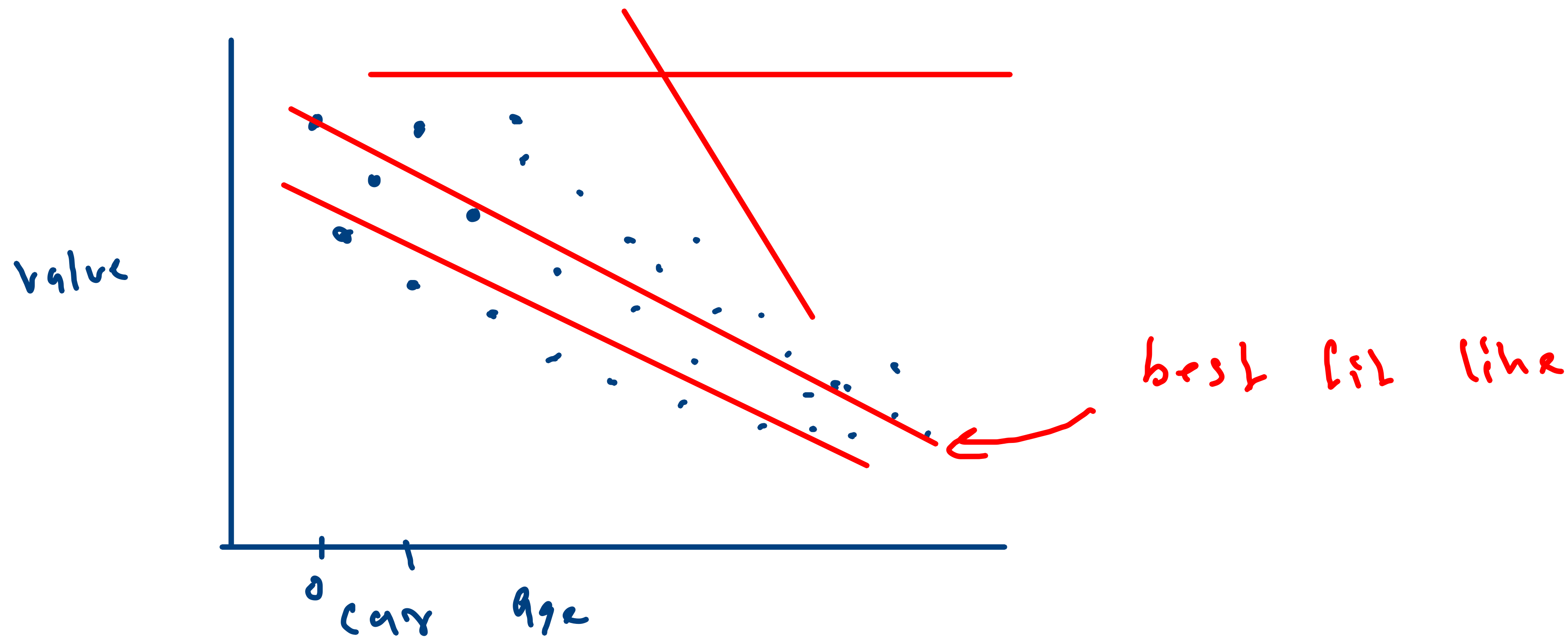
Regression $\longrightarrow$ infinite set

