BAM - IRM2016502

Problem :

A Bidirectional Associative Memory(BAM) is required to store the following M =4 pairs of patterns:

Set A: X 1 =[1 1 1 1 1 1], X 2 =[-1 -1 -1 -1 -1 -1] , X 3 =[1 -1 -1 1 1 1] ,

X 4 =[1 1 -1 -1 -1 -1]

Set B: Y 1 =[1 1 1] , Y 2 =[-1 -1 -1] , Y 3 =[-1 1 1] , Y 4 =[1 -1 1]

Using BAM algorithm, train a W matrix for BAM which can retrieve

all the above mentioned 4 pairs.

Hence test the level of weight corrections of the BAM with examples.

Procedure:

The basic idea behind the BAM is to store pattern pairs so that when n-dimensional vector X from set A is presented as input, the BAM recalls m-dimensional vector Y from set B, but when Y is presented as input, the BAM recalls X.

To create a BAM we need to create a correlation matrix for each pattern pair we want to store. The correlation matrix is the matrix product of the input vector X, and the transpose of the output vector Y.

The BAM weight matrix is the sum of all correlation matrices, that is,

$$\mathbf{W} = \sum_{m=1}^{M} \mathbf{X}_m \, \mathbf{Y}_m^T$$

where m is the number of patterns to be stored.

Reference lecture slides

Here below I've shown the output using the BAM model created.

Also we could see for slight changes in the set A it associates to the nearest possible vector from set B .

```
Weight Matrix:
[[2 2 4]
 [4 0 2]
 [2 2 0]
 [0 4 2]
 [0 4 2]
 [0 4 2]]

Given the set A as input:
[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]

Given the set B as input:
[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]

Given the set A as input with some changes to check nearest associations:
[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]
```