

## ✓ Boosting

RF

XGB

→ Ada boost

→ Gradient Boosting - sklearn.ensemble import GradientBoostingClassifier

→ XG Boost → from xgboost import XGBBoostClassifier.

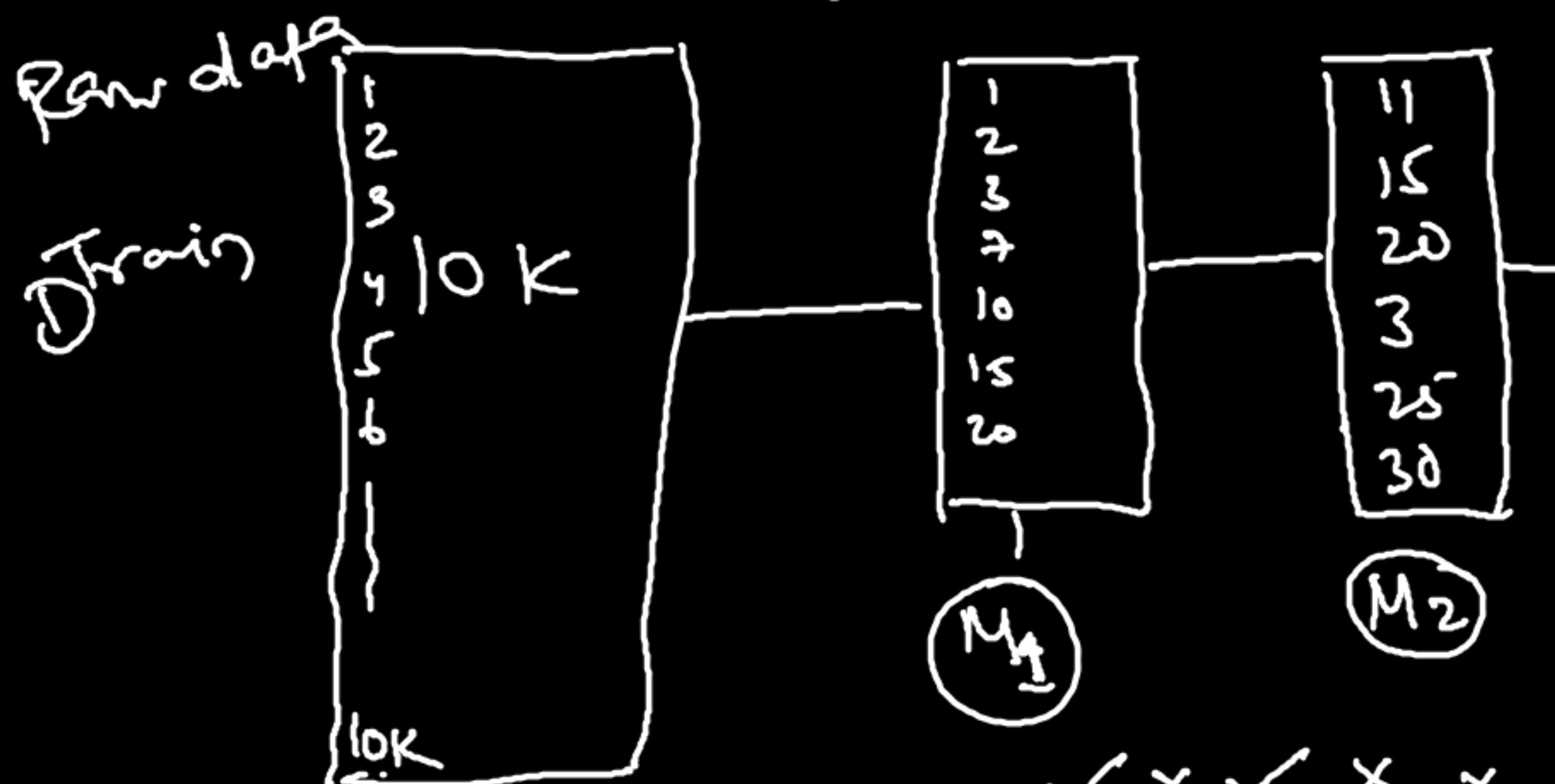
Biasing :- high variance , low bias  
Reduced  
as it is ↓  
low variance      low bias

Boosting :- low variance , high bias  
from sklearn.ensemble  
low variance      Reduced low bias.