Classification $\longrightarrow$ finite set

Linear Regression

$X \longrightarrow Y$

$x_1\ x_2\ x_3\ x_n$

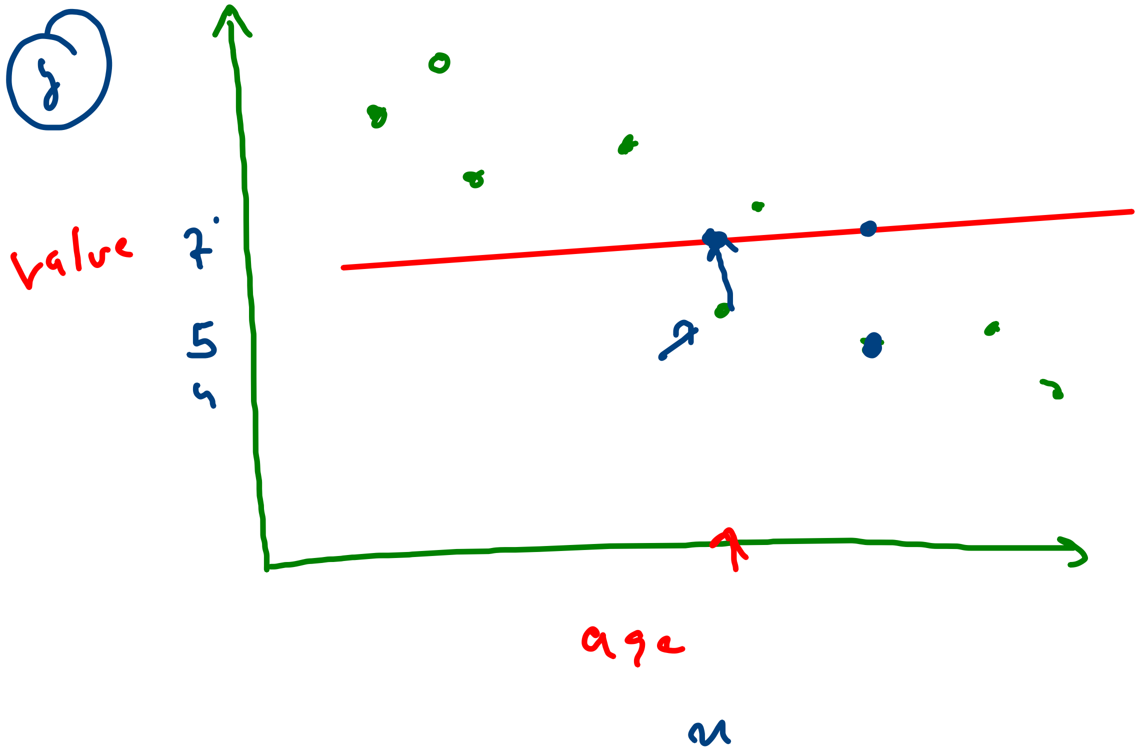


LR → x → y Linear relation

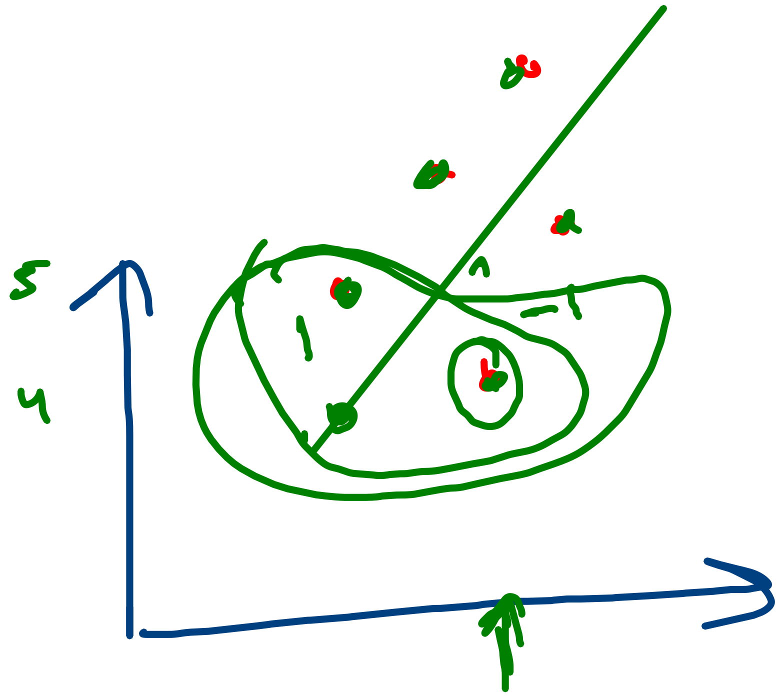
Cost function $= \sum |y_{actual} - y_{predict}|$

