

$$y_l = \begin{cases} 1 & \text{if } l \in Y(x) \\ -1 & \text{if } l \notin Y(x) \end{cases} \quad \text{for } l \in \mathcal{Y} \quad (1)$$

There is a weight w_{il} for each example i and each label $l \in \mathcal{Y}$

Algorithm ADABOOST.MH

Input M , labeled training set \mathcal{D}

Initialize $f = 0$

$$w_{il}^1 = \frac{1}{NL}$$

for $k = 1, 2, \dots, M$

learn classifier b_l^k on \mathcal{D} with weights w_{il}^k predict label y_l , $l = 1 : L$

evaluate error $r^k = \sum_{i=1}^N \sum_{l=1}^L w_{il}^k y_l^i b_l^k(x_i)$

calculate $\varepsilon^k = \frac{1-r^k}{2}$, $\beta^k = \frac{1}{2} \ln \frac{1-\varepsilon^k}{\varepsilon^k}$

compute new weights $w_{il}^{k+1} = \frac{1}{Z^k} w_{il}^k e^{-y_l^i b_l^k(x_i)}$ and normalize them to sum to 1

Output $f(x) = [f_l(x)]_{l \in \mathcal{Y}} = [\sum_{k=1}^M b_l^k(x)]_{l \in \mathcal{Y}}$