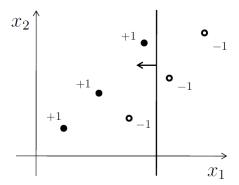
## Question 2 - AdaBoost

AdaBoost (Adaptive Boosting) is another approach to the ensemble method field.

It always uses the entire data and features (unlike before) and aims to create T weighted classifiers (unlike before, where each classifier had same influence). The new classification will be decided by linear combination of all the classifiers, by:

$$g(x) = \operatorname{sign}\left(\sum_{t=1}^{T} \alpha_t f_t(x)\right), \alpha_t \ge 0$$

Consider the following dataset in  $\mathbb{R}^2$ :



- 1) The first decision stump is already drawn, the arrow points in the positive direction. Calculate the classifier error  $(\varepsilon_1)$  and weight  $(\alpha_1)$ .
- 2) Calculate the new weights of the samples (and normalize them to get valid distribution).
- 3) Draw the second decision stump. Reminder: the decision stump (our classifiers) are parallel to x/y axis.
- 4) Without calculations, which classifier's weight is larger,  $\alpha_1$  or  $\alpha_2$ ? Explain why.
- 5) In the right image, there is the dataset and the weights for each point, after finding the <u>third</u> decision stump and calculating the new weights. Which of the following (green or blue) is the correct third decision stump?
- 6) Given  $\alpha_2 = 1.1$ ,  $\alpha_3 = 0.62$ , draw the full classifier, like in slide 13.

What is the train accuracy?

