CS 422: Data Mining

Department of Computer Science
Illinois Institute of Technology
Vijay K. Gurbani, Ph.D.

Fall 2022
Homework 6 (Extra Credit)

<mark>Due date: Tuesday, Nov 08 2022, 11:59:59 PM Chicago Time</mark>

Perceptron

Implement the perceptron algorithm as described in Algorithm 4.3, page 252 of the Tan book and as covered in the lecture. You are provided a perceptron.csv file on which you can test your perceptron.

You are to write a function that can be invoked from the R REPL. The signature of the function is as follows:

perceptron(points, lamda, gamma), where points is a nx4 matrix, lamda is the learning rate, and gamma is the threshold.

The points matrix consists of four columns, the first column is the label (-1 or 1), the second column is the bias, the third and fourth columns are the predictors. (See perceptron.csv.)

The function returns a list containing three elements: the learned weights (as a vector), the number of epochs the training proceeded for (a scalar) and the error (a vector). The error is computed at the end of each epoch.

When the perceptron converges, you should plot the points and the hyperplane separating the points. Furthermore, you should plot the training error versus the epochs as shown in the figure to the right.
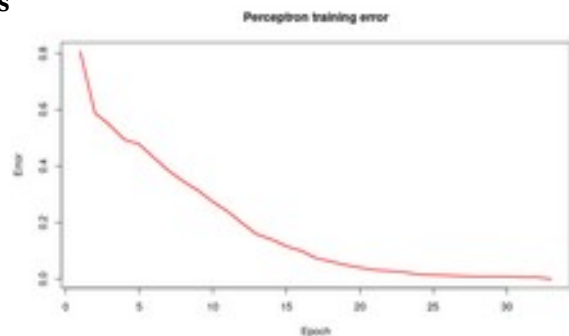
To obtain complete points:

0. Use the Perceptron-Template.Rmd file provided and rename as needed.
1. The code should work; if it does not, then no points will be awarded.
2. You should show the hyperplane as it changes its location after each epoch. If you only display the hyperplane after convergence, a penalty of 1.00 points will be levied.
3. Your perceptron code should faithfully follow the description of Algorithm 4.3 on page 52 of the Tan book. Any other perceptron code will not be accepted, and no points will be awarded.
4. If your solution does not contain any plots, 3.0 points will be deducted.
5. Your perceptron code will be tested on random datasets, so if it only works on the dataset uploaded with this assignment, no points will be awarded.