$5 - 7 = -2$

$4 - 7.2 = -2.2$



$y = mx +$



$$\sum |y_{act} - y_{pred}|$$

$$4 - 5 = -1$$

$$5 - 4 = 1$$

$\sum 0$

slope, intercept

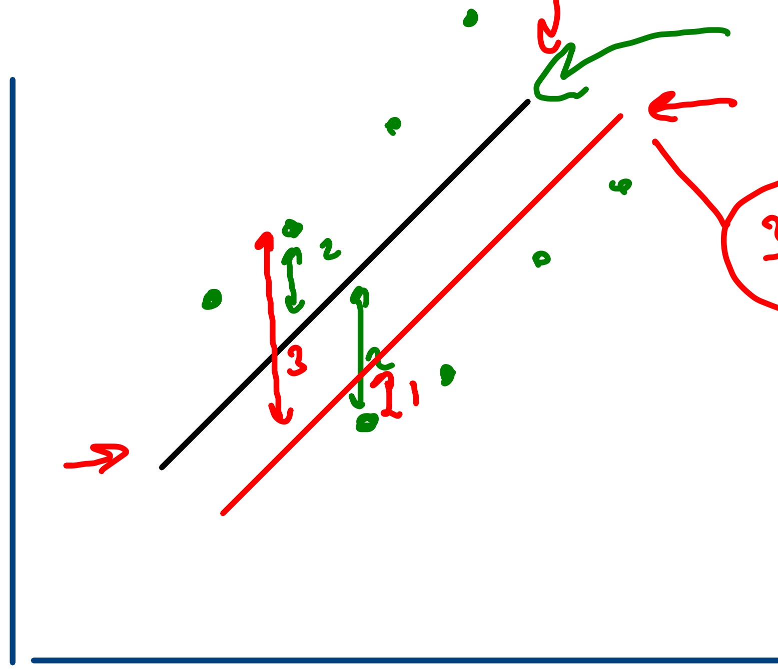
$\boxed{2,2} \rightarrow 2^2+2^2 = 8$

MSE

Cost function $= \frac{1}{m}\sum \left[y_{actual} - y_{predict}\right]^2$

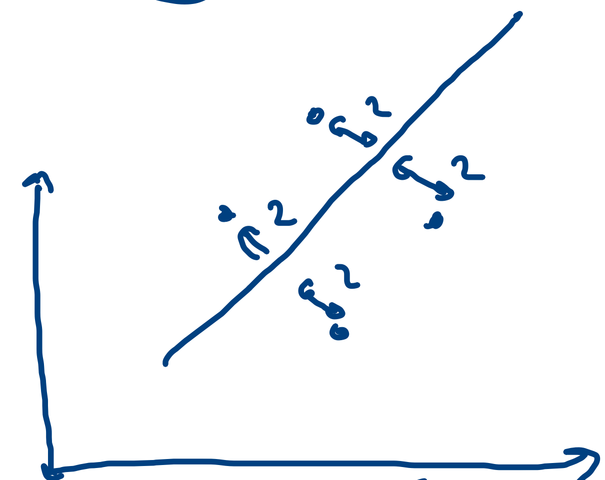
4

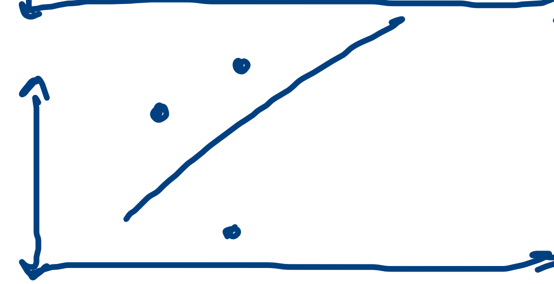
4



$3,1 \rightarrow 9+1 = 10$

$\frac{8}{4} = 2$





$= \frac{6}{3} = 2$

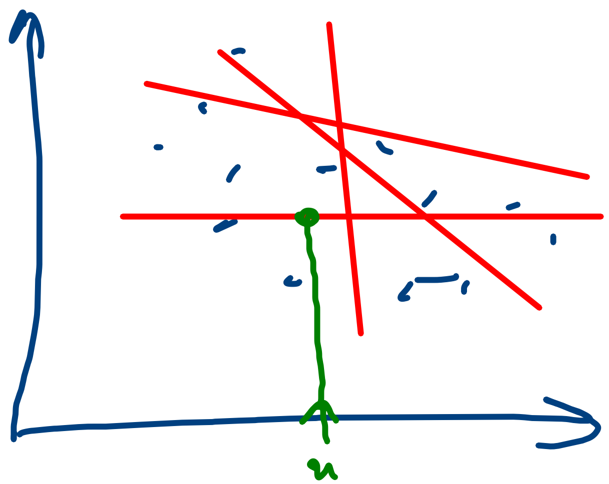
cost function $= \frac{1}{N} \sum \left(y_{actual} - y_{pred} \right)^2$

