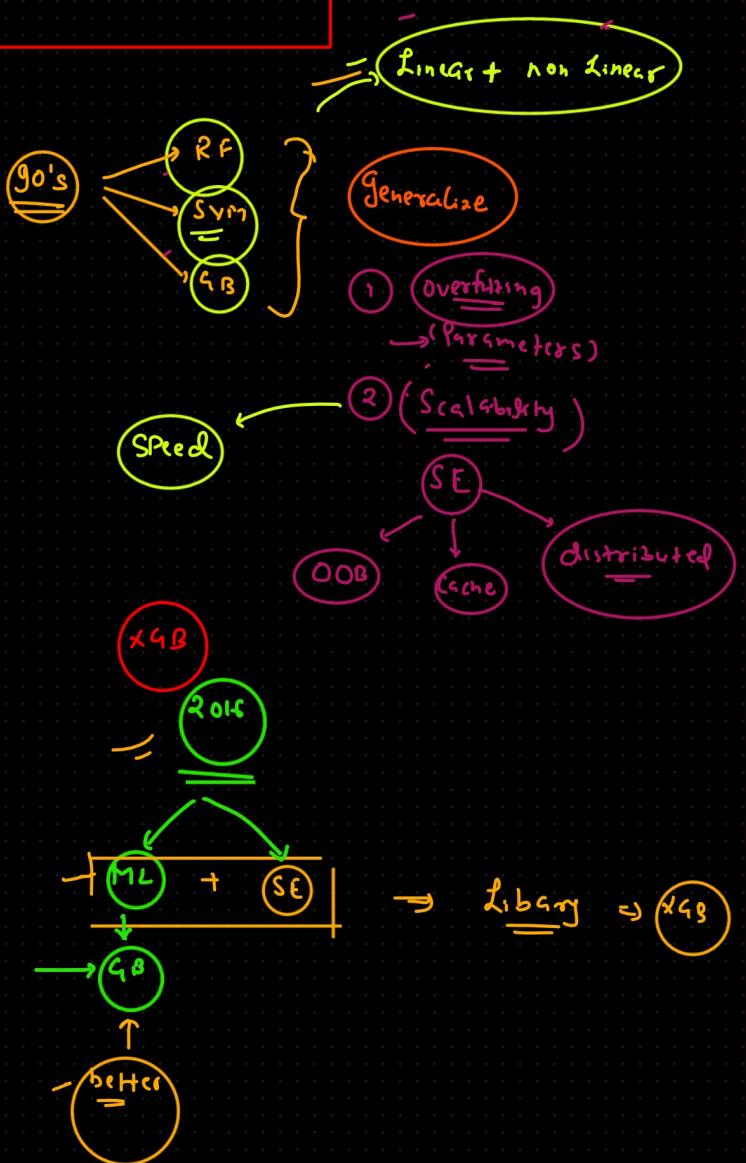
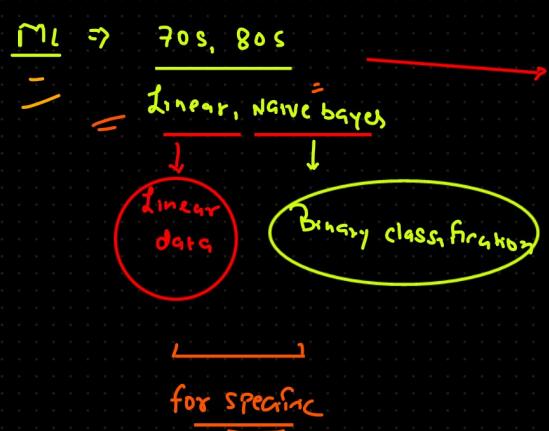
