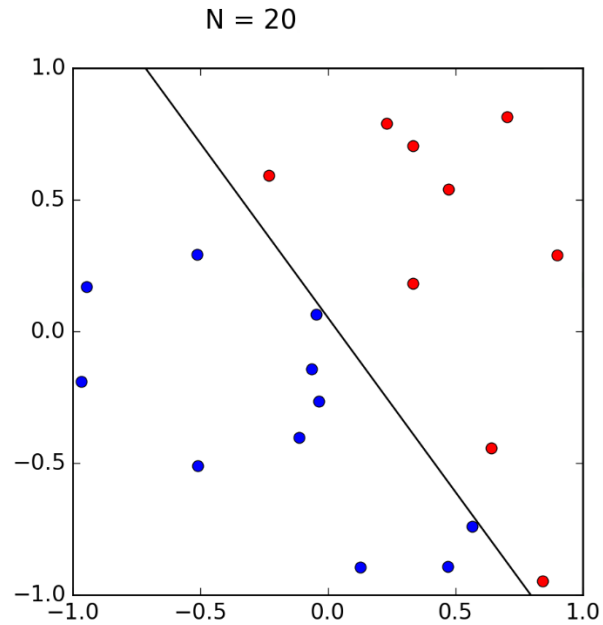


# Homework 1

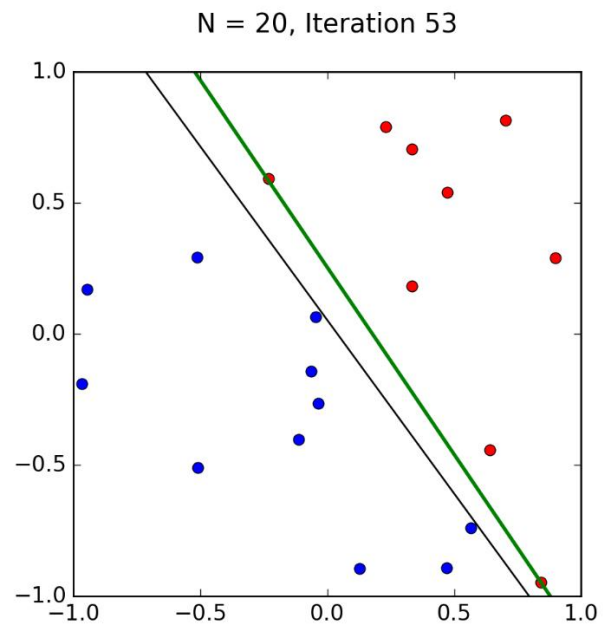
John Randis

9/20/2016

a)

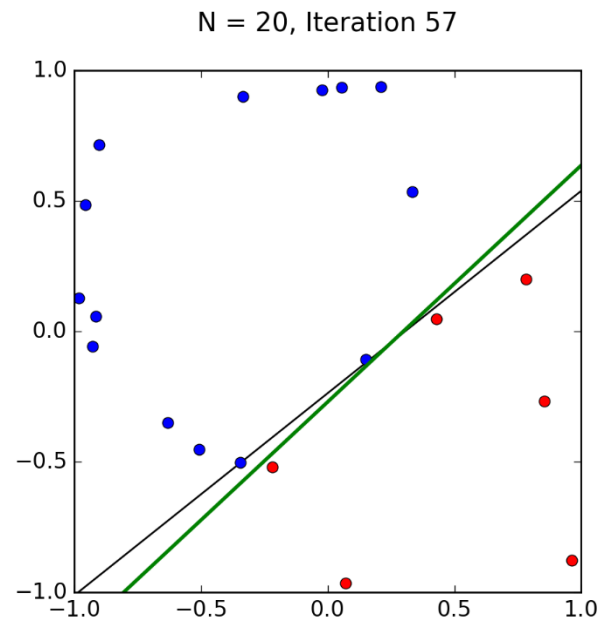


b)



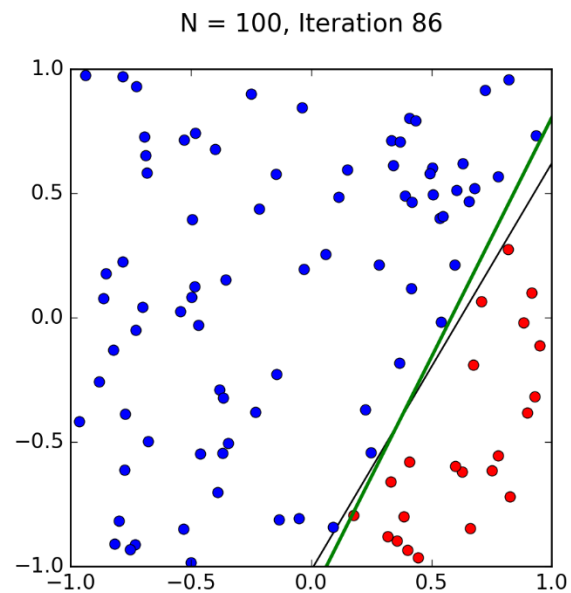
The perceptron learning algorithm took 53 Iterations to find a line that fits.  $f$  is somewhat close to  $g$ , but it is still not the best fit line.