$f(m, c) = \frac{1}{N} \sum \left(y_a - (mx + c) \right)^2$

line

line $\{ \text{slope}, \text{intercept} \}$

$\{ m, b \}$



best fit $y = mx + c$

★ **Gradient Descent**

initial line $\{ m_1, b_1 \}$ 10

$\{ m_2, b_2 \}$ 8

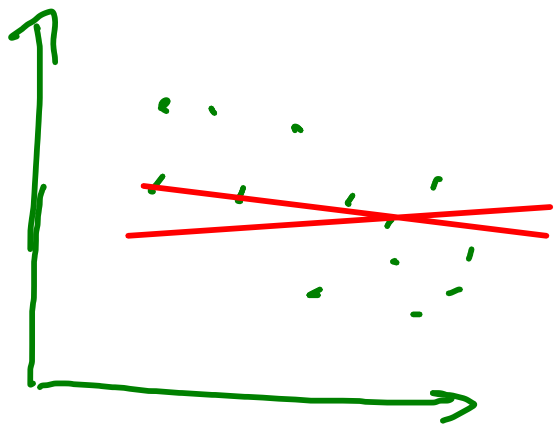
$\{ m_3, b_3 \}$ 5

$\vdots$

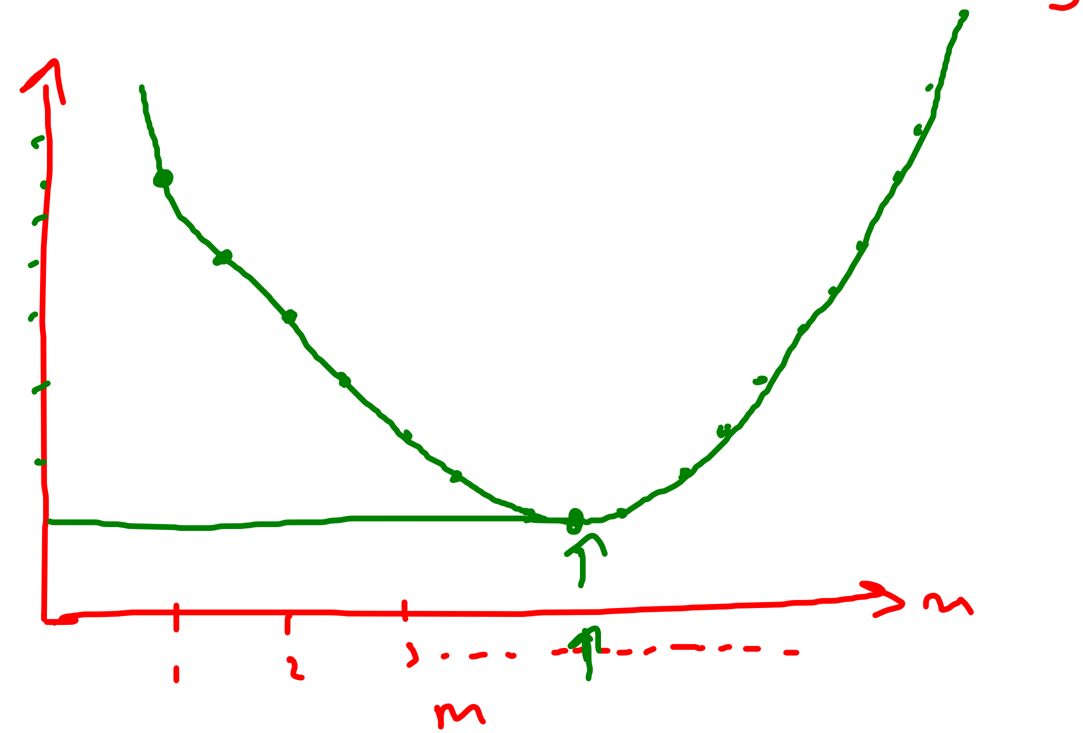
$\to$ 2

$lin = \{m, c\}$

Gradient Descent

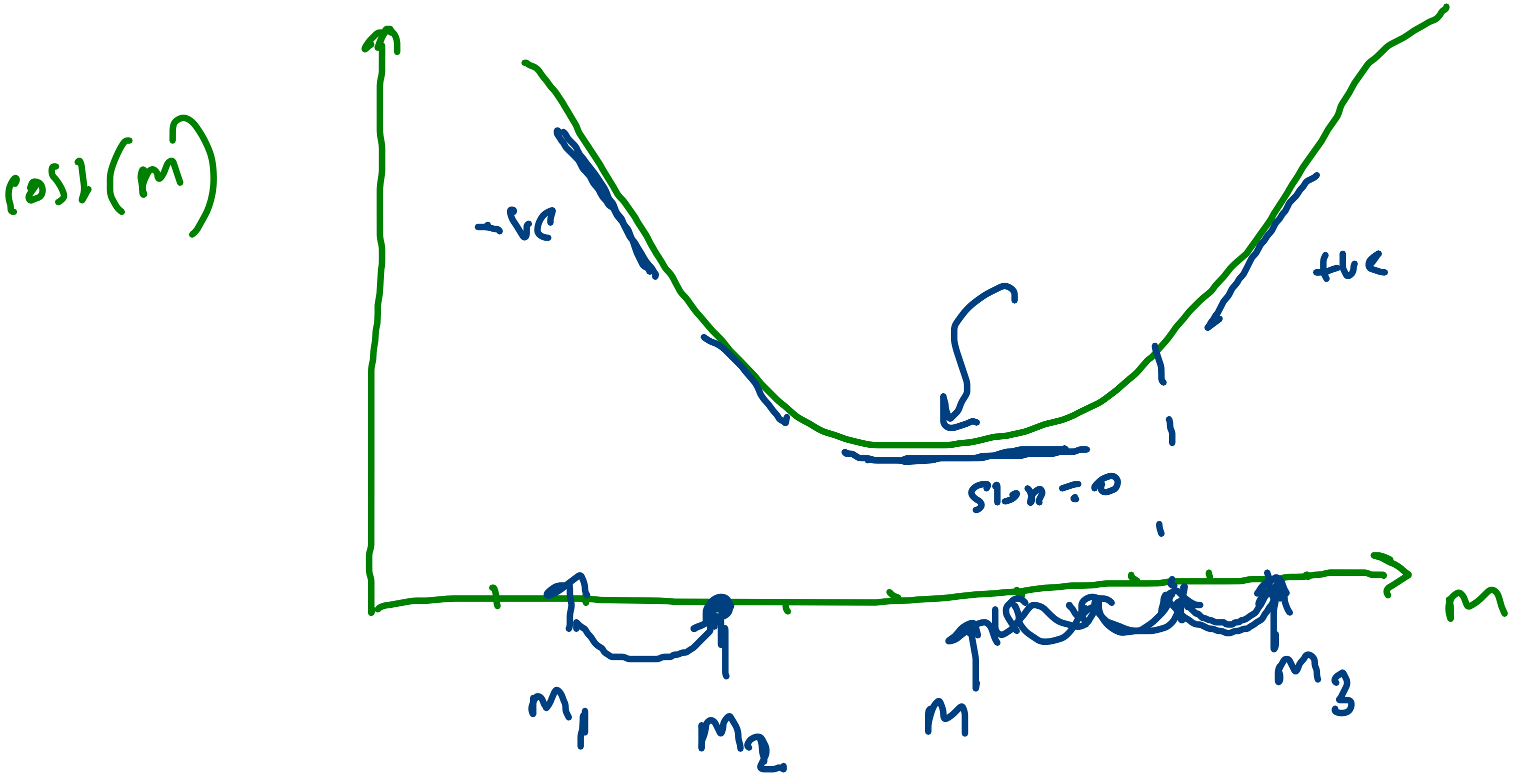


cost (m, c)



$$\boxed{M_{new} = M_{old} - \lambda \frac{d\, cost(m)}{dm}}$$

Learning rate



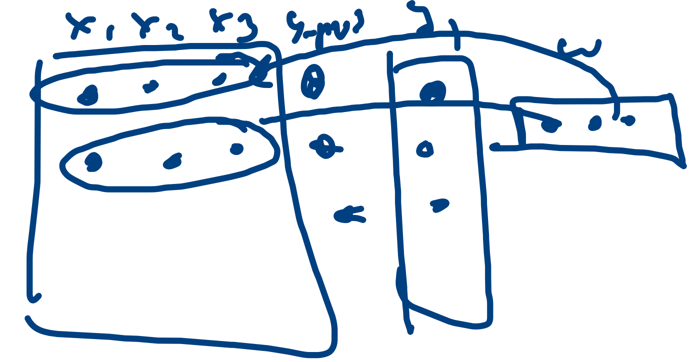
$$M_2 = M_1 - (-ve)$$

$$M_3 = M_2 - (-ve)$$

