Binary Classification through AdaBoost

Author: Rodriguez Noh Santiago Miguel
Professor: Ph.D. Anabel Martin Gonzalez
Link to code: https://github.com/Santiagomrn/AdaBoost.git

I. Introduction

Implement in your favorite programming language the AdaBoost algorithm using as weak classifiers lines parallel to the x and y axis, so that you classify correctly both types of data.

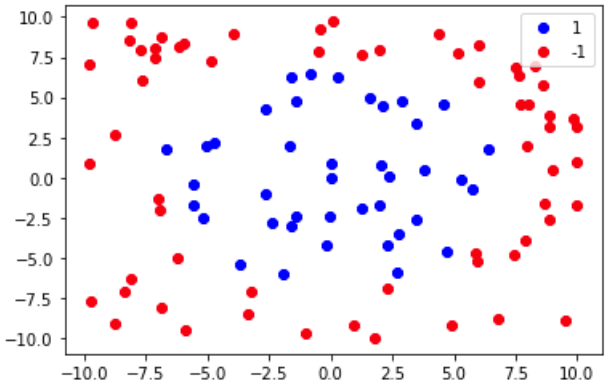

Fig. 1. Data set.

II. AdaBoost

A. *weak calssifier*

Let's first look at the performance of a simple weak classifier with the data set.

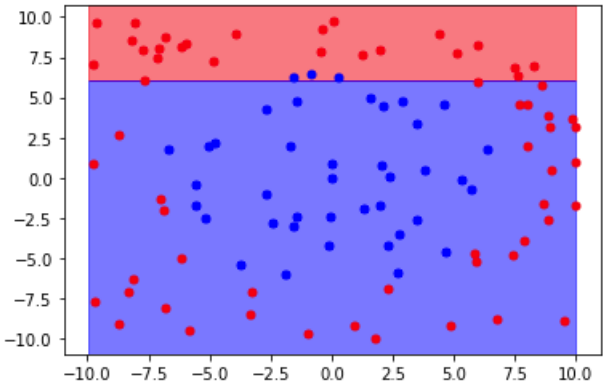

Fig. 2. Prediction zones whit the data set .

We can see that it is really bad.

B. *Training process*

Since adaboost manipulates the data set we can observe how these are affected in the training process. The following figure shows the data points with a variable size, the larger the point, the more weight it has.

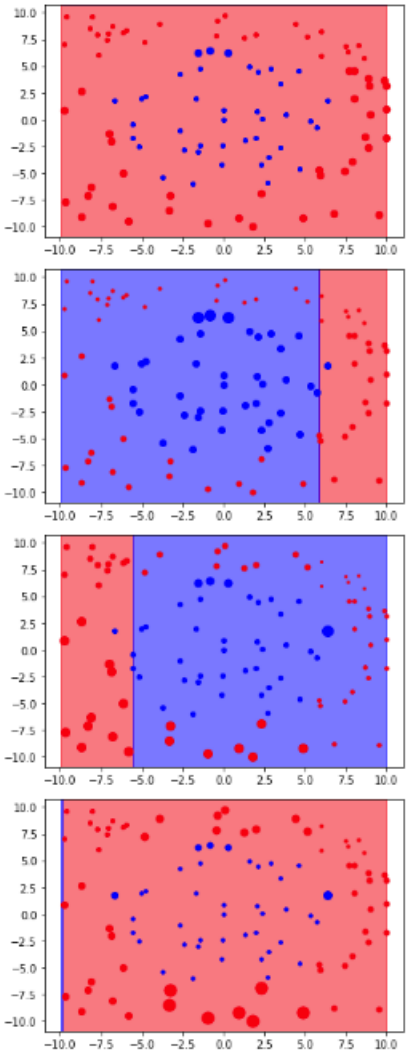

Fig. 3. Data points using one color for each class of data and the prediction zone.

C. AdaBoost models

A weak classifier alone is not capable of performing well but many of them are.

