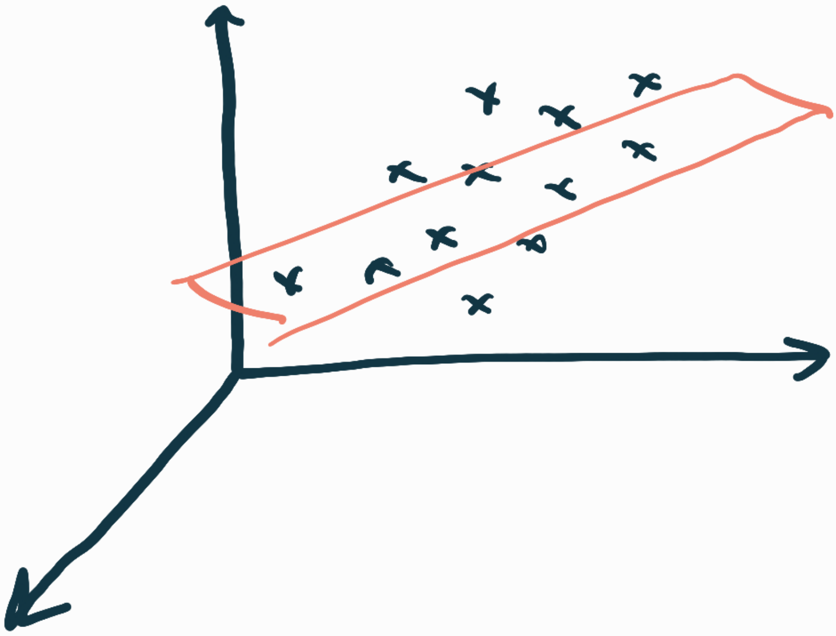
cgpa | iq | lpa



$y = mx + b$

$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$

$x_1 \Rightarrow 1$ ft. (cgpa)

$x_2 = 2$ ft. (iq)

$$\boxed{Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots\ldots \beta_n x_n}$$

hyperplane in
n-dim^n co-ordinate

$$\boxed{\beta_0, \beta_1, \beta_2, \beta_3, \ldots\ldots \beta_n}$$

calculating coefficients

Mathematical formulation

cgpa | iq | lpa

8	80	8
7	70	7
5	120	15

$$\hat{Y}_1 = \beta_0 + \beta_1 8 + \beta_2 80$$

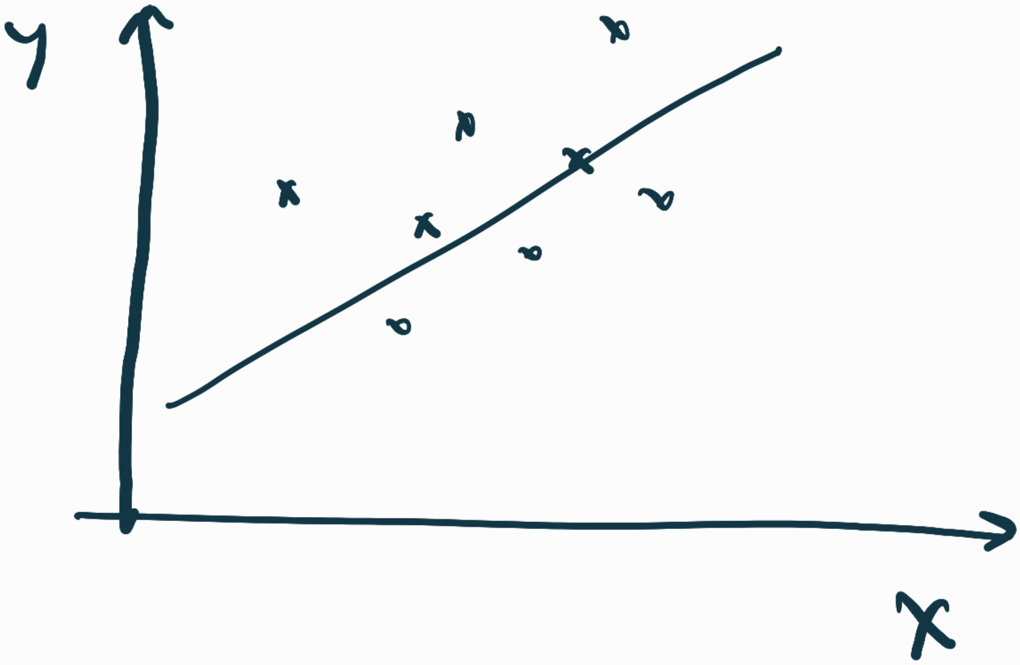
$$\hat{Y}_2 = \beta_0 + \beta_1 7 + \beta_2 70$$

$$\hat{Y}_3 = \beta_0 + \beta_2 5 + \beta_2 120$$

$$\hat{Y} = \begin{bmatrix} \hat{Y}_1 \\ \hat{Y}_2 \\ \vdots \\ \hat{Y}_n \end{bmatrix} = \begin{matrix} \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \cdots \\ \beta_0 + \beta_1 X_{21} + \beta_2 X_{22} + \cdots \\ \\ \beta_0 + \beta_1 X_{n1} + \beta_2 X_{n2} + \cdots \end{matrix}$$