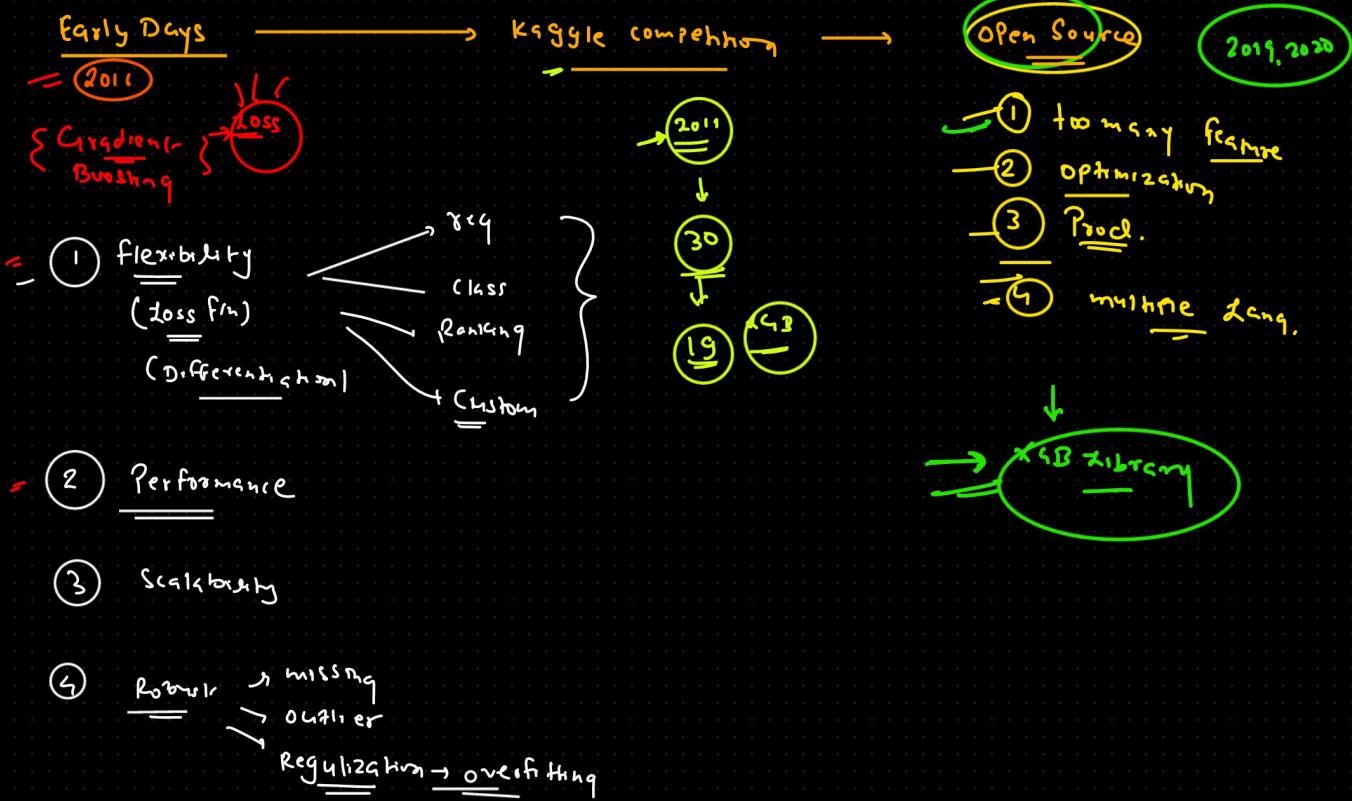


