Yitao Yu
yyu56
CSC 246 Machine Learning

Assignment2 write-up

I ran my perceptron algorithm on all five challenges, LinearSmoke and XorSmoke. For the challenges, my algorithm manage to converge in challenge 1 and 4.

Part 1: Linearly Separable DataSets

The following R value is the maximum volume of a vector in train_xs, which has the bias constant 1 appended for training. I think it's the only way that make sense to get the R value since those are the vectors we actually train on.

Challenge1:
R = 4.14
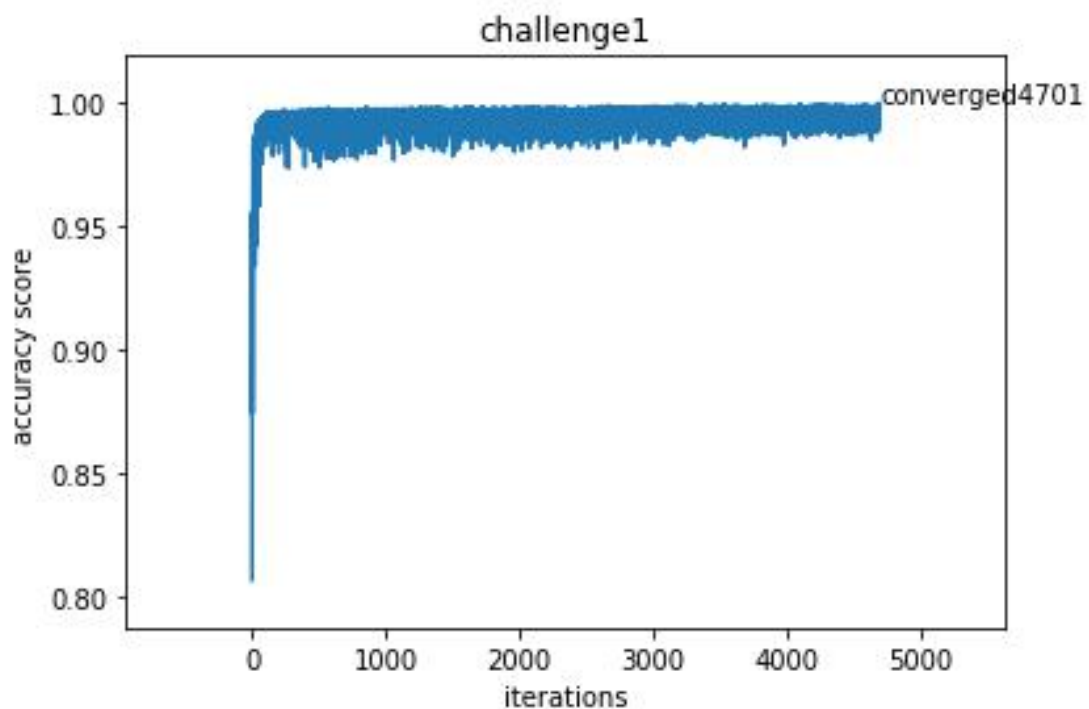
The accuracy score reached 1 after the 4701th iteration.
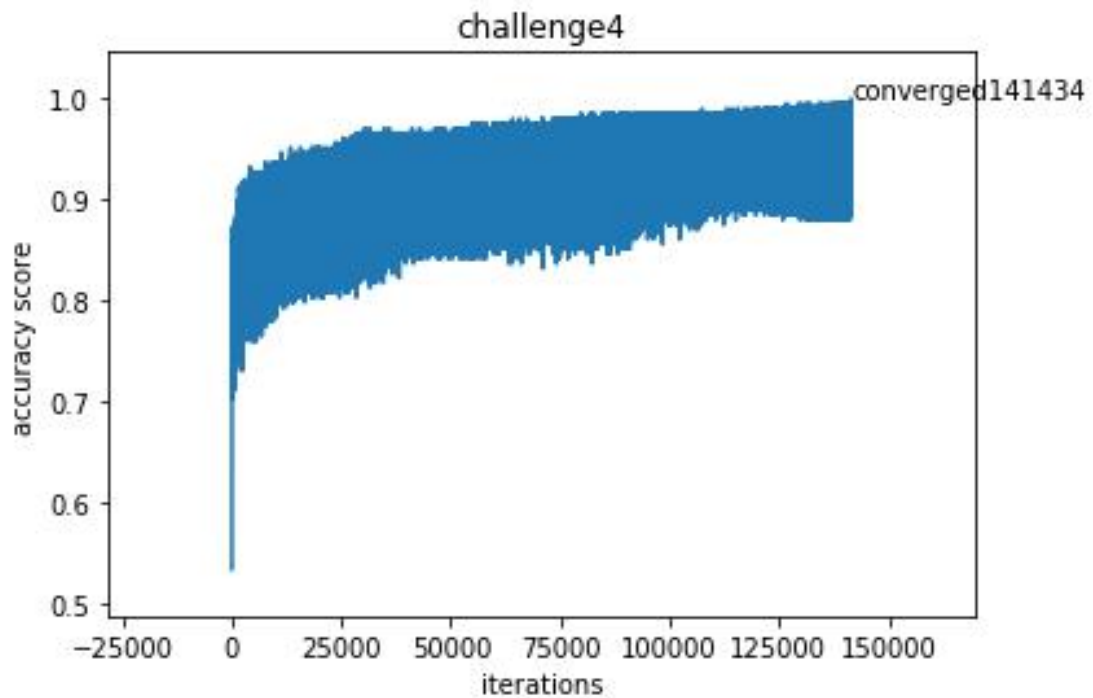Using formula $k <= R^2/sigma^2$
The upper bound for sigma is $sqrt((4.14)^2/4701) = 0.06038$

