Coursework 1

This coursework relates to the Hopfield network. In the `auto` folder you will find programmes `seven_segment.jl` and `seven_segment.py`. These contain a function for converting an 11-component vector of ones and -1's into an old-fashioned seven-segment digit[1] and a number: the first seven digits correspond to the seven-segment display and the remaining four code for the number in a sort of binary where the zeros have been replaced with -1. It also contains three patterns: one, three and eight.

The goal of this coursework is to extend one or other of these programmes to include a Hopfield network to store these three patterns using the formula for w_{ij} when $i \neq j$

$$w_{ij} = \frac{1}{N} \sum_i x_i^a x_j^a \tag{1}$$

where a labels patterns and N is the number of patterns. $w_{ii} = 0$.

In the code there are also two test patterns, your programme should update these synchronously until convergence and print out the patterns at each iteration.

This coursework is intended to check you understand Hopfield networks, you are not being asked to do anything over elaborate beyond that.

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Add to the above a function to calculate the energy of a configuration

$$E = -\frac{1}{2} \sum_{ij} x_i w_{ij} x_j \tag{2}$$

and print out the energy of the three learned patterns, of the test patterns and any patterns formed as the patterns are updated.

Submission instructions

Upload your course on safe; if your programme does what it is supposed to do you will get full marks.

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[1]`https://en.wikipedia.org/wiki/Seven-segment_display`

`github.com/conorhoughton/COMS30127`