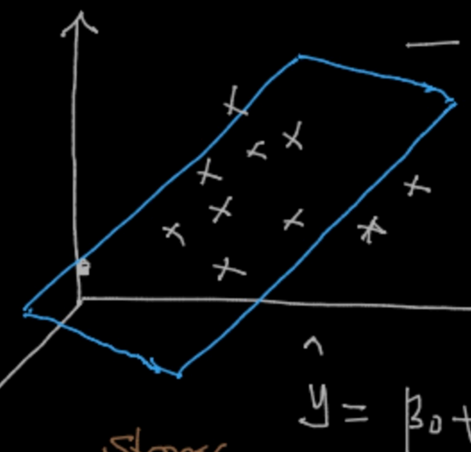
Multilinear Regression

Model parameters = $\beta_0, \beta_1, \beta_2, \cdots \beta_d$

$$\beta_1 = \frac{\Delta y}{\Delta x}$$

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \beta_d x_d$$

— Hyperplane in high dimensional feature space



$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

1. Assumptions on the parameters

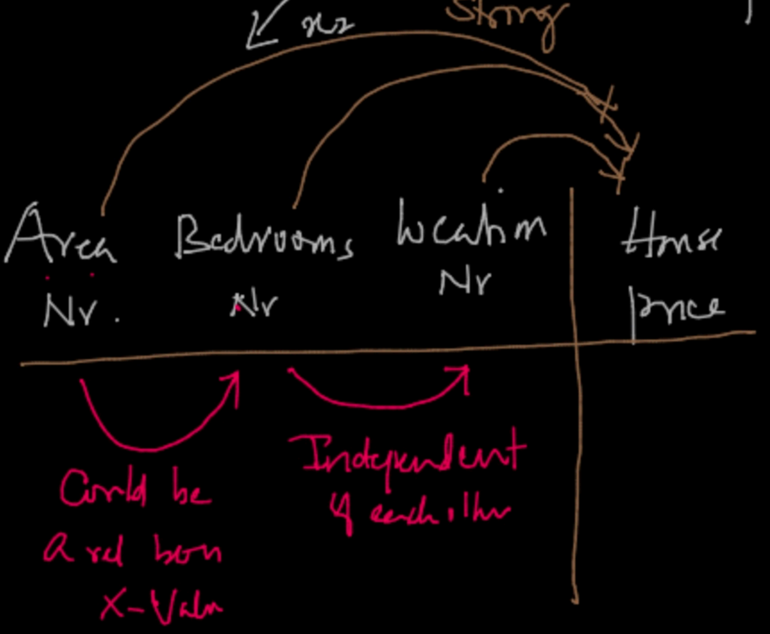
$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_d x_d$$

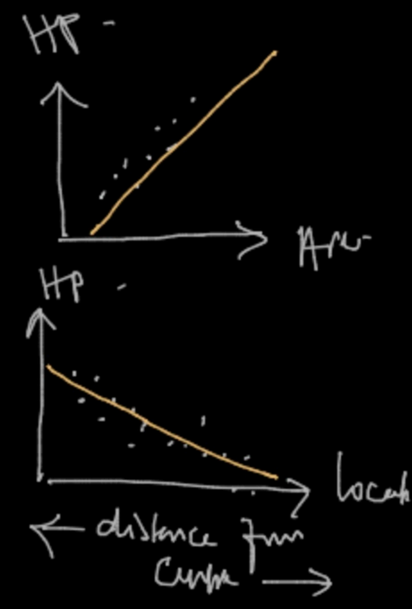
linear combination

2. Assumptions on X-Values

'Multicollinearity problem'

1. The features should be completely independent of each other.
2. The features should be dependent on the y-value. ✓





Assumptions on the residuals.