- ① XGB Regressor
- ② Practical with Hyperparameter tuning (Optuna)
- ③ Why XGB

{ XGB → OpenSource Library }

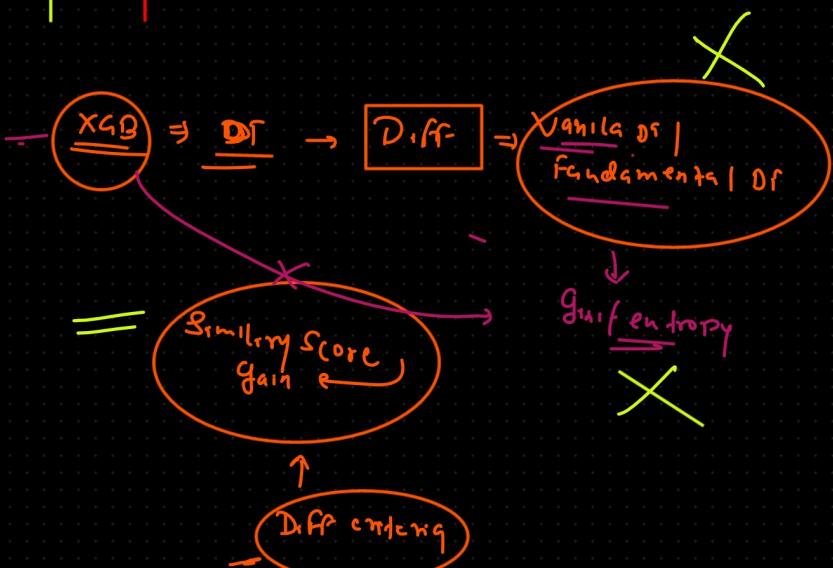


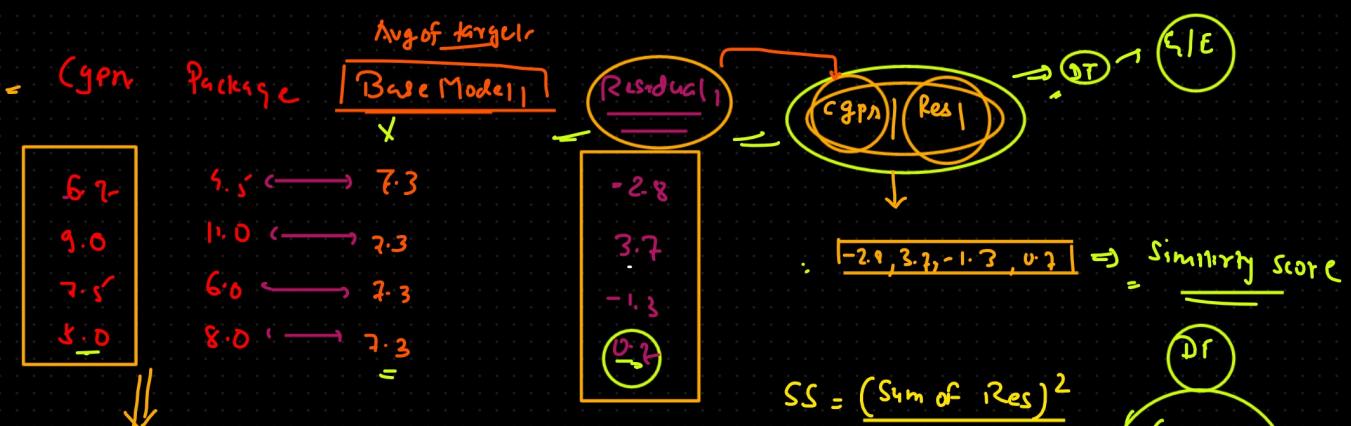
## XGB



## XGB Regressor

Cgpr	Packaged	BE	Res1	Base estimator + α DT1 Stage 2
6.2	4.5	7.37	-3	
9.0	11.0	7.37	3.5	Single
7.5	6.0	7.37	-1.5	A.B. ⇒
5.0	—	7.32	0.5	
	8.0	—	—	





1 Sort the CGPA feature  
 2 Average of the consecutive value

5.0 → 5.85  
 6.2 → 7.1  
 7.5 → 8.25  
 9.0 → 9.0

DT  $\Rightarrow$  Num = Independent

Splitting Criteria

① 5.85

Root

CGPA < 5.85  $\Rightarrow 0.02$

$$\text{child } 0.7 \\ S.S. = \frac{(0.7)^2}{140} = 0.49$$

$$S.S. = \frac{(-2.8 - 1.3 + 3.7)^2}{3 + 0} = \frac{0.16}{3} = 0.05'$$

$$\text{Gain} = \frac{(S.S.L + S.S.R)}{1} - S.S. \text{ total}$$

$$= 0.49 + 0.05' - 0.02$$

$$\Rightarrow 0.52$$

Highest Gain

② 7.1

CGPA < 7.1

6.2, -2.8

3.27

$$\frac{S.S.}{S.S. \text{ total}} = \frac{(0.7 - 2.8)^2}{2.20} = \frac{5.21}{2}$$

