -1, 1, 1, 1, 1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	[1, 1, 1, -1, 1,-1, -1, 1,-1, -1, 1,-1, -1, 1,-1]	**50% Recognize**

6. Conclusion

In this paper we tried to implemented bidirectional associative memory for character recognition for the English alphabets E & F. Here when target patterns are changed randomly, patterns are displayed with noise otherwise if we keep fixed target then all the patterns are recognized correctly.

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