1. Mean = 0 ✓
2. Std deviation ⇒ Constant →
3. Normally distributed ✓
4. No auto correlation.

beta values

	x_1	x_2	x_3	y	$\hat{y}$	Errors / residuals
1	20	11	0.5	3	2.5	0.5
2	23	7	1	4	3.1	0.8
:	32	8	2	7	7.4	−0.4
n	.	.	.	.	.	⇒ n

Independent.

Mean = 0

Mean +ve : y is always more than $\hat{y}$

Mean −ve ; 'y' is always < $\hat{y}$

Mean = 0

Residual

+1
−2.3
+3.4
+0.8
:

Mean ≠ 0 ?

$y - \hat{y}$ ⇒ Actual y > Predicted $\hat{y}$

y	$\hat{y}$	
50	41	+
63	59	+
74	66	+

+ve

Mean = 0

Errors

−ve

Random data → Normally distributed.

Finder File Edit View Go Window Help

zoom 67% Tue 5 Dec 6:23 PM

You are screen sharing Stop Share

Talking: Geethika

You are screen sharing | Stop Share

Talking: Geethika

1 unit

Sp Vol Wt

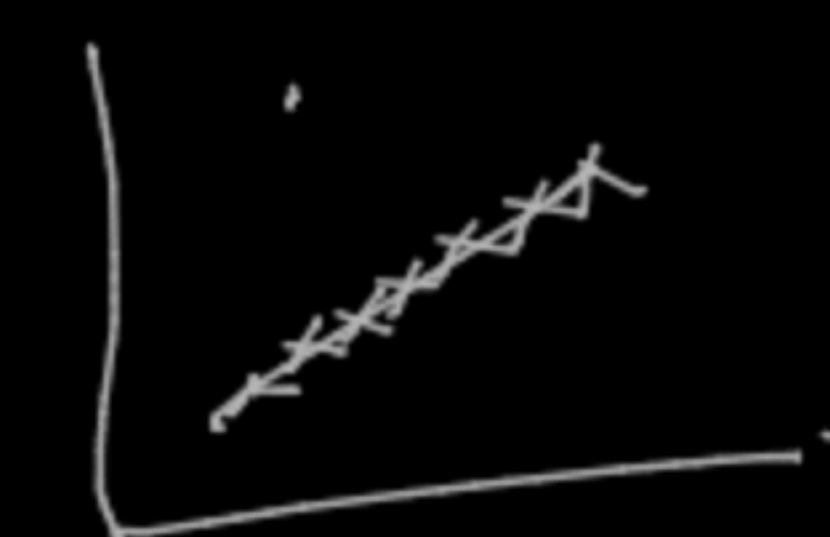
$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$$

constant

$$\begin{cases} \beta_1 = 0 \\ \beta_1 \neq 0 \end{cases}$$

WT ⇒ mileage ?

Vol → mileg.



x_1 y →

x_1	x_2	x_3	y

⇒ ?

x_1	x_2	y

⇒ ?

R_2

WT Vs Mpg ⇒ .0.277 ✓

VOL Vs Mpg ⇒ .0.28 ✓

R^2

(WT + VOL) = Mpg

so /-

Lower the VIF the better.

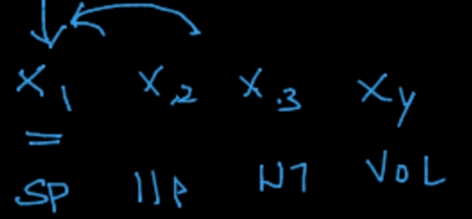
VIF → Variance Inflation Factor

→ Amt of collinearity (multi) in the model.

Lower VIF better the model.

WT ↑

VOL ↓



SP ~ Hp + WT + VOL

R^2 ⇒ ?

SP.

$VIF_{SP.} \Rightarrow \frac{1}{1 - R^2_{SP.}}$

VIF_{WT}

Hp → SP + WT + VOL

R^2

$VIF_{Hp} = \frac{1}{1 - R^2}$

WT → SP. Hp VOL R^2 $VIF_{WT} = \frac{1}{1 - R^2_{WT}}$