

BT 6270: Computational Neuroscience

Assignment No: 3

General Instructions

- ✓ The goal of this assignment is 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: 9th November, 2021 (23:00).**

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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

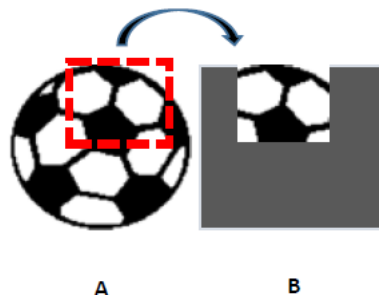


Figure 1

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>

Youtube Playlist for this course video 27

☐ Be careful while choosing the value of lambda (λ) and time step (dt)

☐ Give sufficient number of iterations for retrieval

☐ Note: You may use discrete hopfield network.

***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>_A3.zip by uploading into moodle.