c)



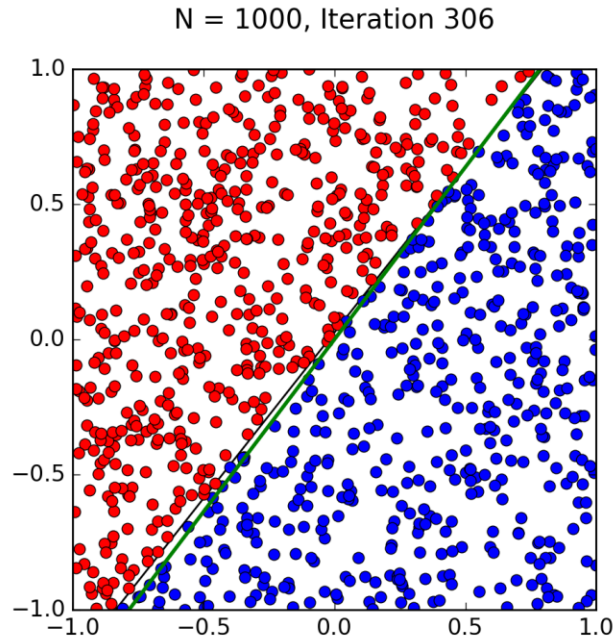
The perceptron learning algorithm took 57 iterations to find a line that fits in another randomly generated data set of 20. This one took about the same amount of iterations as of that in step b, only 4 more.

d)



With a randomly generated data set of 100 points, the perceptron learning algorithm took 86 iterations to find a line that fits  $f$ . This is drastically increased from step b with only 20 data points. The iterations have almost doubled.

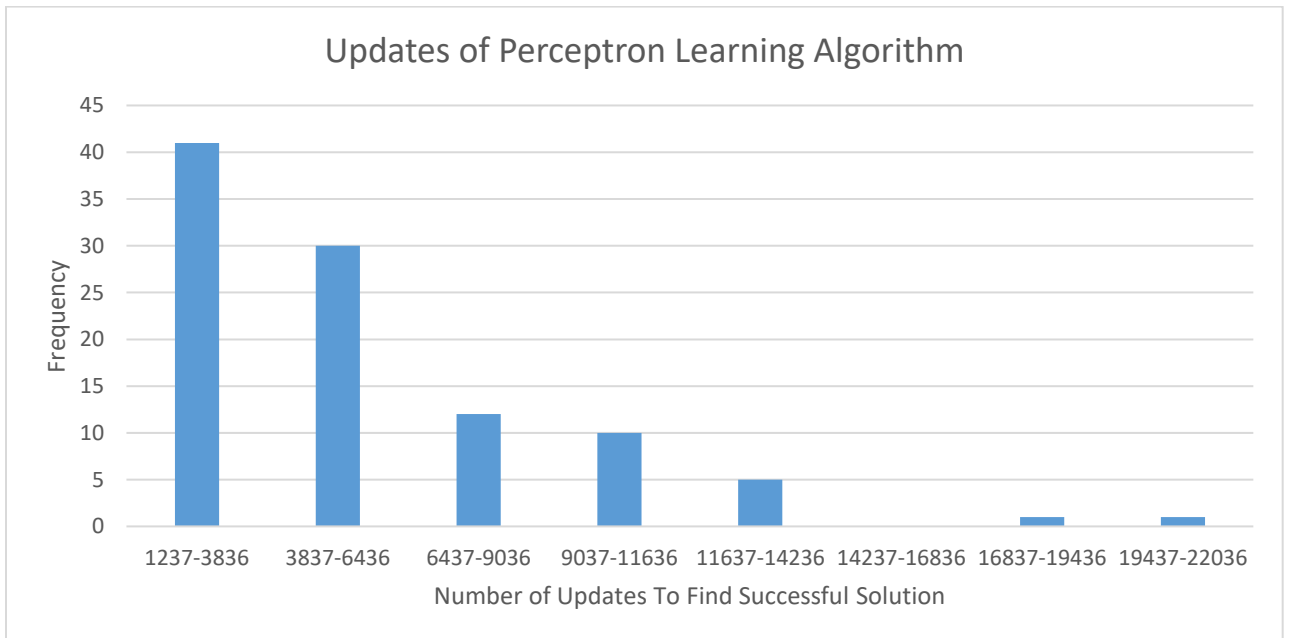
e)



With a randomly generated data set of 1000 points, the perceptron learning algorithm took significantly longer than it would have with only 20, and still significantly more iterations than it did with 100. With 306 iterations, the usefulness of the algorithm definitely drops off once too many data points are introduced.

f) In the 10<sup>th</sup> dimension, the algorithm takes 1547 iterations to converge.

g)



f) Conclusions that can be drawn from the data are that the perceptron learning algorithm is most effective when the sample data is rather small. As we can tell from the histogram, most of the run-throughs in the 10<sup>th</sup> dimension took thousands of iterations, with the longest taking over 22,000 updates. The perceptron has very good accuracy on linearly separable data, but slows down significantly with many data points introduced.