GRADIENT BOOSTING ALGORITHM

1. Regression
2. CLASSIFICATION

Regression Dataset

Exp	Degree	Salary
2	B.E	50K
3	Masters	70K
5	Masters	80K
6	PHD	100K

Exp	Degree	Salary
		Y
2	B.E	50K
3	Masters	70K
5	Masters	80K
6	PHD	100K
		75K

Steps

① Create a Base Model

Exp	Degree	y Salary	$\hat{y}$	$(y-\hat{y})$ R_1
2	B.E	50K	75K	-25K
3	Masters	70K	75K	-5K
5	Masters	80K	75K	5K
6	PHD	100K	75K	25K
		75K		

Steps

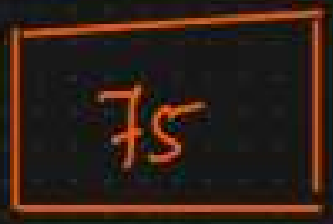
① Create a Base Model

Average = 50+70+80+100 = 75

75K

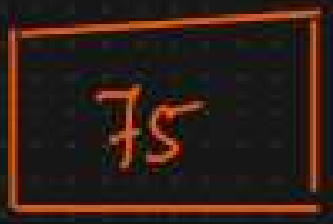
Steps

① Create a Base Model



$$\text{Average} = \frac{50+70+80+100}{4} = 75$$

② Compute Residuals, Error

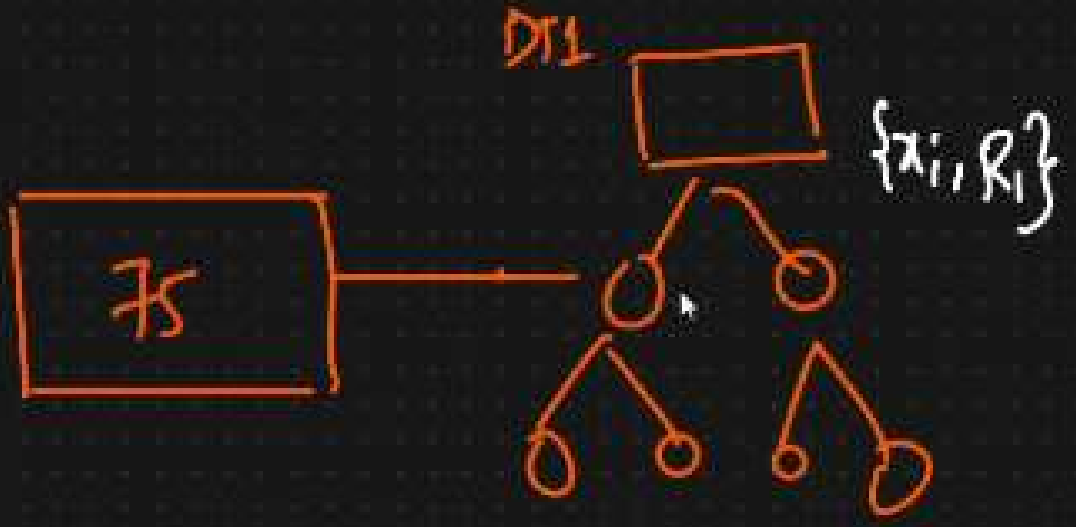


Average = $\frac{50+70+80+100}{4} = 75$

② Compute Residuals, Error

③ Construct a Decision Tree

Consider inputs x_i and O/p R_i



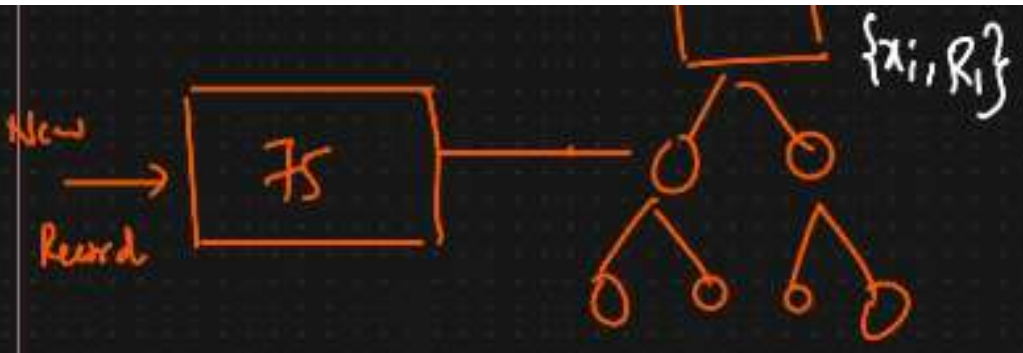
Exp	Degree	y Salary	$\hat{y}$	$(y-\hat{y})$ R_1	R_2
2	B.E	50K	75K	-25K	-23
3	Masters	70K	75K	-5K	-3
5	Masters	80K	75K	5K	3
6	PHD	100K	75K	25K	20

75K

Steps

① Create a Base Model

Average = $\frac{50+70+80+100}{4} = 75$



Predicted o/p ⇒ 75 + (-23) = 75 - 23 = 52 {overfitting}

Predicted o/p ⇒ 75 + α(DT1) = 75 + (0.1)(-23)