Challenge4:

R = 4.05
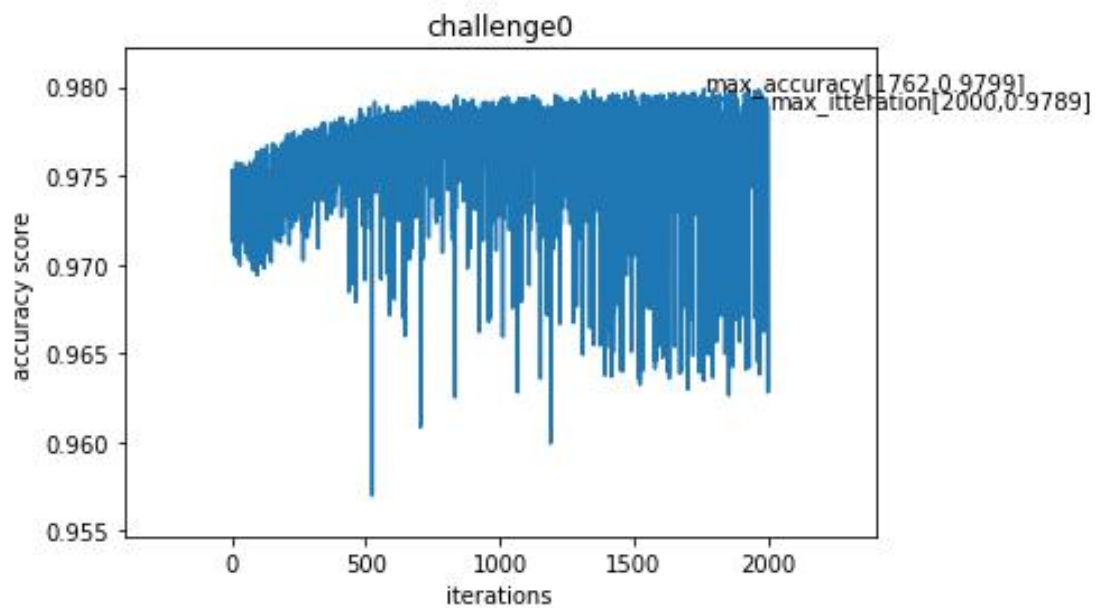The score reached 1 after the 141434th iteration.
Using formula, the upper bound is $sqrt((4.05)^2/141434) = 0.010769$

challenge4

Part2: non-LS DataSets

Challenge0:

challenge0

I decided not to train it after 2000 iterations because it seems that the accuracy score is not converging. The graphs looks unpromising since the accuracy value is just bouncing between some interval randomly. The asymptote seems to be 0.98 after 1000 iteration. The peak value is at the 1762th iteration, reaching 0.9799.

