EE 550 - Project 2

Due: November 1, 2024

Binary Hopfield Model

This project requires the implementation of binary Hopfield model.

1) Create 5 sample patterns from letters of A, C, K, T, W and plot the patterns in 10×10 grid by setting light pixels as 1 and dark pixels as -1 on the grid to visualize those letters.

2) Convert each letter to a 100-element vector, i.e., $x_i^s \in \{\pm 1\}$.

3) Implement the Hopfield algorithm to obtain weight matrix that stores 5 sample patterns.

4) Distort the original sample patterns by adding zero-mean ($\mu = 0$) Gaussian noise with three different standard deviations ($\sigma_1 = 0.5, \sigma_2 = 0.8, \sigma_3 = 1.1$) to each pattern. Do not forget to convert noisy image into noisy binary image, i.e.,

$$I_{noisy,binary} = sign(I_{noisy})$$

where $I_{noisy,binary}$ is distorted image whose elements are 1 or -1.

5) Iterate each case until convergence for each pattern and standard deviation. Plot the resulting image after each epoch as shown in Figure 1.

Figure 1: Sample plot

NOTES:

1) Please upload all your files (codes and report) to Moodle with the file convention LAST-NAME_FIRSTNAME_project1.zip.

2) Grading Policy: 25% Report, 75% Code. Code that does not work will be an automatic 50% deduction.

3) Plagiarism will not be tolerated.

4) Late submissions will not be accepted.