α = learning (0 to 1)

α = 0.1

= 75 - 2.3

= 72.7

Regression Dataset

Exp	Degree	Salary (y)	$\hat{y}$	$(y-\hat{y})$ R_1	R_2	$\hat{y}$	R_3
→ 2	B.E	50K	75K	-25K	-23	72.7	-22.7
3	Masters	70K	75K	-5K	-3	74.7	-4.7
5	Masters	80K	75K	5K	3	—	—
6	PHD	100K	75K	25K	20	—	—
		75K					

Steps

① Create a Base Model

Average = 50+70+80+100 = 75

α = learning (0 to 1)

$\alpha = 0.1$

$= 75 - 2.3$

$= 72.7$

$\Rightarrow 75 + 0.1(-3)$

$= 75 - 0.3 = 74.7$

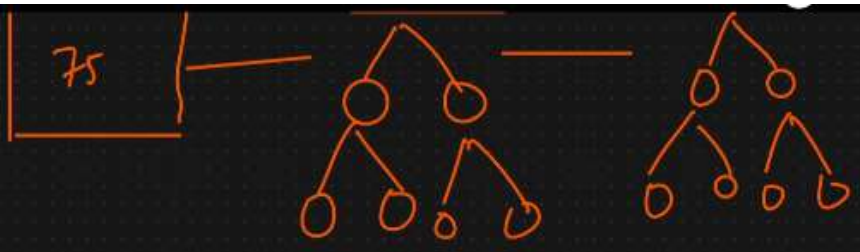
Regression Dataset

Exp	Degree	Salary (y)	$\hat{y}$	$(y-\hat{y})$ R_1	R_2	$\hat{y}$	R_3	R_4
→ 2	B.E	50K	75K	-25K	-23	72.7	-22.7	-
3	Masters	70K	75K	-5K	-3	74.7	-4.7	-
5	Masters	80K	75K	5K	3	-	-	-
6	PHD	100K	75K	25K	20	-	-	-
		75K						

Steps

① Create a Base Model

Average = 50+70+80+100 = 75



$$F(x) = \alpha_0 h_0(x) + \alpha_1 (h_1(x)) + \alpha_2 (h(x)) + \alpha_3 (h(x)) - - + \alpha_n (h(x))$$

Learning Rate $\alpha = 0.1$

$$F(x) = \sum_{i=0}^{n} \alpha_i h_i(x)$$

$$F(x) = \alpha_0 h_0(x) + \alpha_1(h_1(x)) + \alpha_2(h(x)) + \alpha_3(h(x)) - - + \alpha_n(h(x))$$

Learning Rate $\alpha = 0.1$

$$F(x) = \sum_{i=0}^{n} \alpha_i h_i(x)$$

$\Rightarrow$ Final Function of Gradient Boosting