③ 8.25

CGPA < 8.25

0.7, -2.1, 1

3.27

-1.3

3.27

5.12

0.02

$$\begin{aligned} S.S.R. &= (-1.3 + 3.7)^2 / 2 \\ &= \frac{8.76}{2} = 4.38 \\ &= 0.02 \end{aligned}$$

$$\begin{aligned} \text{Gain} &= (3.85 + 12.69) - (0.02) \\ &= 17.52 \end{aligned}$$

Gain

$$= \frac{S.S.L + S.S.R. - S.S. \text{ total}}{2.20 + 2.88 - 0.02}$$

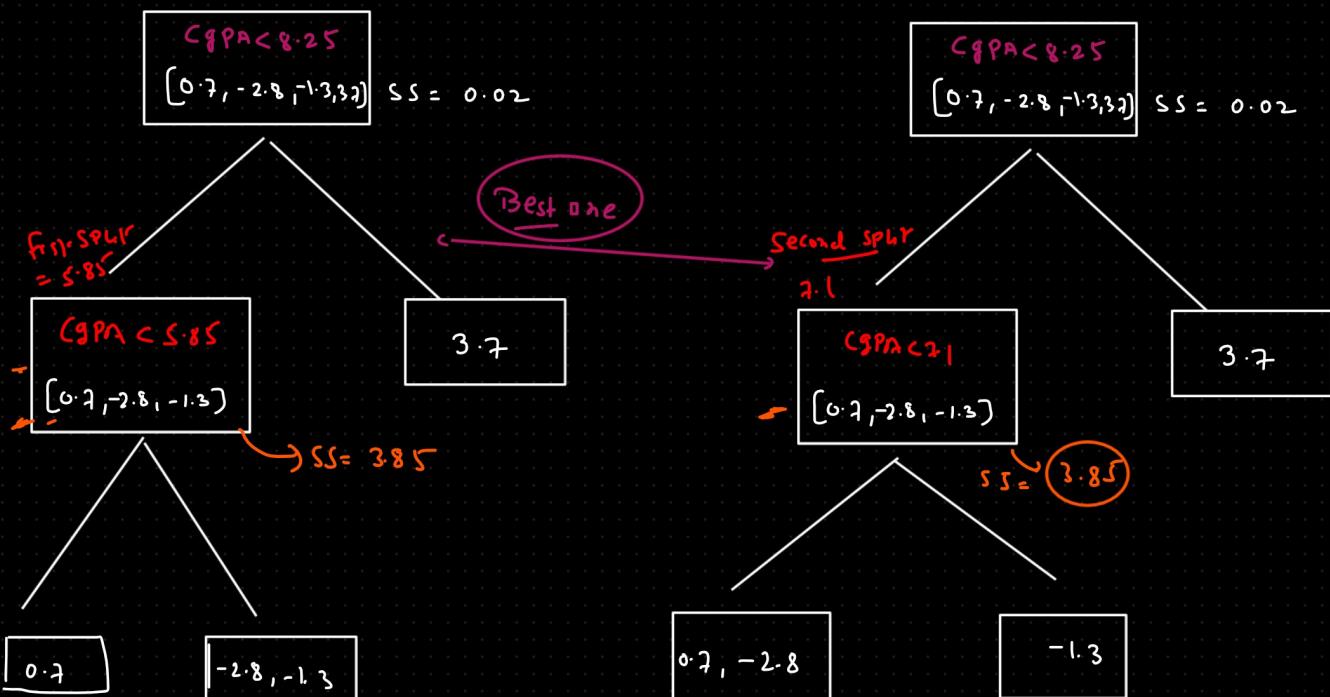
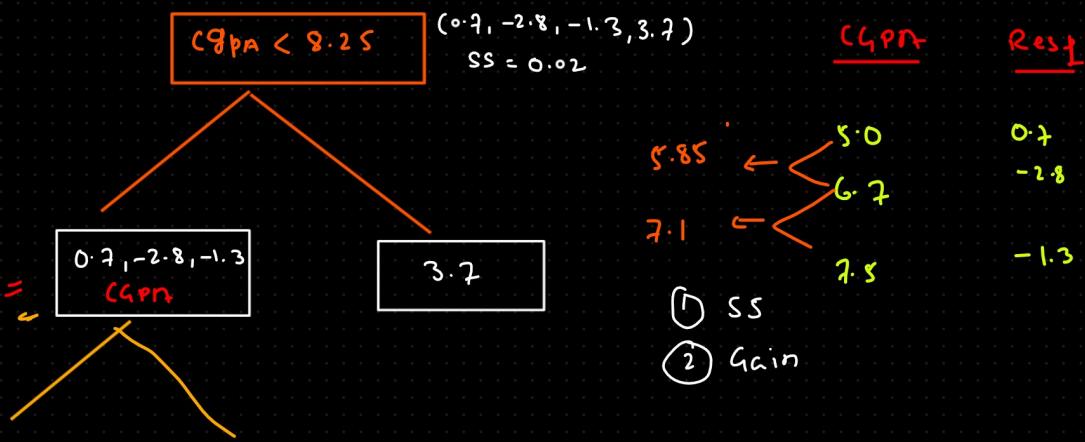
$$= 5.06$$

