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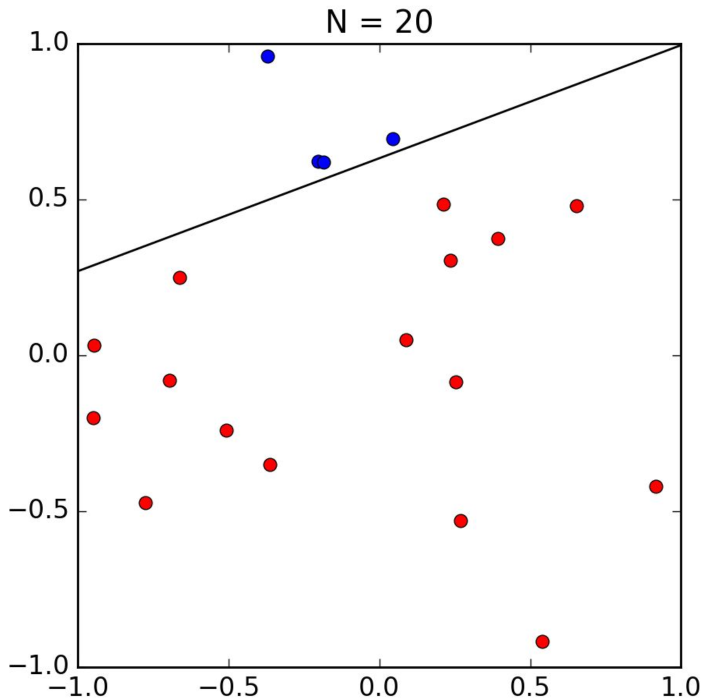
CMPT404-Homework 1
2016-09-20

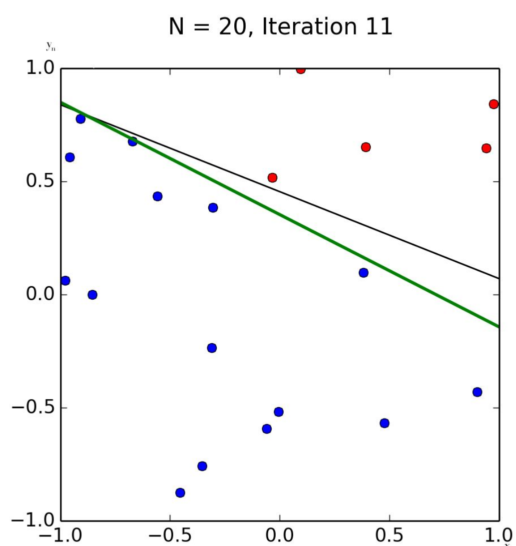
1.4

a. *Generate a linearly separable data set of size 20 as indicated in Exercise 1.4. Plot the examples $\{(x_n, y_n)\}$ as well as the target function f on a plane. Be sure to mark the examples from different classes differently and labels to the aces of the plot.*

   i. 

b. *Run the perceptron learning algorithm on the data set above. Report the number of updates that the algorithm takes before converging. Plot the examples $\{(x_n, y_n)\}$, the target function f, and the final hypothesis g in the same figure. Comment on whether f is close to g*

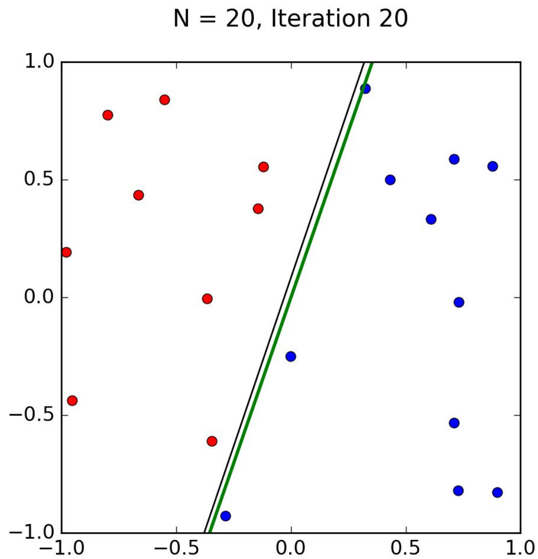
   i. Number of Iterations: 11

   ii. 

iii. Relatively close however still not exactly converging.

c. Repeat everything in (b) with another randomly generated data set of size 20. Compare your results with (b)

