LINEAR REGRESSION

dep $Y \rightarrow X$ indep

β_0 – ~~slope~~ Y-intercept

$\beta_1 \rightarrow$ first reg. cofficient

$\beta_2 \rightarrow$ second Reg. coffient

3 3

$Y\uparrow \Leftarrow \uparrow_x \Leftarrow$ change

$$\boxed{Y = \beta_0 + \beta_1 x} + e \leftarrow \text{simple}$$

$$\boxed{Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \cdots \beta_n x_n} + e$$

$\leftarrow$ multiple

$e \rightarrow$ residual error which is unmeasured variable.

$\boxed{e = E(x) - A(x)}$

Multiple Regression

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}_{n\times 1} \quad X = \begin{bmatrix} x_{10} & x_{11} & \cdots & x_{1p} \\ x_{20} & x_{21} & \cdots & x_{2p} \\ \vdots & & & \\ x_{n0} & x_{n1} & \cdots & x_{np} \end{bmatrix}_{n\times p}$$

$$\beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_n \end{bmatrix}_{n\times 1} \quad \& \quad e = \begin{bmatrix} e_0 \\ e_1 \\ \vdots \\ e_n \end{bmatrix}$$

$$\boxed{Y = \beta x + e}$$

$\therefore \quad Y = \beta X$ neglect $- e$

$\hookrightarrow \boxed{\beta = X^{-1} Y}$

$\boxed{A \cdot A^{-1} = I}$

$\therefore \quad Y X^{-T} = \beta X \cdot X^{-T}$

$(X \cdot X^{T})^{-I} Y X^{-T} = \beta (X \cdot X^{-T}) (X \cdot T^{-T})^{-1}$

$\therefore \boxed{\beta = (X \cdot X^{T})^{-1} \cdot Y \cdot X^{T}}$ can calculate β values by this

Ex Simple Reg.

$\boxed{Y = \beta_0 + \beta_1 X}$

$$\beta_0 = \bar{Y} - \beta_1 \bar{x}$$

$$\beta_1 = \frac{\sum (x_i - \bar{x})(Y_i - \bar{Y})}{\sum (x_i - \bar{x})^2}$$

Qn when $x = 80$, $Y = ?$

X	Y	$x_i - \bar{x}$ (A)	$Y_i - \bar{Y}$ (B)	A · B	$(x_i - \bar{x})^2$
95	85	17	8	136	289
85	95	7	18	126	49
80	70	2	-7	-14	4
70	65	-8	-12	96	64
66	70	-18	-7	126	324
$\bar{x} = 78$	$\bar{Y} = 77$			94	146

$$\beta_1 = \frac{94}{146} = 0.64$$

$$\beta_0 = 77 - 0.64 * 78 = 27.08$$

Cal

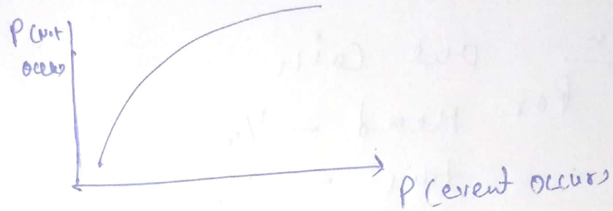
$$Y = 27.08 + 0.64 * 80$$

$\boxed{Y = 78.28}$ $\Leftarrow$ its Round about 80 value of X so its linear reg.

Logistic Regression

A modeling of an event occurring versus event is not occurring.

→ Probability :-



data

⇒ Category or Numerical.

(hot/cold/humid)   (0-10, 10-20, 20-30)

Binomial distribution (0,1)

Binary Data (0's & 1's)

Unknown Probability

'p' = Probability will occur

'q' = " event " not occur

UTKARSH

$$\boxed{P = 1-q}$$

Odd's $\quad$ odd's $= \dfrac{P(\text{occuring})}{P(\text{not occuring})}$

Ex one coin

for Head $-$ $1/2$

tail $-$ $1/2$

$$\boxed{\text{odd's} = \frac{1/2}{1/2} = 1}$$

for ~~[illegible]~~ Dice

~~[illegible]~~ $P(2\,4) = \frac{1}{6} + \frac{1}{6} = 2/6$

$P(2\,4) \neq \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + 1/6 = \frac{4}{6}$
not coming.

$$\text{odd's} = \frac{2/6}{4/6} = 1/2$$

Odd Ratio –

$$\text{Odd Ratio} = \frac{\dfrac{P_1}{1-P_1}}{\dfrac{P_0}{1-P_0}}$$

$P_1 \rightarrow$ Current event

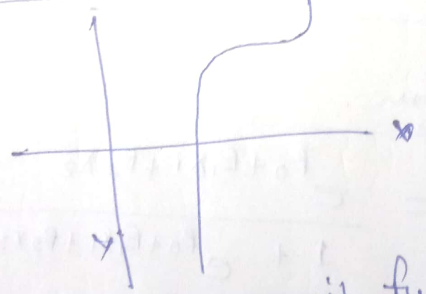
$P_0 \rightarrow$ Previous event

Logit function

$Y \rightarrow X$

$$\text{logit}(P) = \ln(\text{odds}) = \ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 x$$

* this only for x axis move any-axis for



Sigmoid fun^n

$$\text{logit}^{-1}(\alpha) = \frac{1}{1+e^{-\alpha}}$$

$$\ln\left(\frac{P}{1-P}\right) = \text{logit}(P)$$

$$= \beta_0 + \beta_1 X$$

$$\frac{P}{1-P} = e^{\beta_0 + \beta_1 X}$$

$$P = (1-P)\, e^{\beta_0 + \beta_1 X}$$

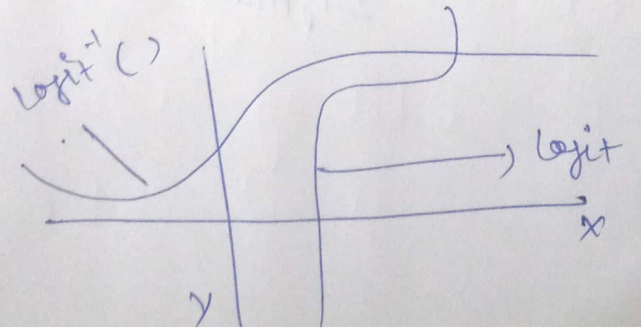
$$P = e^{\beta_0 + \beta_1 X} - P \cdot e^{\beta_0 + \beta_1 X}$$

$$\therefore P - P \cdot e^{\beta_0 + \beta_1 X} = e^{\beta_0 + \beta_1 X}$$

$$\therefore \boxed{P = \frac{e^{\beta_0 + \beta_1 X}}{1 + e^{\beta_0 + \beta_1 X}}}$$ simple regress

Multiple Regression

$$\boxed{P = \frac{e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 \cdots \beta_n x_n}}{1 + e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 \cdots \beta_n x_n}}}$$



sigmoid graph