


ADA Boost:

$$1. \epsilon_1 = \frac{\text{Missclassification}}{\text{Whole Data Set}} = \frac{1}{6}$$

$$\alpha_1 = \frac{1}{2} \log \left(\left(1 - \frac{1}{6}\right) / \frac{1}{6} \right) = \frac{1}{2} \log(5)$$

$$2. \text{ for each } x_i. \boxed{d_{t+1}(x_i) = d_t(x_i) \cdot \exp(-\alpha_1 y_i f_t(x_i))}$$

for true classified Points: $y_i f_t(x_i) = 1$

and for missclassified Points: $y_i f_t(x_i) = -1$

so we get:

correctly classified:

$$d_{t+1}(x_i) = \frac{1}{6} \exp\left(-\frac{1}{2} \log(5)\right) = 0.074$$

Misclassified:

$$d_{t+1}(x_i) = \frac{1}{6} \exp\left(\frac{1}{2} \log(5)\right) = 0.372$$

Normalize the points so $\sum_{i=1}^6 d_{t+1}(x_i) = 1$:

Correctly classified:

$$d_{t+1}(x_i) = \frac{d_{t+1}(x_i)}{\sum_{j=1}^6 d_{t+1}(x_j)} = 0.09973\dots$$

Missclassified:

$$d_{t+1}(x_i) = \frac{d_{t+1}(x_i)}{\sum_{j=1}^6 d_{t+1}(x_j)} = 0.50134\dots$$

$$\sum_{i=1}^6 5 * \frac{1}{10} + 1 * \frac{1}{2} = 1$$

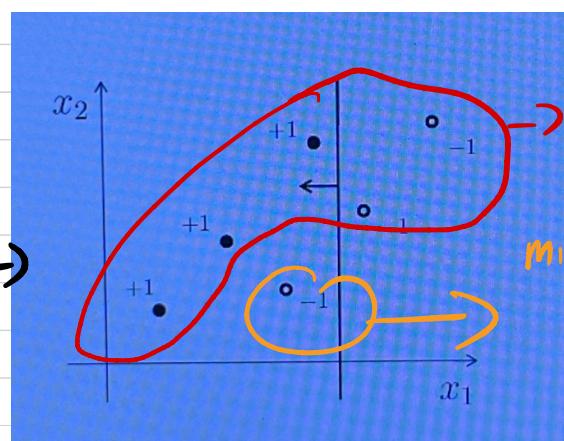
: "pun p/c!"

\downarrow \downarrow

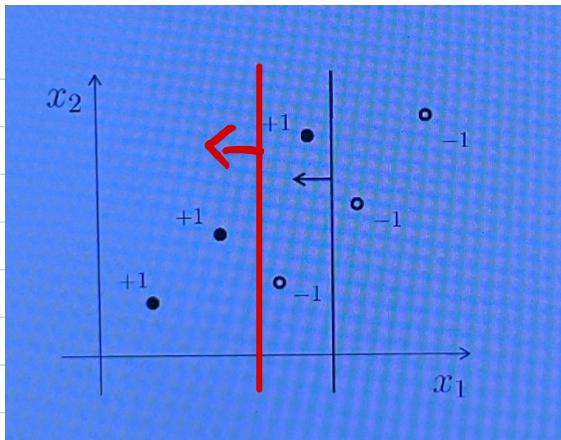
collect missclassified

Note: $d_{t+1}(x_i)$

data points according →



3.



The red line here is the second decision stump

4. in ADA boost the weight of the classifier is determined by the error rate ϵ

$$\alpha = \frac{1}{2} \log \left(\frac{1-\epsilon}{\epsilon} \right)$$

where The classifier weight α increase as the error rate ϵ decrease .

• The first classifier is trained on the original dataset and therefore the whole weights for samples are equal.

The error rate ϵ_1 is for a misclassified sample

for the initial weight.

