

Assignment 4 Problems

Neural Networks : Fall 1400 : Dr. Mozayani
Due Sunday, Azar 28, 1400

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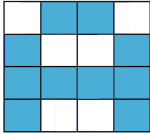
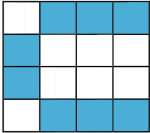
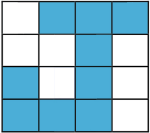
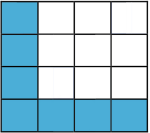
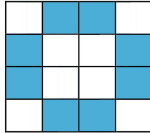
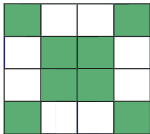
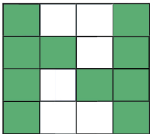
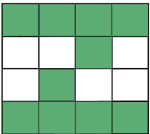
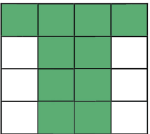
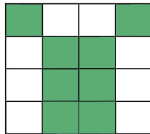
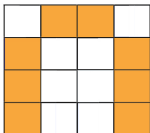
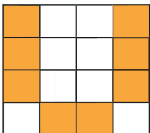
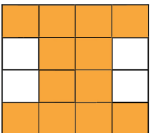
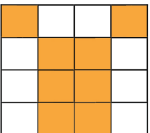
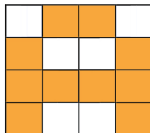
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Problem 1

Assume we have the following patterns that look like English alphabets. We want to train an ART1 model that can discriminate between them. Determine your parameters and then train the model on the training set. Then, introduce the test sample to the network and classify it. Can your model perform well on continuous patterns? Why? (35 pts)

Considerations:

1. Choose your training and test set according to your student id.
2. Train your model with an arbitrary vigilance.
3. Train the model until convergence.
4. You don't have to write code, but you can utilize it for ease of calculations.
5. Don't forget to define the F1 and F2 units of your network.
6. Specify the following items after introducing each pattern:
 - Weights
 - Distances
 - Active prototypes
 - Winner prototype
 - Similarity
 - Classes and their patterns

	Train				Test
Student_id ***** $\star \% 3 = 0$	 A	 C	 J	 L	 O
Student_id ***** $\star \% 3 = 1$	 X	 N	 Z	 T	 Y
Student_id ***** $\star \% 3 = 2$	 n	 U	 I	 Y	 A

Problem 2

Which of the following situations can occur after training an RCE network? explain your yes or no answer in two lines at most. (15 pts)

- a. Having concentric circles of the same class.
- b. Having concentric circles of different classes.
- c. Having tangent circles of the same class.
- d. Having tangent circles of different classes.
- e. Having circles enclosed by another circle.

Problem 3

In this section, you should answer the following questions. (10 pts)

(a)

What is the drawback of the Hopfield network in comparison to the Boltzmann machine? How does Boltzmann overcome this problem?

(b)

Compare Hopfield and BSB model. Explain their applications separately.

Problem 4

In this section, you are going to implement an LVQ1 model from scratch. Please complete the Q4.LVQ1.ipynb notebook provided in your assignment folder. (40 pts)

(a)

First, initialize your prototypes with the **first** two training samples (one prototype for each class). Then train your model with the rest of the training samples (You can see the training samples provided in the notebook. It has 18 samples with 3 features.).

(b)

Then, plot the data in 3D space. Use two different colors for each prototype and another color for the rest of the training samples. You should plot the data twice; before and after training.

(c)

Test your model on the given sample in the notebook.

Considerations:

1. Set $\alpha = 0.03$.
2. Set epochs = 10.

Notes

- Codes should be implemented in .ipynb format (notebooks)
- All Code cells should be executed before turning in the assignment (Make sure your outputs are there before you submit your assignment)
- Please explain the code and the results in the notebook
- We will not answer any further questions as comprehension of the questions is part of your overall score
- Please upload your assignments as a zipped folder with all necessary components. Upload your file in HW4_NN_YourStudentID_YourName.zip format.