Exercise 1: AdaBoost - Updates

Suppose you apply AdaBoost on a data set \mathcal{D} consisting of 19 instances $(\mathbf{x}^{(1)}, y^{(1)}), \dots, (\mathbf{x}^{(19)}, y^{(19)})$. AdaBoost just completed the (m-1)-th iteration and the weights for the next iteration are

$$w^{[m](i)} = 0.01$$
 for $i = 1, ..., 10$, and $w^{[m](i)} = 0.1$ for $i = 11, ..., 19$.

For the beginning of the m-th iteration consider three cases:

- (a) $\hat{b}^{[m]}$ is only wrong for i = 5 and the rest is correct.
- (b) $\hat{b}^{[m]}$ is correct for i = 11, 12, 13, 14, 19 and the rest is wrong.
- (c) $\hat{b}^{[m]}$ is only correct for i = 10 and the rest is wrong.

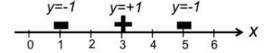
Compute $\operatorname{err}^{[m]}$, $\hat{\beta}^{[m]}$ and the new weights $w^{[m]}$ before the normalizing step for each case. Use the following table:

Case	$err^{[m]}$	$\hat{eta}^{[m]}$	$w^{[m+1](i)}$
(a)			
(b)			
(c)			

Hint: You can use that $\sqrt{99} \approx 9.95$ and $99^{-1/2} \approx 0.1$.

Exercise 2: AdaBoost - Decision Stump

Suppose you apply AdaBoost with a decision stump on the data set as in the following figure:



- (a) What would be a decision boundary for the first decision stump?
- (b) How do the weights of the points change after the first iteration?
- (c) How many iterations are at least needed such that AdaBoost's training error is zero?

Exercise 3: Quiztime

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