Challenge2:

challenge2

max_accuracy[935,0.9942]

max_itteration[100000,0.9818]
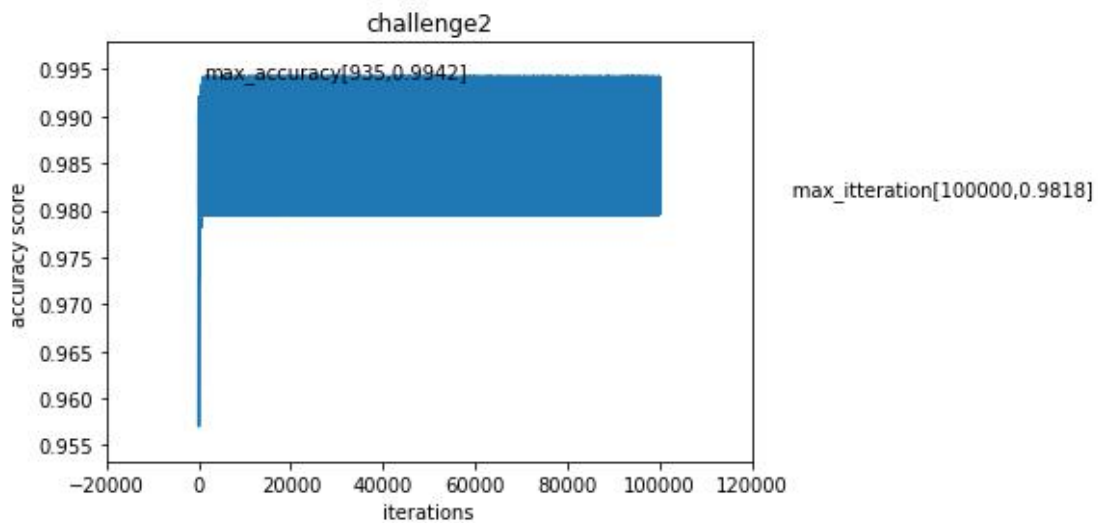
The first few thousands of iteration seems very promising but when I train it to 100,000 iterations, it's very clear that after one thousand of iteration, it's just bouncing between 0.98 to 0.995. The peak is at the 935th iteration and the algorithm never manage to go beyond that later. The asymptote will be somewhere above 0.9942.

challenge3

max_accuracy[1921,0.9945]

max_itteration[100000,0.9912]
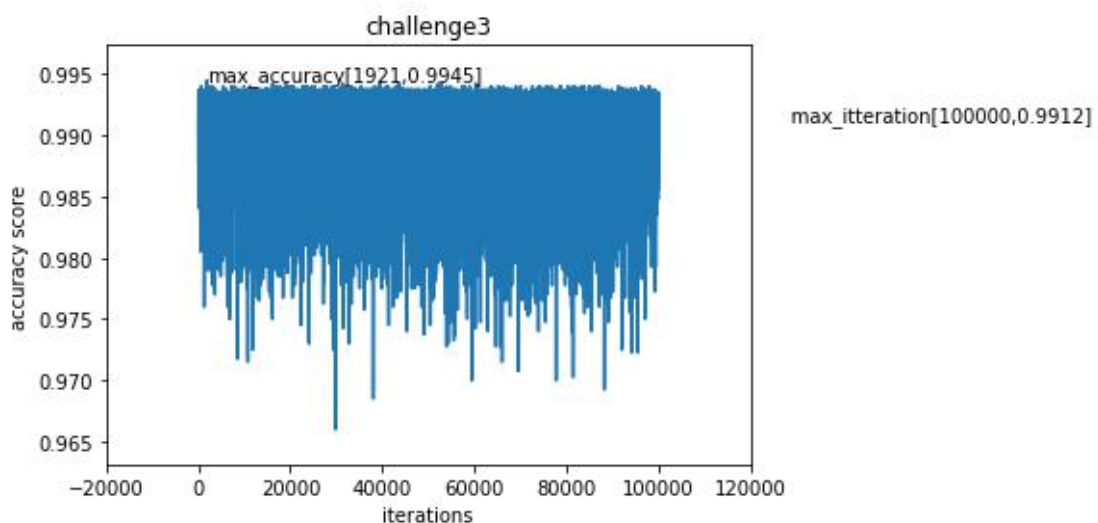
Challenge 3 starts at a very high accuracy(the accuracy reached 0.99 at the third iteration with an initial weight 1 and when I initialize weight at -1, it also reach 0.99 fairly quickly from a roughly 0.5 accuracy after the first iteration). That's why I thought it might be promising. The peak accuracy was reached at the 1921th iteration and the maximum iteration I used was 100,000. The accuracy seems to be bouncing between 0.97 to 0.995. I would say that the asymptote would be 0.995.