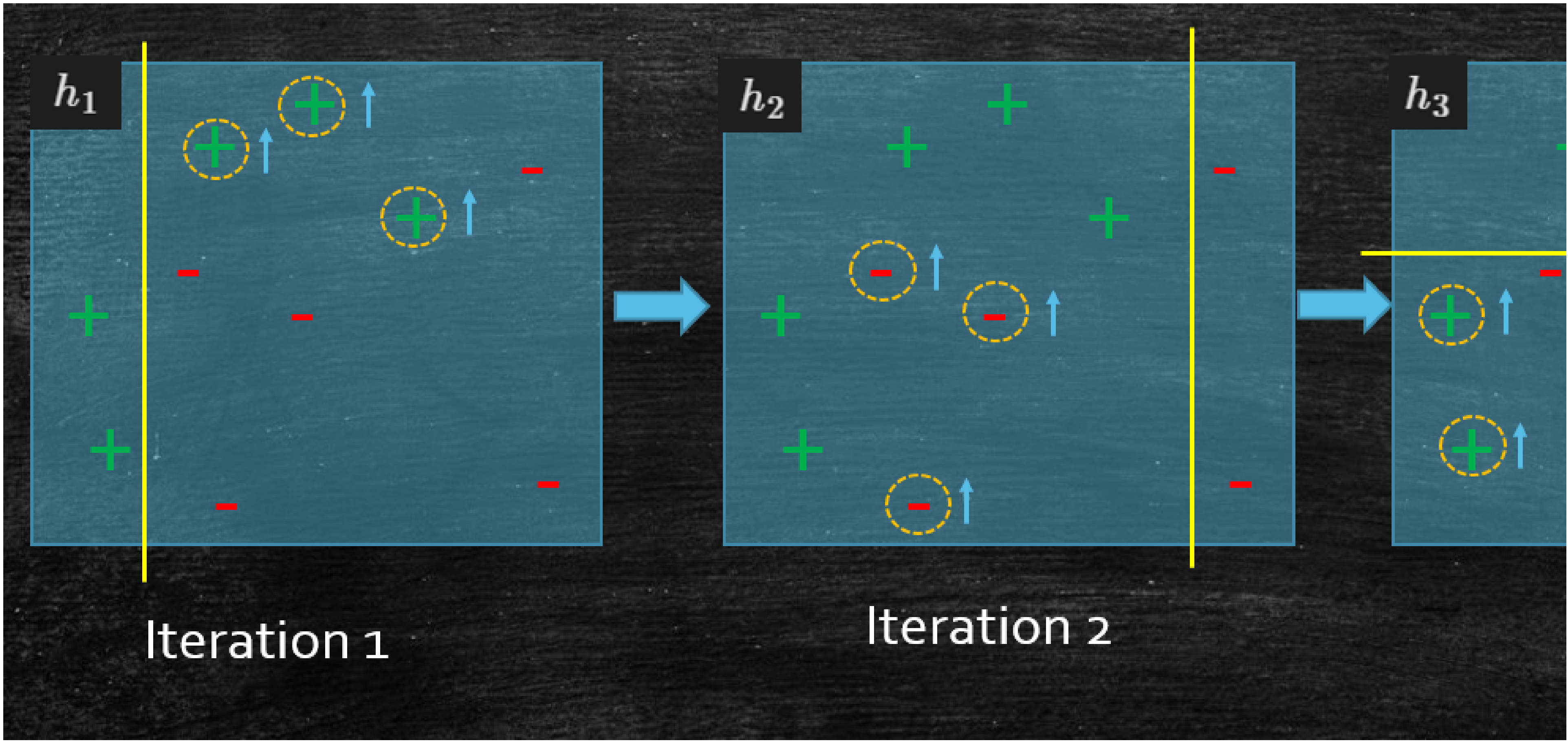


lets say our training samples are $(x_1, y_1), (x_2, y_2), \ldots (x_m, y_m)$ *where* $x_i \in X$ *and* $y_i \in$

$So\ total\ "m"\ samples.$

$we\ will\ have\ T\ iterations,$
$t\ =\ 1,...,T$

$waits\ will\ always\ follow\ a\ distribution,\ that\ means \sum D_t(i) = 1\ ,\ where\ i\ =\ i^{th}\ sa$

$$for\ 1^{st}\ iteration\ D_1(i) = \frac{1}{m} = \frac{1}{10}$$

1) $Train\ the\ weak\ learner\ using\ weights\ D_1(i)$
2) $Get\ the\ weak\ hypothesis\ h_t\ :\ X\ \rightarrow (-1, +1)$

$$error\ rate\ \epsilon_t = Pr[h_t(x_i)\ \neq y_i]\ =\ \frac{3}{10}\ =\ \sum_{h_t(x_i)\ \neq\ y_i} D_t(i)$$

