Linear Regression - 2

Model

$\Downarrow$

sum of square (errors)

weight (g)	height (cm)	y	$\hat{y}$
90000	178	2000	2200
—	—	2400	2600
—	—	—	

y → sugar level

weight (kg)	height (ft)	y	$\hat{y}$
90	5.10	2	2.2
—	—	2.4	2.5

$\Downarrow$ m_1

$$\Rightarrow (2200 - 2000)^2 + (2500 - 2400)^2$$

$$\Rightarrow (200)^2 + (100)^2$$

$$\Rightarrow 5000$$

$\Uparrow$

50

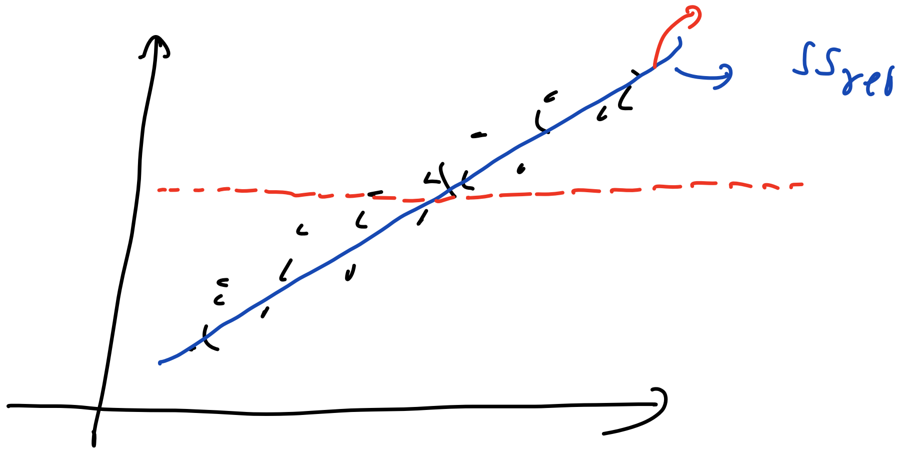
$\Downarrow$ m_2

$$\Rightarrow (2.2 - 2)^2 + (2.5 - 2.4)^2$$

$$\Rightarrow 0.05$$

$\Downarrow$

0.01



x	y	$\hat{y}$	$\bar{y}$
1	10	10	20.33
2	20	20	20.33
3	31	30	20.33

$\bar{y} = Avg(y)$

$y = 10x$

$(31 - 30)^2$

$\Rightarrow 1$

SSres

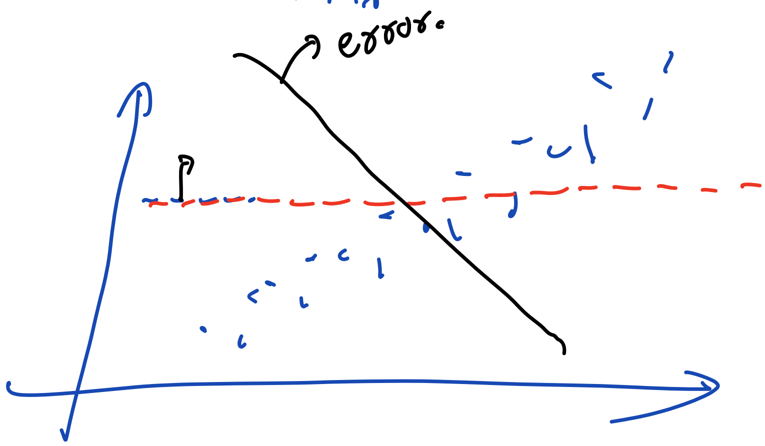
$((10 - 20.33)^2 +$
$(20 - 20.33)^2 +$
$(31 - 20.33)^2$

$\Rightarrow 215$

SStotal

$$\frac{SS_{res}}{SS_{total}} = \frac{1}{215} \approx 0. -$$

$$1 - \frac{SS_{res}}{SS_{total}} \Rightarrow R^2 \text{ metric}$$



$-\infty$ to 1

$\Rightarrow 1 \Rightarrow$ good

$0 \Rightarrow$ dumb model

$< 0 \Rightarrow$ leave ML

Car price prediction $\Rightarrow R^2 = 0.8$

Cancer prediction $\Rightarrow R^2 = 0.8$

$\Rightarrow 0.95+$

Neural Networks $\Rightarrow$ speed

$\Downarrow$

optimise

$\Downarrow$

(ORACLE)

ORAAH

changing

X → model
y → price

$$1 - \frac{SS_{res}}{SS_{total}}$$

SS_{res} → num
SS_{total} → denom

num → $SS_{res} = \Sigma (y - \hat{y})^2$

⇒ np.sum((y - y_hat)**2)

den → $SS_{total} = \Sigma (y - y_{mean})^2$

= np.sum((y - y.mean())**2)

$$\left(1 - \frac{num}{den}\right)$$

sklearn

X	Y
—	—
—	—

slope & intr

model = LinearRegression()

→ fit()

⇓

gradient descent

model. fit(X, Y)

a ⇒ (3,)

a. reshape (a.size , 1)

a ⇒ (3, 1)

model . predict (X)

w_0 w_1

model → car

model. intercept_

model. coef_

model . score (X, Y)

⇓

R^2

OLS $\Rightarrow x_0 \cdot w_0 + w_1 x_1 + w_2 x_2 + w_3 x_3 =$ ___

$x_0 = 1$

$X.shape \Rightarrow (\_\_, 3)$

X

x_0	x_1	x_2	x_3
1	2	2	4
1			
1			
1			

$\Rightarrow (4, 3)$ x[0].shape

ones = np.ones((x.shape[0], 1))

ones = [1, 1, 1, 1]

$\hat{y} = \underbrace{w^T X}_{2f}$ (w) (x)

np.dot(x, weight)

Break: 10:17 PM

$$\frac{\partial L}{\partial w_1} = -2(y-\hat{y})x$$

$$\frac{\partial L}{\partial w_0} = -2(y-\hat{y})$$

~~solo~~ → Gradient descent code ⇒ H/w

1 gdown →

Problem with R^2 → 1 hr.

⇓

R^2

$x_1 \mid x_2 \mid x_3$

⇓

$R^2 = 0.80$

⇓

$x_1 \mid x_2 \mid x_3 \mid x_4$

⇓

$R^2 \geq 0.80$

↓

0.78

Adjusted R^2

$$= 1 - \left[\frac{(1-R^2)(m-1)}{(m-d-1)} \right]$$

\# of samples

\# of features

$$y = w_0 + w_1 x_1 + w_2 x_2 + \cdots + w_d x_d$$

$$\hat{y} = w_0 + w_1 x_1 + 2 x_2 + \cancel{w_3 x_3} - + w_d x_d$$

$$w_3 = 0$$

$$w_4 = -ve$$

$$\hat{y} = w_0 + 2x_1 + 10x_2 + \cdots + w_d x_d$$

$$w_i \Rightarrow 0.004$$

$$\hat{y} = w_0 + \cdots + (-100,000)\, age + \cdots$$

$$(-10)\ odometer$$

$$\Downarrow$$

(0,0)

scale

Data → standardize → z scores

Build model

$\hat{y}_i = w_0 + \dots + (-2)\,\text{age} + \dots$
(-1.6) odometer

$$R^2 = 1 - \frac{SS_{res}}{SS_{mean}}$$

800

$1 - \frac{800}{100}$

$1 - 8$

-7