$$M_4 = M_3 - (+ve)$$

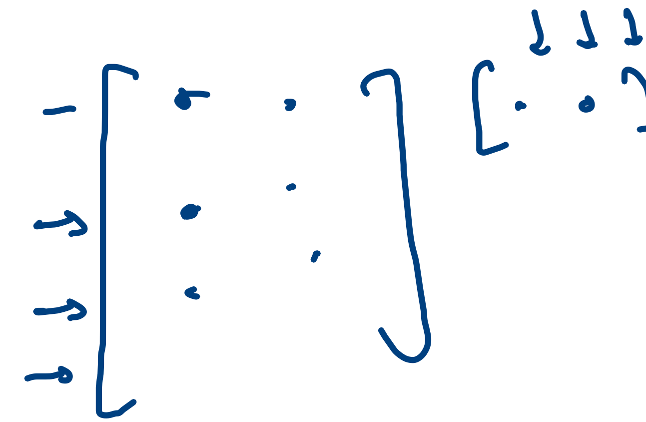
$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{dy}{dx} = \frac{d\, cost(m)}{dm}$$

$$\text{cost} = \frac{1}{N} \sum \left(y_{act} - (mx + b) \right)^2$$



$$\frac{d\,\text{cost}}{dm} = -2 \frac{1}{N} x \sum \left(y_{act} - (mx+b) \right)$$