$$= \begin{bmatrix} 1 & x_{11} & x_{12} & + \cdots & x_{1m} \\ 1 & x_{22} & x_{22} & + \cdots & x_{2m} \\ & & \vdots & & \\ 1 & x_{n1} & x_{n2} & + \cdots & x_{nm} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_m \end{bmatrix}$$

$$\boxed{\hat{Y} = X\beta} \quad (1)$$



$$\boxed{E = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2}$$

→ matrix form

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} \qquad \hat{Y} = \begin{bmatrix} \hat{y}_1 \\ \hat{y}_2 \\ \vdots \\ \hat{y}_n \end{bmatrix}$$

$$* \quad e = Y - \hat{Y} = \begin{bmatrix} y_1 - \hat{y}_1 \\ \ldots \end{bmatrix}$$

$$\begin{bmatrix} y_2 - \hat{y}_2 \\ \vdots \\ y_n - \hat{y}_n \end{bmatrix}$$

$$e^T e = [y_1 - \hat{y}_1 \quad y_2 - \hat{y}_2 \; \cdots \; y_n - \hat{y}_n] \cdot e$$

$$= \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$$\boxed{E = e^T e} \longrightarrow \text{(II)}$$

Imp.

$$\hat{Y} = X\beta \longrightarrow \text{(I)}$$

$$E = e^T e \longrightarrow \text{(II)}$$

Minimize the G

↳ minimize

$$E = (Y - \hat{Y})^T (Y - \hat{Y}) = (Y^T - \hat{Y}^T)(Y - \hat{Y})$$

$$= Y^T Y - Y^T \hat{Y} - \hat{Y}^T Y - \hat{Y}^T \hat{Y}$$

$$\boxed{E = Y^T Y - 2 Y^T \hat{Y} + \hat{Y}^T \hat{Y}} \quad \text{(iii)}$$

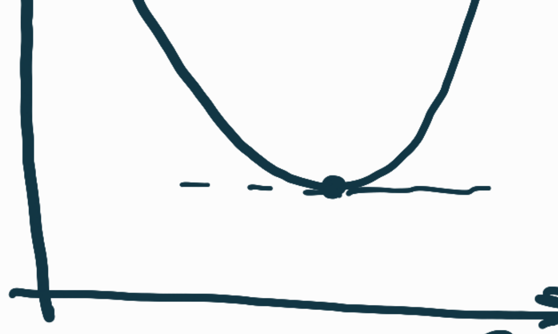
$$\hat{Y} = X\beta$$

$$\Rightarrow \boxed{E = Y^T Y - 2 Y^T X \beta + \beta^T X^T X \beta} \quad \text{(iv)}$$

$\underline{E(\beta)}$

» We have to find such value of β such that E is least

$$\boxed{\frac{\partial E}{\partial \beta} = 0} \longrightarrow$$



$$\frac{\partial E}{\partial \beta} = 0$$

$$0 - \cancel{2}Y^T X + \cancel{2}\beta^T X^T X = 0$$

$$\beta^T X^T X = Y^T X$$

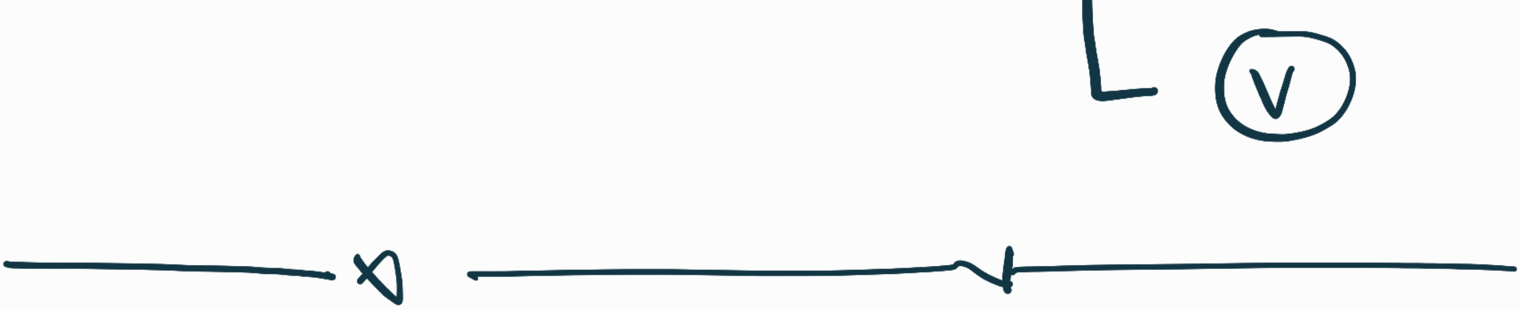
$$\beta^T X^T X (X^T X)^{-1} = Y^T X (X^T X)^{-1}$$

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

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

$$\beta = \left[Y^T X (X^T X)^{-1}\right]^T$$

$$\boxed{\beta = \left[(X^T X)^{-1}\right] X^T Y}$$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