= 17.52  $\Rightarrow$  CGPA < 8.25

DT  $\Rightarrow$  AB  $\Rightarrow$  Stump  
 max depth = 1

GB = DT  
 8  $\rightarrow$  32

$x_{GB} \Rightarrow \text{max depth} \leq 6$



$$\begin{aligned} SS_L &= \frac{(0.7)^2}{1} \\ &= 0.49 \end{aligned}$$

$$\begin{aligned} SS_R &= \frac{(-2.8 - (-1.3))^2}{2} \\ &= 8.40 \end{aligned}$$

$$\begin{aligned} SS_L &= \frac{(0.7 - 2.8)^2}{2} = 2.20 \\ SS_R &= \frac{(-1.3)^2}{1} = 1.69 \end{aligned}$$

$$\text{Gain} = [(SS_L + SS_R) - Root]$$

$$\text{Gain} = [(SS_L + SS_R) - Root]$$

$$= 0.49 + 8.40 - 3.85$$

$$\begin{aligned} &= 2.20 + 1.69 - 3.85 \\ &= 0.04 \end{aligned}$$

$0.04$

Max\_depth = 6

$\text{CGPA} < 8.25$

$\text{CGPA} < 8.85$

3.7

0.7

$$-2.8, -1.3 \Rightarrow \underline{\text{avg}} = 0.4 \text{trup}$$



pairg-Model

Res2

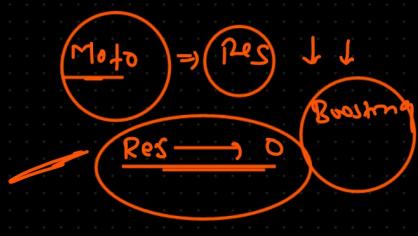
Residual 2

$$[\text{CGPA}, \text{Res1}] \xrightarrow{SS \rightarrow \text{train}}$$

DT1

$$\text{final Pred} \Rightarrow \text{Base model} + \underbrace{\text{Avg.} \times \text{DT}_1}_{LR} \xrightarrow{\text{first DT}}$$

$\text{CGPA} < 8.25$



$$\Rightarrow 7.3 + (0.3) * (-2.05) = 6.49$$

$$\Rightarrow 7.3 + 0.3 * (3.7) = 8.41$$

$$\Rightarrow 7.3 + 0.3 * (-2.05) = 6.49$$

$$\Rightarrow 7.3 + 0.3 * (0.7) = 7.51$$

$\text{CGPA} < 8.85$

3.7

0.7

-2.05

no\_Base\_estimator = 10, 15, 20 ..

Final result =  $Bm + eLg \times Dr_1 + eLg \times Dr_2 - \dots + eLg \times Dr_n$