

AI/ML - CS 337 Lab - Lab Assignment 2

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Task 1: Boolean functions in Perceptron

If you run the booleanFunc.py we get the required number of boolean functions which can be represented by perceptron for $n = 2$ and $n = 3$

Task 2: Convex Hull

b) Plot showing Convex Hull

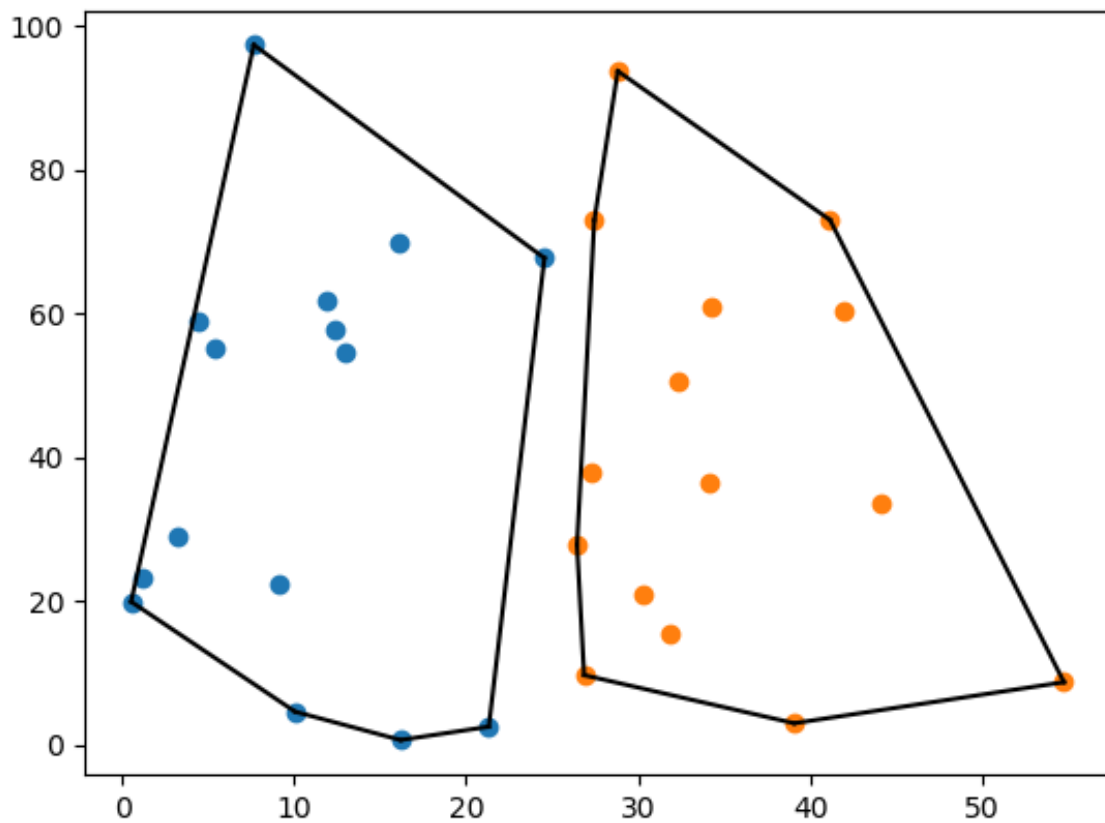


Figure 1: Convex Hull for two given set of points.

c) Separating line between two non-intersecting hulls

Given boundaries, we can divide the points into two classes, points inside first boundary and points inside second boundary. Then we can get the separating line by applying basic two class perceptron.

Two non-Intersecting hulls implies we can get a line separating two hulls. Therefore, non-intersecting hulls are linearly separable.

