11- Nov- 2023

ADABOOST ALGORITHM

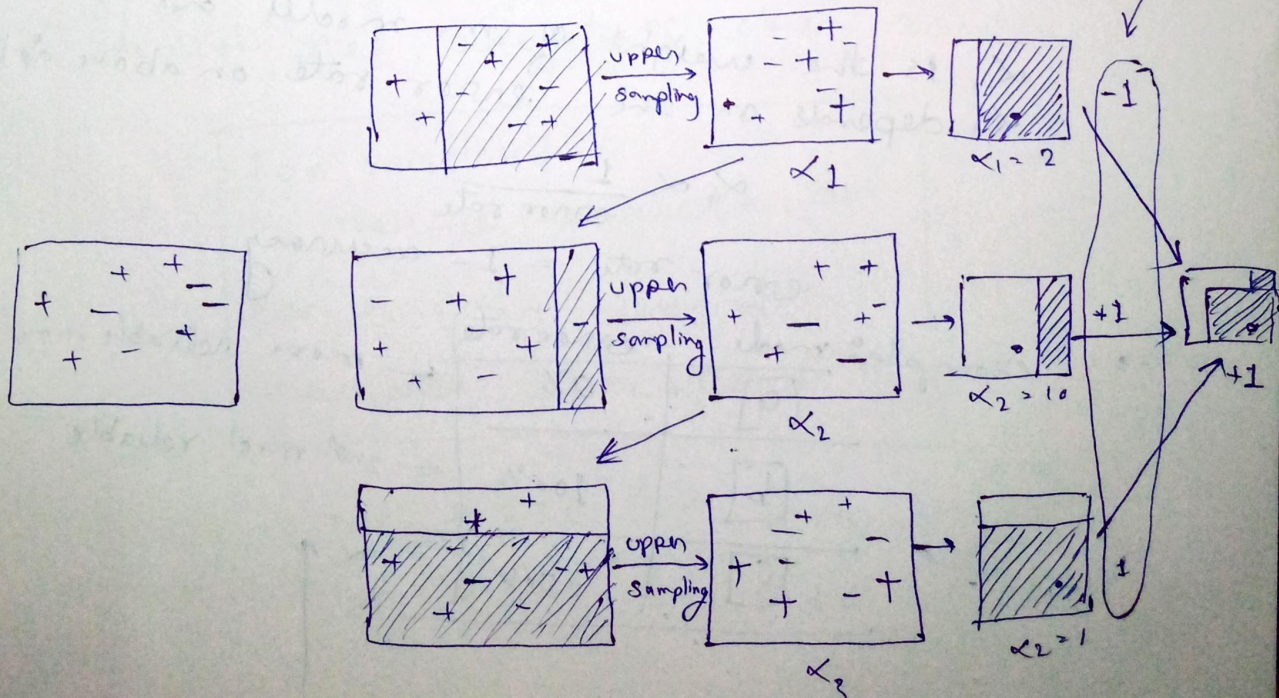
Adaboost Algorithm → Adaptive boosting
→ used for face detection

weak learners-
A model that have accuracy is approximately 50%.
Adaboost combine all weak learners model and make a strong model (stage wise addive method)

Decision stumps:
- it is one of the type of weak learners where max-depth = 1 that means only one split, we use that split in which entropy में सबसे ज्यादा reduction.

+1 and -1:
In the adaboost we have the two class +1 (+ve) and -1 (-ve)

for example {7.5, 81} - ?



$$h(x) = \text{Sign}(\alpha_1 h_1(x) + \alpha_2 h_2(x) + \alpha_3 h_3(x)) = +Ve \text{ or } -ve$$

$h(x) = 2(-1) + 10(1) + 1(-1)$

$= +7$

hence for $\{7.5, 8\} \rightarrow +ve(1)$

placement ho jayega.

Y_pred	x_1	x_2	Y	weight
1	3	7	1	0.2
(1)	2	9	0	0.2 ← misclassified raw
(0)	1	4	1	0.2 ← misclassified raw
0	9	8	0	0.2
0	3	7	0	0.2

$n = 5$ weight $= 1/5 = 0.2$

Step-1 train jaw decision tree on above data set in which max_depth = 1 (decision stump) let us model - m_1

अब model m_1 को x_1 and x_2 input देंगे और Y_pred generate होगा।

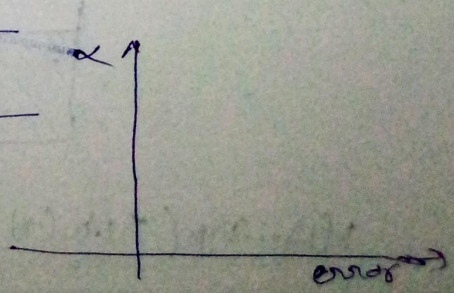
α_1 is the weight of m_1 model and α_1 depends on the error rate on above data

$$\alpha_1 \propto \frac{1}{\text{error rate}}$$

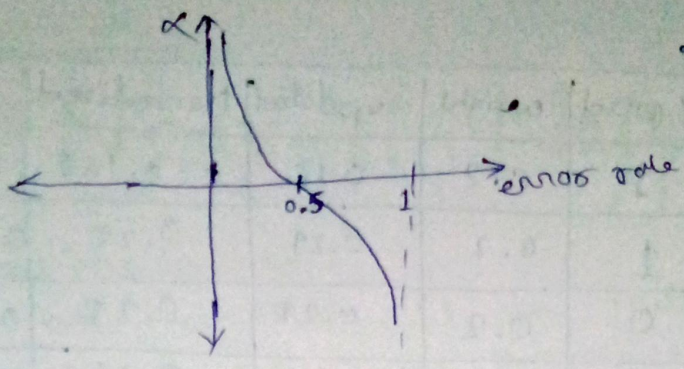
error rate = 1 − accuracy

example:

model	error rate	
a	0%	← more reliable model
b	100%	← 2nd most reliable
c	50%	



$$\alpha = \frac{1}{2} \ln\left(\frac{1-\text{error}}{\text{error}}\right)$$



for calculating error.
→ choose missclassified rows.
→ add them
→ we get the error

in above data error = $0.2 + 0.2 = 0.4$

$$\alpha_1 = \frac{1}{2} \ln\left(\frac{1-0.4}{0.4}\right)$$

$$= 0.20$$

step-2

उसके बाद model को train करने से पहले miss-classified raw के importance को बढ़ा दिया जाता है using up-sampling it mean miss-classified raw का weight बढ़ा देंगे, or also decrease the weight of other row.

For misclassified.
$$\text{new\_wt} = \text{curr\_wt} \times e^{\alpha_1}$$

For correctly classified.
$$\text{new\_wt} = \text{curr\_wt} \times e^{-\alpha_1}$$

$$wt = 0.2 \times e^{0.2} = 0.24$$

$$wt = 0.2 \times e^{-0.2} = 0.16$$

X_1	X_2	Y	Y-pred	weight	updated	Normalized	range
3	7	1	1	0.2	0.16	0.166	0 - 0.166
2	9	0	1	0.2	0.24	0.25	0.166 - 0.416
1	4	1	0	0.2	0.24	0.25	0.416 - 0.666
9	8	0	0	0.2	0.16	0.166	0.666 - 0.832
3	7	0	0	0.2	0.16	0.166	0.832 - 1.0
					0.96	1	

5 randomly number generated b/w 0 and 1	lies on
0.13	raw 1
0.43	raw 3
0.62	raw 3
0.50	raw 3
0.80	raw 4

hence raw selected is [1, 3, 3, 3, 4]