Houman Mehrafarin
Sara Rajaee
Iran University of Science and Tech.
www.iust.ac.ir

Assignment 2

Neural Networks : Fall 1399 : Dr. Mozayani
Due Saturday, Azar 22, 1399

Contents

Problem 1

In this problem we will be focusing on Kohonen Networks and Self Organized Maps.

(a)

Explain the Kohonen algorithm step-by-step (No math required).

(b)

Consider the following inputs: $I_1 = [1 \quad -1]^T$, $I_2 = [1 \quad 1]^T$ and $I_3 = [-1 \quad 1]^T$ By using the Kohonen learning algorithm, train the network for a single epoch ($\alpha = 0.5$).
Assume an initial weight matrix as:

$$\begin{bmatrix} \sqrt{2} & 0 \\ 0 & \sqrt{2} \end{bmatrix}$$

(c)

What kind of problems are SOMs well suited for. Give a few examples and explain why.

Problem 2

In this problem, we want to do a binary classification using Redial Basis Function(RBF). Use Gaussian Kernels and classify the following points. Write down EVERY step of training process.
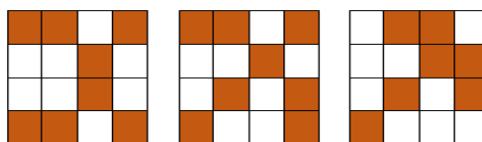
class 1: $[0 \quad 0], [1 \quad 1], [2 \quad 0]$
class 2: $[0 \quad 1], [1 \quad 0], [2 \quad 1]$

Problem 3

In this section, we would like to consider Hopfield network and its training algorithm.
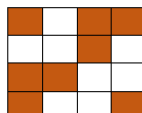
(a)

Train a Hopfield network that can recognize the following patterns.

(b)

What is the network's response to the pattern below. Was it predictable? Explain your answer.

Problem 4

Remember LVQ algorithms? Well in this problem we would like to implement two LVQ algorithms for a binary classification task.

1. LVQ 2.1

2. LVQ 3

The dataset to evaluate your code is attached. Please note that you should split the data into training and validation sets (9.0 ratio). The last column is a label for each point.
Please be advised, any use of python libraries, which have predefined algorithms is strictly prohibited. You should use numpy for your implementation (Tensorflow implementation has bonus score).

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