Task 5: Analysing the 1vr perceptron's performance

a) Variation with number of training data points 'seen'

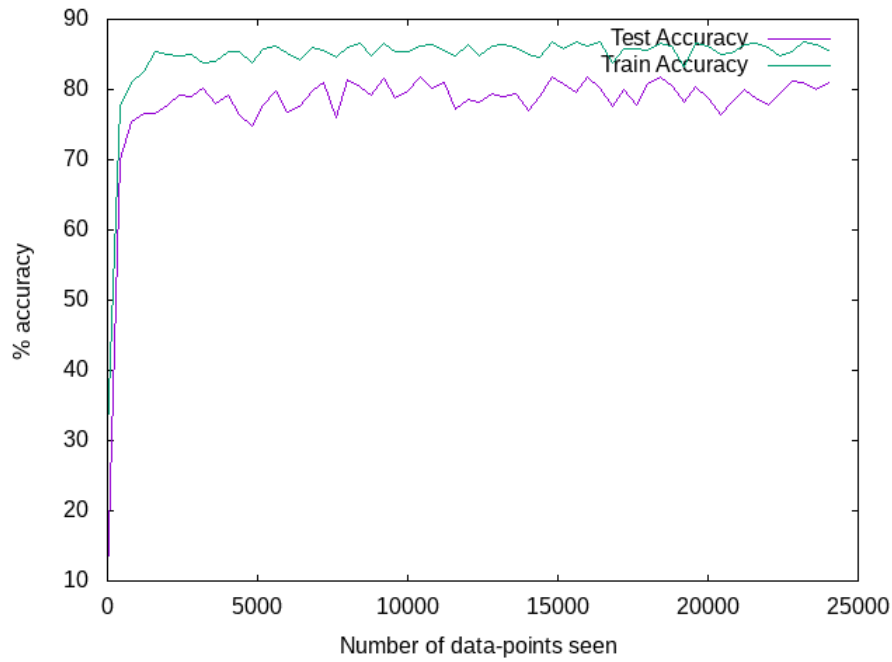


Figure 2: Variation of Accuracy with number of data points processed.

Initially untrained classifier performs very badly as it classifies points based on the initial weights vector. But as the number of data-points processed increases the weights vector is updated to classify points to high accuracy. Eventually the accuracy saturates for both test and train data sets.

b) Variation with training set size in each iteration

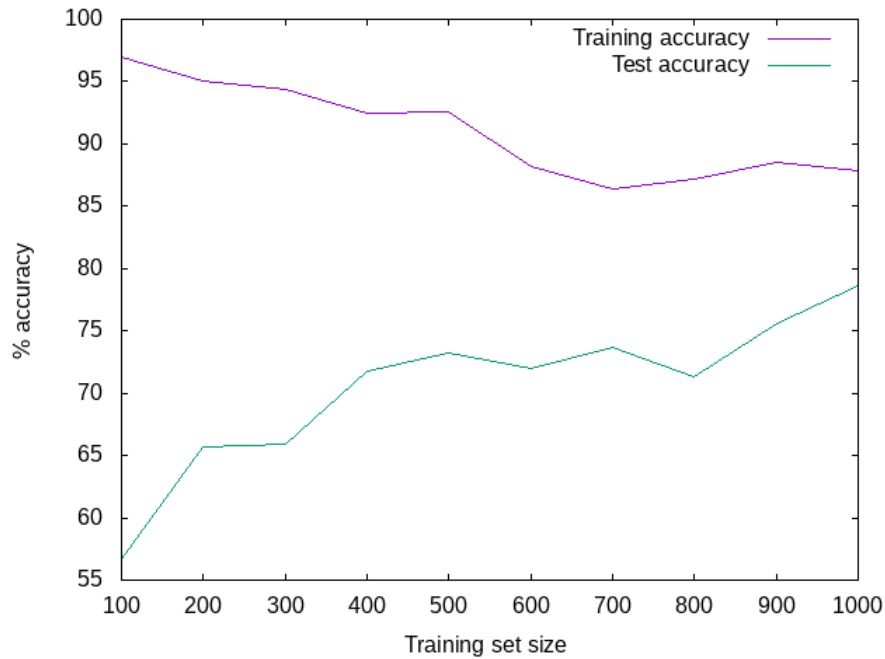


Figure 3: Variation of Accuracy with increase in Training set size per Iteration.