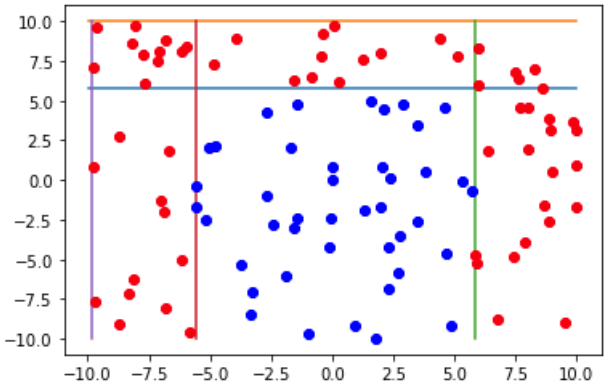

Fig. 4. Data points using one color for each class of data and the weak classifier lines for five classifiers.

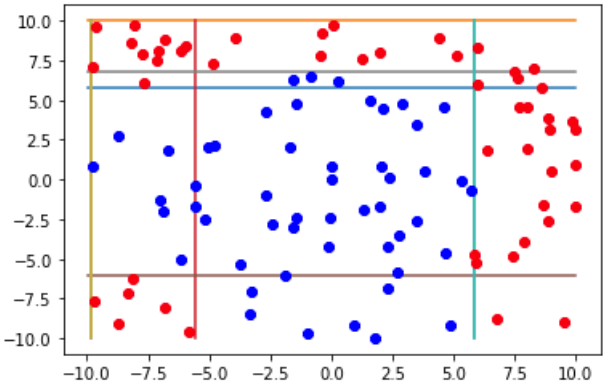

Fig. 5. Data points using one color for each class of data and the weak classifier lines for ten classifiers.

III. FINAL MODEL

The best model for this data set is obtained with 41 weak classifiers

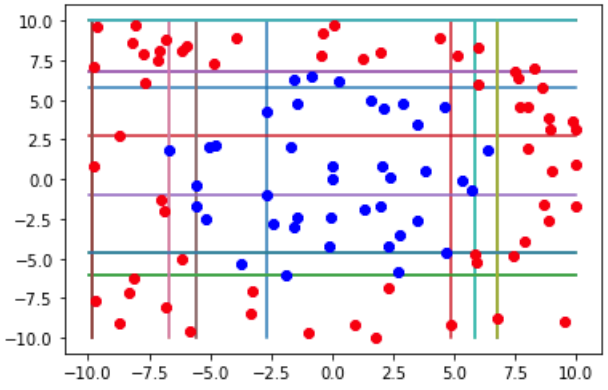

Fig. 6. Final model

```
alpha:  0.480  threshold y:  5.736
alpha:  0.699  threshold y:  9.992
alpha:  0.831  threshold x:  5.835
alpha:  0.589  threshold x:  -5.595
alpha:  0.880  threshold x:  -9.812
alpha:  0.733  threshold y:  -5.995
alpha:  0.532  threshold x:  -9.812
alpha:  0.791  threshold y:  6.815
alpha:  0.561  threshold x:  -9.812
alpha:  0.756  threshold x:  5.835
alpha:  0.482  threshold x:  -2.678
alpha:  0.631  threshold y:  9.992
alpha:  0.660  threshold y:  -4.636
alpha:  0.525  threshold y:  2.698
alpha:  0.534  threshold x:  -9.812
alpha:  0.633  threshold x:  6.755
alpha:  0.478  threshold y:  9.992
alpha:  0.654  threshold x:  -5.595
alpha:  0.421  threshold x:  -9.812
alpha:  0.648  threshold y:  -5.995
alpha:  0.486  threshold x:  -9.812
alpha:  0.711  threshold y:  6.815
alpha:  0.520  threshold y:  9.992
alpha:  0.695  threshold x:  4.876
alpha:  0.392  threshold y:  -0.999
alpha:  0.423  threshold y:  9.992
alpha:  0.600  threshold y:  6.815
alpha:  0.459  threshold x:  -9.812
alpha:  0.641  threshold x:  -6.694
alpha:  0.482  threshold y:  9.992
alpha:  0.586  threshold x:  6.755
alpha:  0.451  threshold y:  9.992
alpha:  0.665  threshold y:  -5.995
alpha:  0.496  threshold x:  -9.812
alpha:  0.556  threshold y:  6.815
alpha:  0.433  threshold x:  -9.812
alpha:  0.548  threshold x:  -6.694
alpha:  0.428  threshold y:  9.992
alpha:  0.555  threshold x:  6.755
alpha:  0.433  threshold y:  9.992
alpha:  0.579  threshold y:  -4.636
```

Fig. 7. Final parameters