AdaBoost for Face Detection

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AdaBoost stands for **Ada**ptive **Boosting**, which builds a strong classifier from many individually weak learners.

AdaBoost

AdaBoost is a method for face detection which uses many simple classifiers. The weak learner makes a simple binary decision for a single feature

$$h_1(x) \in \{-1, 1\} \ ... \ h_T(x) \in \{-1, 1\}$$

For all the T features, we have a simple classifier which makes a decision that's better than a random decision. Then, if we take a weighted sum of the simple classifiers, we can get a strong classifier. [1]

[1] In this formula, the α value is the weight of the classifier.

$$H_T(x) = \text{sign}(\sum_{t=1}^{T} \alpha_t h_t(x))$$

AdaBoost Process

We first assume a uniform distribution and choose a classifier with a minimal weighted error. Then we increase the weight of the misclassified elements and thus make our decision for the next round.

Then we repeat the step, and choose the classifier with the minimal weighted error. Since in the previous step we increased the weights of the misclassified points, this will "pull" the classifier line towards those elements. After the second iteration we again increase the weights of the misclassified elements.

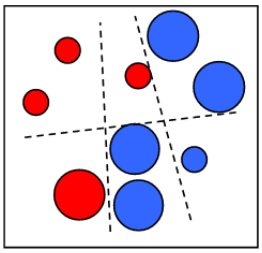

Figure 1: The three dashed lines are individually weak classifiers, since they all mislabel a couple of data points. However, if our model $H(x)$ uses all three classifers, the combined results will be quite strong.