As the Training set size increases, Test accuracy increases because we are updating weights vector many times whereas in case of Training accuracy, increasing Training size might make data not linearly separable and many points are mismatched leading to decrease in accuracy.

Task 6: Feature Design

a) Number of Black pixels

Counting number of black pixels will give area of the shape. So, the first basic feature is to classify image by counting number of black pixels.

b) Perimeter of given shape

Counting number of white pixels which are immediate neighbours of black pixels gives perimeter of the given shape. Using the above two features a) and b) accuracy comes to be around 80.

Task 8: Comparison between performance of 1vr perceptron and MIRA Classifier

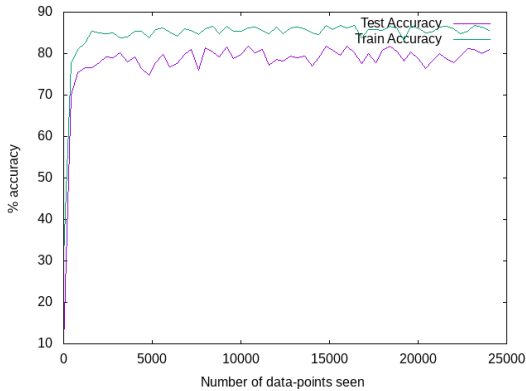


Figure 4: Variation of Accuracy with number of data points processed for 1vr perceptron.

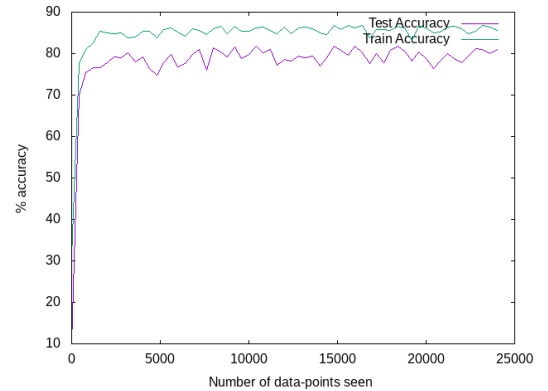


Figure 5: Variation of Accuracy with number of data points processed for mira perceptron.

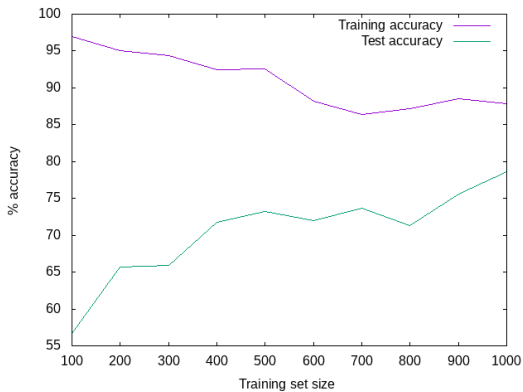


Figure 6: Variation of Accuracy with increase in Training set size per Iteration for 1vr perceptron.

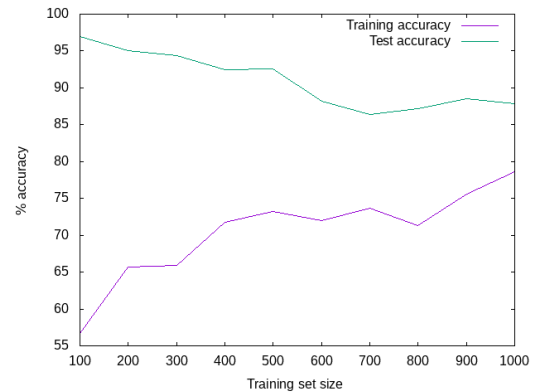


Figure 7: Variation of Accuracy with increase in Training set size per Iteration for 1vr perceptron.

There is a slight increase in accuracy for mira perceptron classifier. Mira performs better than 1vr perceptron.