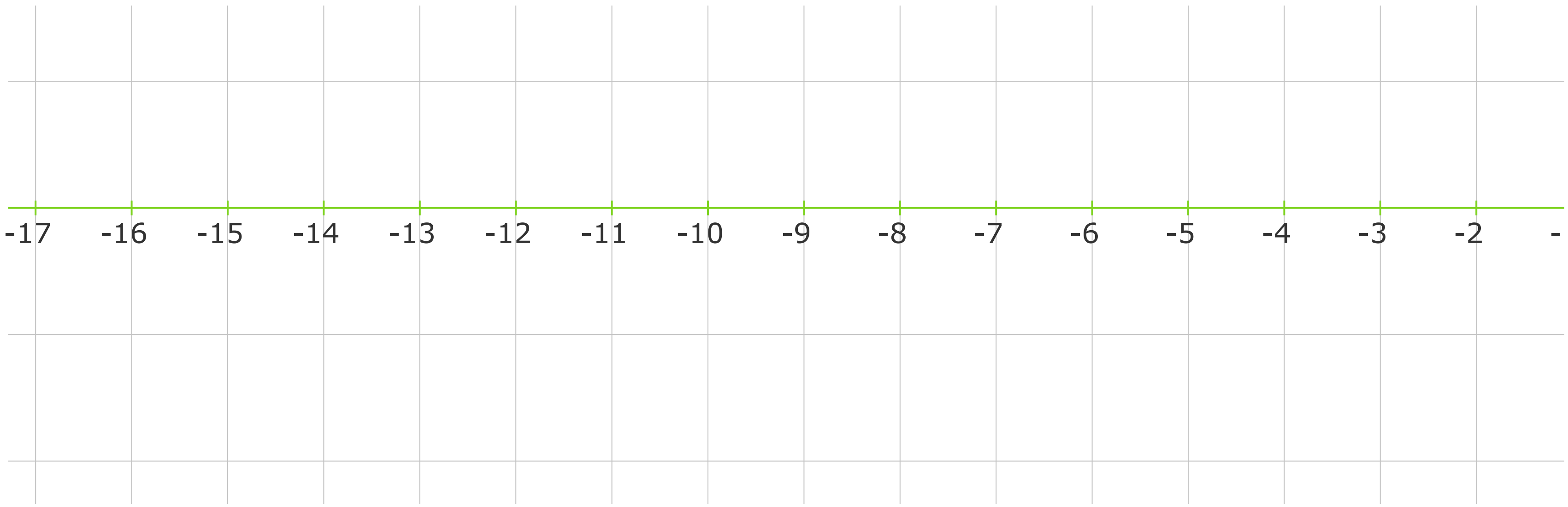
$$1 - \epsilon_t = \sum_{h_t(x_i)\ =\ y_i} D_t(i)$$

3) $\alpha_t = \frac{1}{2} \ln\left(\frac{1-\epsilon_t}{\epsilon_t}\right)$

$$\alpha_t = \ln\left(\sqrt{\frac{1-\epsilon_t}{\epsilon_t}}\right)$$

$$e^{\alpha_t} = \sqrt{\frac{1-\epsilon_t}{\epsilon_t}}$$

$$e^{-\alpha_t} = \sqrt{\frac{\epsilon_t}{1-\epsilon_t}}$$



$4)\ Update\ :$

$$D_{t+1}(i) = \frac{D_t(i)}{Z_t} * \begin{cases} e^{-\alpha_t}\ if\ h_t(x_i) = y_i \\ \\ e^{\alpha_t}\ if\ h_t(x_i) \neq y_i \end{cases}$$

$$= \frac{D_t(i)\ e^{-\alpha_t y_i h_t(x_i)}}{Z_t}$$

$$= \frac{D_t(i)}{Z_t} * \begin{cases} \sqrt{\frac{\epsilon_t}{1-\epsilon_t}}\ if\ h_t(x_i) = y_i \\ \\ \sqrt{\frac{1-\epsilon_t}{\epsilon_t}}\ if\ h_t(x_i) \neq y_i \end{cases}$$

$Now\ what\ will\ be\ the\ value\ of\ Z_t,$

$$\sum_{h_t(x_i)=y_i} \frac{D_t(i)\ \sqrt{\frac{\epsilon_t}{1-\epsilon_t}}}{Z_t} + \sum_{h_t(x_i)\neq y_i} \frac{D_t(i)\ \sqrt{\frac{1-\epsilon_t}{\epsilon_t}}}{Z_t} \ = \ 1$$

$$\implies \sqrt{\frac{\epsilon_t}{1-\epsilon_t}} \sum_{h_t(x_i)=y_i} D_t(i) \ + \sqrt{\frac{1-\epsilon_t}{\epsilon_t}} \sum_{h_t(x_i)\neq y_i} D_t(i) \ = \ Z_t$$

$$\implies \sqrt{\frac{\epsilon_t}{1-\epsilon_t}}\ \ (1-\epsilon_t)\ +\ \sqrt{\frac{1-\epsilon_t}{\epsilon_t}}\ \epsilon_t\ =\ Z_t$$

$$\implies \sqrt{\epsilon_t(1-\epsilon_t)}\ + \sqrt{\epsilon_t(1-\epsilon_t)}\ = Z_t$$

$$\implies 2\sqrt{\epsilon_t(1-\epsilon_t)}\ = Z_t$$

$$D_{t+1}(i)\ =\ \frac{D_t(i)\ \sqrt{\frac{\epsilon_t}{1-\epsilon_t}}}{2\sqrt{\epsilon_t(1-\epsilon_t)}}\ =\ \frac{1}{2(1-\epsilon_t)}\ D_t(i)\ where\ h_t(x_i)\ =\ y_i$$

$$D_{t+1}(i)\ =\frac{D_t(i)\ \sqrt{\frac{1-\epsilon_t}{\epsilon_t}}}{2\sqrt{\epsilon_t(1-\epsilon_t)}}\ =\frac{1}{2(\epsilon_t)}\ D_t(i)\ where\ h_t(x_i)\ \neq\ y_i$$

$$\sum_{h_t(x_i) = y_i} D_{t+1}(i) \; = \; \frac{1}{2(1-\epsilon_t)} \sum_{h_t(x_i) = y_i} D_t(i) \; = \frac{1}{2}$$

$$\sum_{h_t(x_i) \neq y_i} D_{t+1}(i) = \frac{1}{2(\epsilon_t)} \sum_{h_t(x_i) \neq y_i} D_t(i) \; = \frac{1}{2}$$

$$Final\ Hypothesis\ H(x) \; = \; sign\left(\sum_{t=1}^{T} \alpha_t h_t(x)\right)$$