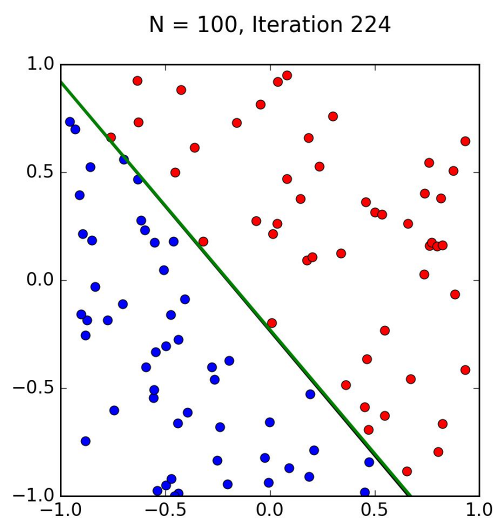
i. Number of Iterations: 20

ii. 

iii. f is relatively close to g with a similar number of points. However seems to be converging better.

d. *Repeat everything in (b) with another randomly generated data set of size 100. Compare your results with (b)*

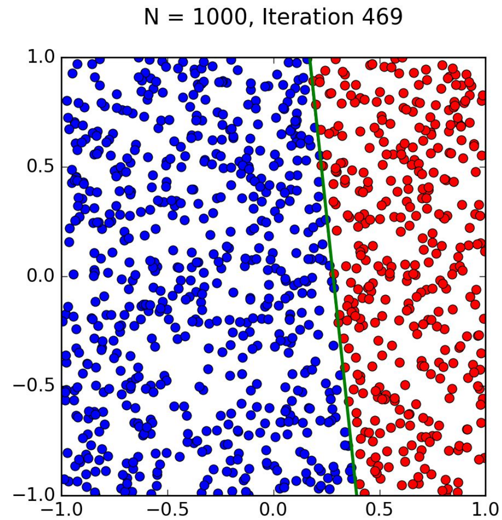
i. Number of Iterations: 224

ii. 

iii. The line converges almost exactly with 100. Compare to (b) this seems to be much more accurate. This could mean the the results from (b) are inaccurate somehow.

e. Repeat everything in (b) with another randomly generated data set of size 1000. Compare your results with (b)

i. Number of Iterations: 469

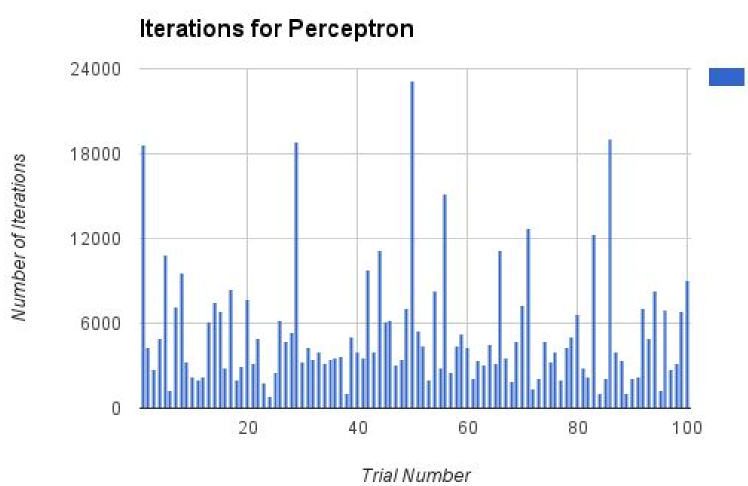


ii.

iii. Again the lines converge much better than the lines did in (b) This would supplement the assertion that the data set and/or results in b are slightly more inaccurate the others performed afterwards.

f. *Modify the algorithm such that i takes $x_n \varepsilon \mathbb{R}^{10}$ instead of $\mathbb{R}^{2}$. Randomly generate a linearly separable data set of size 1000 with $x_n \varepsilon \mathbb{R}^{10}$ and feed the date set to the algorithm. How many updates does the algorithm take to converge?*
   i. Number of Iterations: 18584

g. *Repeat the algorithm on the same data set as (f) for 100 experiments. In the interactions of each experiment, pick x(t) randomly instead of deterministically. Plot a histogram for the number of updates that the algorithm takes to converge.*



   i.

h. Summarize your conclusions with respect to accuracy and running time as a function of N and d

i. Accuracy seems to be generally on the higher level with iterations of problem after (b). In all the data sets (b) seems to be the outlier. As you can see from the figures it seems that the running time of of the function seems dependent of conditions directed by the number of data points generated for each test case. $O(n)$