ECE 449/ECE595 Machine Learning

Project 2: Perceptron

The perceptron is a binary classifier separated by a line or hyperplane $w^T x = 0$

$$h(x) = 1, if \ w^T x > 0$$

$$h(x) = -1, if \ w^T x < 0$$

where $x = (x_0 = 1, x_1, x_2, \dots, x_d), w = (w_0, w_1, w_2, \dots, w_d)$

The history of perceptron can be found on Wikipedia. https://en.wikipedia.org/wiki/Perceptron.
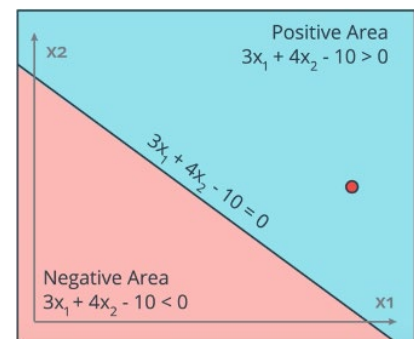
Perceptron Learning Algorithm

Assume data can be binary classified. The perceptron classifier can be implemented in a simple iterative algorithm

Randomly initialize weights w or set all weights to zero
Repeat if misclassification exists{
Randomly select a misclassified sample x_t
Update rule: w := w + y_t*x_t
}

Data (two dimensional data for easy visualization)

Generate 200 samples in the area of $3x_1 + 4x_2 - 10 > 0$ as positive samples. (Label $y = +1$)

Generate 200 samples in the area of $3x_1 + 4x_2 - 10 < 0$ as negative samples. (Label $y = -1$)

Task

1. Implement the perceptron learning algorithm
2. Plot the original data. "+" for positive samples and "o" for negative samples
3. Plot the perceptron line $w^T x = 0$ over the data: the initial perceptron line (solid line in red), two intermediate states (dotted lines. one in yellow and one in green), and the final state (thick solid line in red).
4. Submit your jupyter notebook files or Matlab files to BrightSpace.