# Boosting :- Classification & Regression

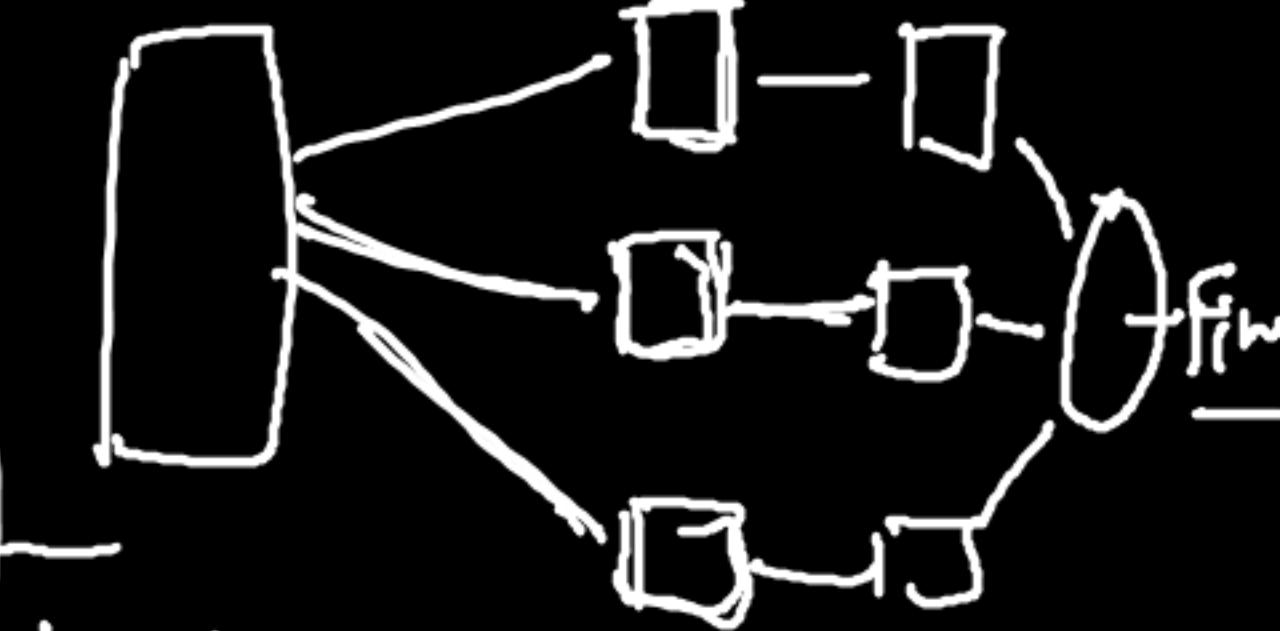
## Sequential model

iterative weighted seq. wise fit



Test {1, 11, 12, 15, 20} - y<sub>pred</sub> = ?

