

Hopfield networks

For this assessment, you are asked to write a simulation of a Hopfield neural network using Hebbian learning as discussed in the lectures. This program must be written in Java and must be executable on raptor from the command line. Your computer program must have the following behaviour:

-The program accepts two text files:

- (I) A file that specifies complete patterns to be learned.
- (II) A file that specifies a number of corrupted patterns, corresponding to (I).

I will call the program using the following commands with command line switches:

```
java hopf pathtocompletepattern pathtoincomplete
```

Here “*pathtocompletepattern*” will be replaced by a path to the file containing the complete patterns to be learned/stored; similarly with “*pathtoincomplete*” which will be replaced by the path to a file containing the incomplete/corrupted patterns. So, for example, I will call the programme using

```
java hopf ~/storedpatterns.txt ~/incompletepatterns.txt
```

or

```
java hopf ~/stp.dat ~/inc.dat
```

or something similar. The program must be executable from the command line in the relevant folder on raptor, that is you cannot use BlueJ. Before you submit your final version, make sure you test your program on raptor.

-The program should then output to standard out (i.e. the command line) a list of patterns corresponding to the input corrupted input pattern.

-The number of output patterns should be equal to the number of corrupted patterns that were supplied in the file.

-If the input given is not feasible, for example because it cannot be learned, then the program should exit straight away outputting 0.

An example:

The complete patterns could be:

```
1 1 1 1 -1
```

The partial pattern could be

```
-1 1 1 1 -1
```

-The output of the program should be the reconstituted pattern corresponding to the list of corrupted input patterns. One pattern per line. So, if the list of corrupted input patterns contains 5 lines, then the output should also be 5 lines. In the above example this would be a single line output:

1 1 1 1 -1

...and nothing else! No comments no words, just the patterns.

Example input files and output files will be made available on moodle, so you can test your program.

Submission:

Please submit your work on raptor into the directory:

/proj/co528c/hopf/

To do so, you need to connect to raptor.kent.ac.uk using ssh (on Linux) or putty (from Windows).

Note

- **that your program MUST be compiled and executable from the command line, i.e. should not require BlueJ.**
- that you are not allowed to use any specialised packages for neural networks. The basic functionality of the network must be programmed by you.
- You will lose write access to the directory on the day of the deadline a few minutes before midnight.
- **Marks will be deducted for not following the instructions.**

Marking scheme: The maximum number of points for this assignment is 10.

-If your program cannot be run from the command line or does not accept input patterns as requested then you receive 0 points.

-You get 4 points if the program works with the example patterns given on moodle.

-You get another 2 points if the program works with patterns that are equal in length to the example pattern, but different in contents.

-You get another 2 points if your program correctly works on an arbitrary test pattern.

-The final 2 points if it correctly exits when asked to learn impossible patterns.

-You get up to 2 points deduction for unreasonably long execution times.

-You get up to 4 points deduction when the program exits with an error, when in fact the pattern is learnable.

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submitted work in an effort to identify possible plagiarism, and take disciplinary action against anyone found to have committed plagiarism. When you use other peoples' material, you must clearly indicate the source of the material.