

CS 6673 fall 2016

Individual Project, Due December 6, 2016 Submit a hardcopy before the start of class

This is an individual project that you must complete all by yourself without the help in any way with anyone else. If you have questions, you should come talk to me or your TA.

Write a program to implement an autoassociative neural network using the Hebb rule to set the weights and biases. Consider the 10 input patterns for the 10 digits as shown for problem 3.2 on page 153 of our textbook (except for digit 1). Answer these **three broad** questions:

1. What is the maximum number of patterns that can stored and recalled **successfully**? Does it matter which ones you try to stored? Specify the choice of those patterns. Is there another choice that works nearly as good? (Consider whether any of these input vectors are orthogonal or nearly so; how is that relevant?) Consider bipolar input and output only.
2. How much noise can your net handle? Consider separately missing data values and mistakes in the input patterns. It is important to write your computer program in a way that allow you to generate noisy input patterns to test your program easily. Also your program must be able to display the output patterns so you can immediately visualize them.
3. Find a few of the spurious patterns. These are patterns that the neural network recalls but they are not in the training set. Report exactly how you find them so that your results can be verified.

Please note that as a project, some of the questions make have somewhat open-ended answers. You will have to judge how much effort and how deep and thorough you want to answer them.

To help you generate the patterns for the ten digits from 0 to 9, use the text file that comes with this problem. There are two differences compared with the patterns given in the textbook: (1) dots are replaced here by blanks, (2) the pattern for digit one has been modified slightly.

Each pattern is taken row by row and concatenated to form a 35-element vector. The resulting 10 vectors are combined to form a 10 by 35 array. The first row of the array is the pattern for digit 0, the second row for digit 1, etc.

You must use this array so some of the important processes can be readily automated (rather than hardwired or done by hand).

Submit a hardcopy of your programs and functions. Present a lot of results by thoroughly exploring the neural network. Produce results and document your findings in a way that they can be easily verified without having to read every line of your computer program.