Boosting - Parallel

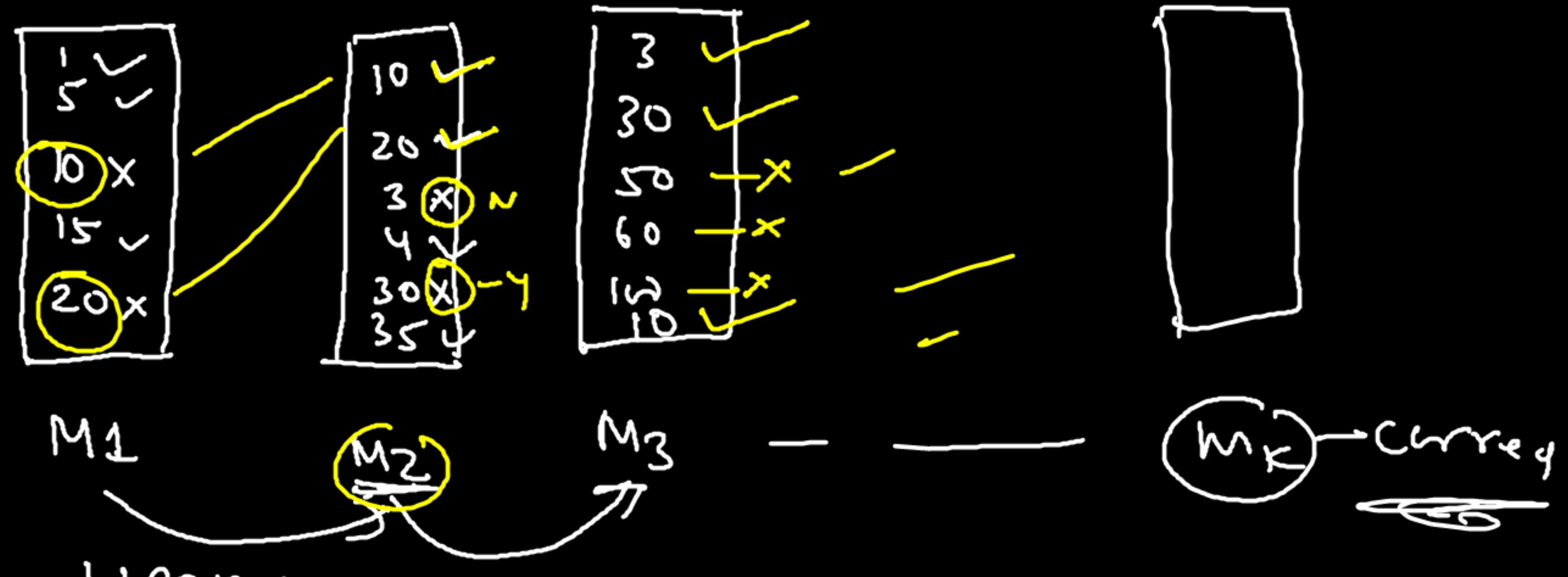


D<sub>train</sub>

1	w <sub>1</sub>
2	w <sub>2</sub>
3	w <sub>3</sub>
4	w <sub>4</sub>
.	
30	N
.	
10K	+ w <sub>10K</sub>

iterative appo

D<sub>1</sub> → D<sub>2</sub> → D<sub>3</sub>



Misclassified data → increase their weight

Correctly classified → decrease their weight.

## Ada Boost - Given dataset

$v_1$	$v_2$	$v_3$	$v_k$	Def	Weight
-	-	-	-	Y	$1/10k$
-	-	-	-	Y	$1/10k$
-	-	-	-	N	$1/10k$
-	-	-	-	Y	$1/10k$
-	-	-	-	N	$1/10k$
-	-	-	-	Y	$1/10k$
-	-	-	-	Y	$1/10k$
-	-	-	-	Y	$1/10k$
-	-	-	-	Y	$1/10k$

$$\frac{1}{2} \log_2 \left[ \frac{1 - \frac{2}{5}}{\frac{2}{5}} \right] = \frac{1}{2} \log_2 \left( \frac{3}{2} \right) = 0.29$$

## Step 2

Find the total error

## Step 3 :-

Performance of

$$\text{Stump} = \frac{1}{2} \log_e \left( \frac{1 - \text{Total error}}{\text{Total error}} \right)$$

Please note, we have to decrease the weight for rightly classified data and increase the weight for wrongly classified —

Step 4 :- Updated Weight (Incorrectly classified)

$$\text{(New Sample)} \text{Weight} = \text{(Old Sample)} \text{Weight} * e^{\text{Perfom Score}}$$

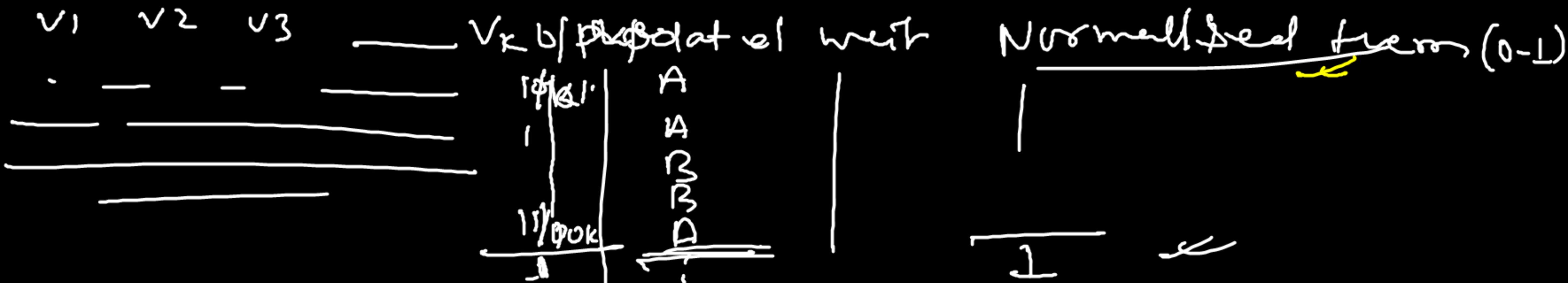
$$\therefore \frac{1}{10k} * e^{0.29} = Ax$$



right classified weight  $\rightarrow$  decrease them

$$(\text{New weight}) = (\text{Old weight}) * e^{-\text{Performance Jump}}$$

$$= \frac{1}{10K} * e^{-0.29} = \frac{1}{10K} * \frac{1}{e^{0.29}} = B \sim$$



Normalized weight  $\Rightarrow \frac{\text{individual weight}}{\text{Total weight}}$

Gradient Boosting — Pseudo residual — Histogram;

build DT model

sc	y	<u><math>y_{avg}</math></u>	<u>loss</u>
1	1	3	-2
2	2	3	-1
3	3	3	0
4	4	3	1
5	5	3	1