
BT 6270: Computational Neuroscience

Assignment No: 4

General Instructions

- ✓ The goal of this assignment to understand Hopfield network covered in the class.
 - ✓ This is an individual assignment.
 - ✓ Submission instructions are given at the end of this document
 - ✓ **Submission deadline: 10th November, 2018 (23:59).**
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1. Three figures (mona, ball, cat) are given in .txt format. Each figure is a 90x100 matrix.
 - a. Visualize the images and make sure that the black pixels are represented by -1 and white pixels are represented by +1.
 - b. Develop a code for Hopfield network with $N=9000$ neurons which are fully connected
2. Save the image of ball in the network
 - a. Initialize a zero matrix of the same size as that of the input image and replace a small patch with a portion of the input image as shown in figure 1. Use this (figure 1.B) as the cue for retrieving the image
 - b. Plot the patch which is given as the input trigger
 - c. Plot the Root Mean Squared (RMS) error with time

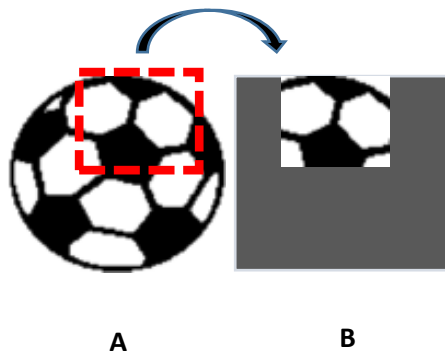


Figure 1

3. Save all three images (mona, ball and cat) in the network
 - a. Give small patches of each image to retrieve the corresponding saved image.
 - b. Plot the RMS error with time and the final retrieved image for all three inputs.
 - c. Make $X\%$ of weights to be zero and repeat questions 3.a and 3.b for $X=25\%$, $X=50\%$ and $X=80\%$
 - i. Plot the RMS error with time for each case
 - ii. Plot the final retrieved image for each case

Useful references and parameters:

Refer the NPTEL notes on computational neuroscience (Chapter 7).

<https://nptel.ac.in/courses/102106023/8>

- Be careful while choosing the value of lambda (λ) and time step (dt)
- Give sufficient number of iterations for retrieval

*Submission Instructions

Enclose in a single zip folder the following:

1. The codes for question 2 and question 3.
 - a. You can code in Matlab or Python
 - b. Include the main file and the functions with necessary comments
2. A detailed report with the all the necessary images

Submit the compressed zip or tar file named as <ROLLNO>_A4.zip to any one of the following address. **Please note do not drop your assignment on to the group.**

bhadra.edu@gmail.com or anila.gundavarapu@gmail.com.