* 2015 final.

R1

weight of pts	WA	1/5	1/8	1/12	
	WB	1/5	1/8	3/12	
	WC	1/5	1/2	4/12	
	WD	1/5	1/8	1/12	
	WE	1/5	1/8	3/12	
error rates of hi	ε_1	2/5	(2/8)	6/12	
	ε_2	3/5	6/8	(10/12)	if 10/12
	ε_3	1/5	1/2	4/12	
	ε_4	3/5	6/8	6/12	
	ε_5	2/5	1/4	(2/12)	
	ε_6	4/5	4/8	8/12	
Chosen best* classfier	h	x<6	x<2	x≥4	x<5
	ε	1/5	1/4	2/12	10/12
	α	$\frac{1}{2}\ln 4$	$\frac{1}{2}\ln 3$	$\frac{1}{2}\ln 5$	$\frac{1}{2}\ln\frac{1}{5} = -\frac{1}{2}\ln 5$

$$\alpha(x<6) = \frac{1}{2}\ln\left(\frac{4/5}{1/5}\right) = \frac{1}{2}\ln 4.$$

$$H(\vec{x}) = \text{sign}\left(\frac{1}{2}\ln 4\cdot(x<6) + \frac{1}{2}\ln 3(x<2) + \frac{1}{2}\ln 5(x\geq 4)\right)$$

C BE AD

init weights of pts $w_i = \frac{1}{N}$. #pts.

→ find best* classier
① smallest error rate
furthest from $\frac{1}{2}$ (max $|\frac{1}{2}-\varepsilon|$)
② $\varepsilon = \sum_{wrong} w_i$

→ Calculate voting power α. for chosen h
$\alpha = \frac{1}{2}\ln\left(\frac{1-\varepsilon}{\varepsilon}\right)$

→ finished?
① H is good enough
② enough rounds
③ No good classifer left ($\varepsilon = \frac{1}{2}$)

→ update weight to emphasize misclassified by h pts.

$$W_{new}\begin{cases}\frac{1}{2}\cdot\frac{1}{1-\varepsilon}W_{old} \text{ (if correct)}\\ \frac{1}{2}\cdot\frac{1}{\varepsilon}\cdot W_{old} \text{ (if wrong)}\end{cases}$$

$R_1 > W^{C}_{new} = \frac{1}{2}\cdot\frac{1}{1/5}\cdot\frac{1}{5} = \frac{1}{2}$

$W^{ABDE}_{new} = \frac{1}{2}\cdot\frac{1}{1-1/5}\cdot\frac{1}{5} = \frac{1}{8}$

Useful Facts.

① $\sum_{wrong} w_i = \sum_{correct} w_i = \frac{1}{2}$ while keeping ratio

② If 3+ classifers have DISJOINT (NON-OVERLAPPING) errors can make perfect H by setting α_s to satisfy triangular inequality.

↳ No guarantee Adaboost outvote misclassification until change this first

③ Never choose same classifer in a row.
→ $\varepsilon = \frac{1}{2}$ next round → $W_{new} = W_{old}$, $\alpha = 0$
↳ BUT POSSIBLE if NOT consecutive

If has overlapping errors ⟷ might still be possible to have perfect H.

* α: ∞ ← 0 — ½ — 1 → $-\infty$

always correct	always wrong
∞ ← less v.p. → $-\infty$	
more (+) voting power	more (−) voting power
$W^{✓}_{new}$ ↓	↑
W^{x}_{new} ↑	↓