The second classifier is trained on new weights where misclassified examples have more weights and the ones where correct got less weights, and the second classifier emphasizes on misclassified samples, and since the correct classified samples got less weights the error rate is less so

$$\epsilon_1 > \epsilon_2$$

and according to the formula we get

$$\alpha_2 > \alpha_1$$

1

5. the right Third decision stump
is green and That's due according
to The Second stump

the point 3 (in picture) \rightarrow

is The only one misclassified

so it gets more weight

and $(1,2,4,5,6)$ get less weight in stump 3

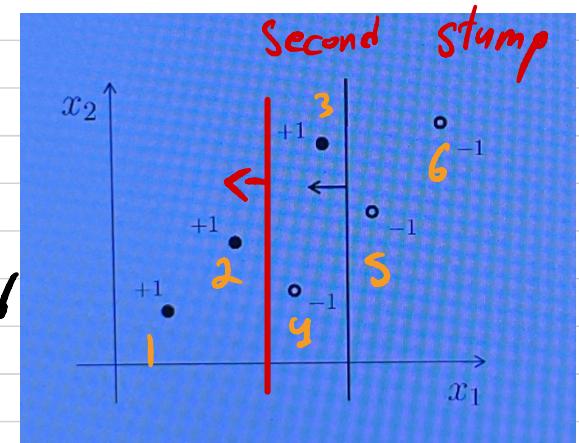
but also point 4 weight is more than

points $(1,2,5,6)$ because it was misclassified

in stump 1, and therefore The Third
stump should pay more attention to points

$(3,4)$ since Their weights are higher than The rest

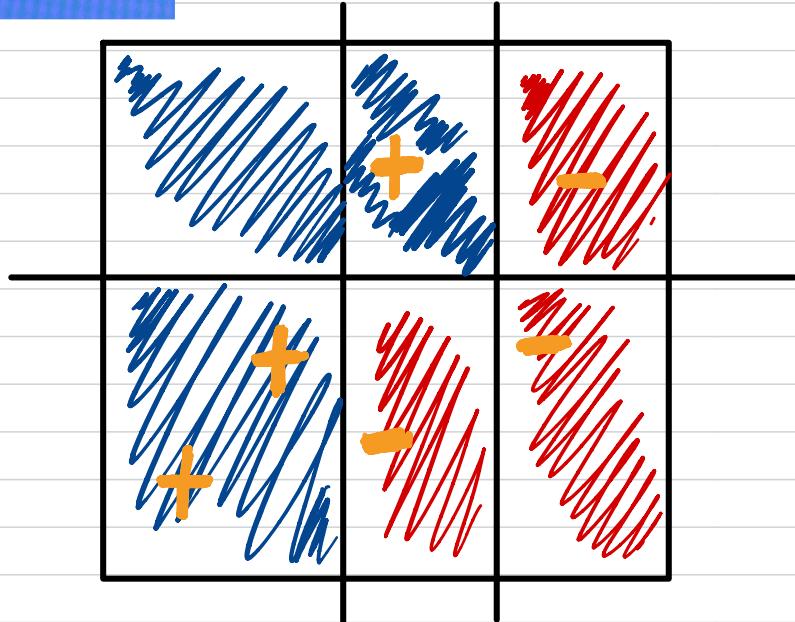
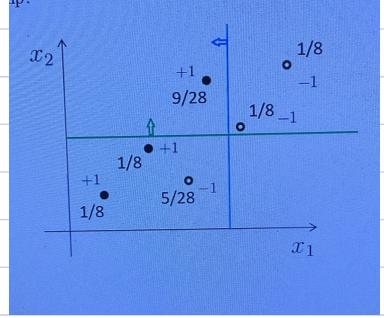
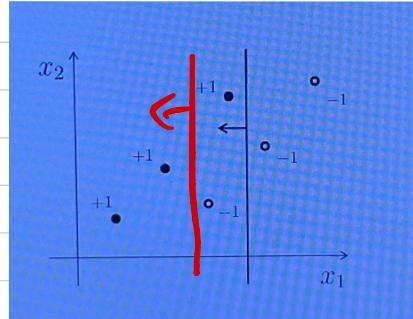
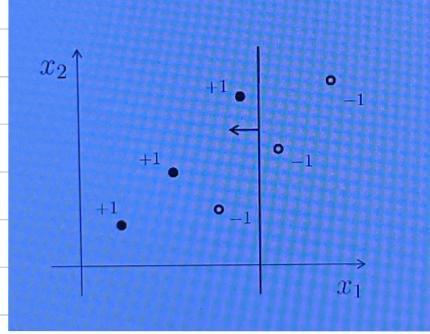
and The green decision line is The right one.



(Blue don't classify point 4 right)

6.

$$\text{Sign} \left(0.5 \log(5) \text{ Stump 1} + 1.1 \text{ Stump 2} + 0.62 \text{ Stump 3} \right)$$



The accuracy is 1.0.