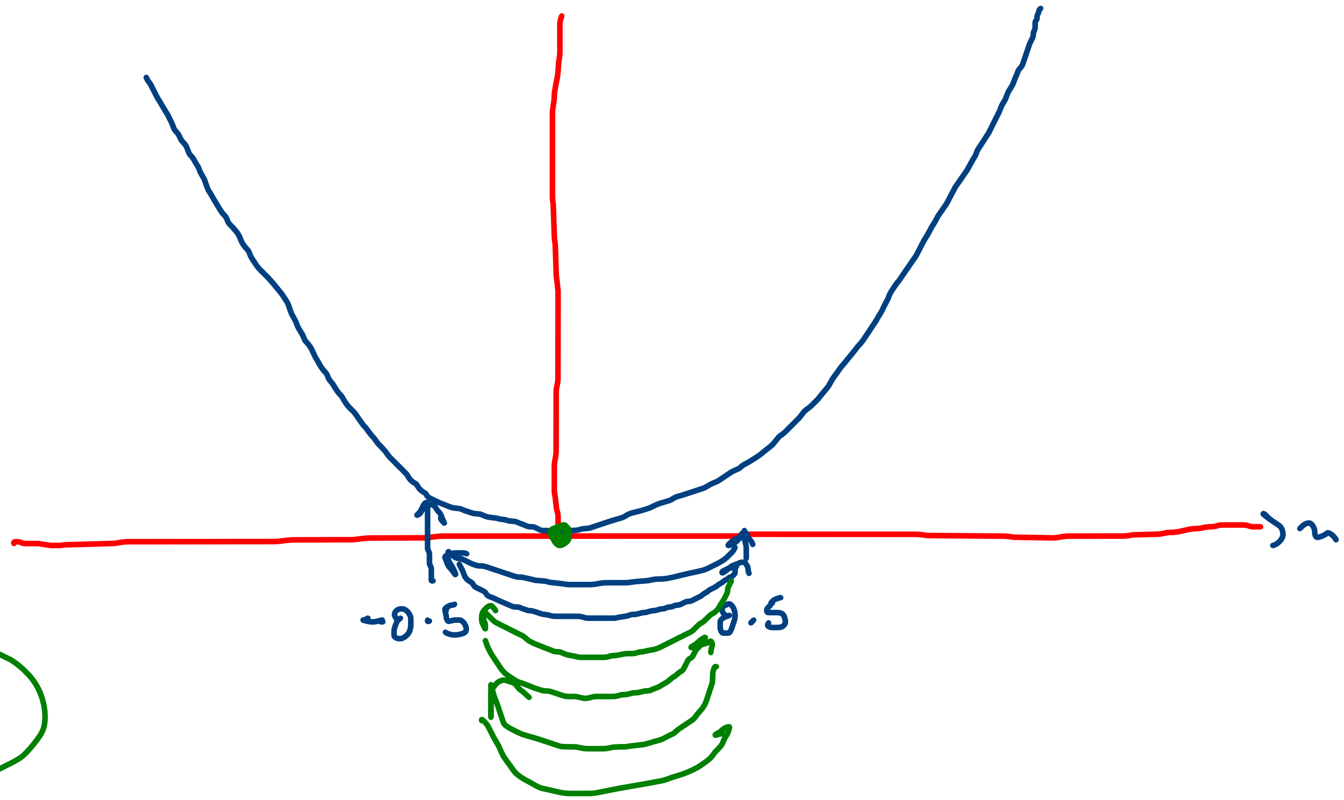
$$\frac{d\,\text{cost}}{db} = -2 \frac{1}{N} \sum \left(y_{act} - (mx+b) \right)$$



$$\boxed{m_{new} = m_{old} - \lambda \frac{d\,\text{cost}(x)}{dm}}$$

λ×1

0.01



$y = x^2$

1

$$\frac{dy}{dx} = \frac{d(x^2)}{dx} = \boxed{2x}$$

$x_2 = x_1 - \text{slope}$

$= 0.5 - 1$

$= -0.5$

$x_3 = x_2 - (-1)$

$= -0.5 + 1$

$= 0.5$

1×0.01

0.01

0.5 − 0.01

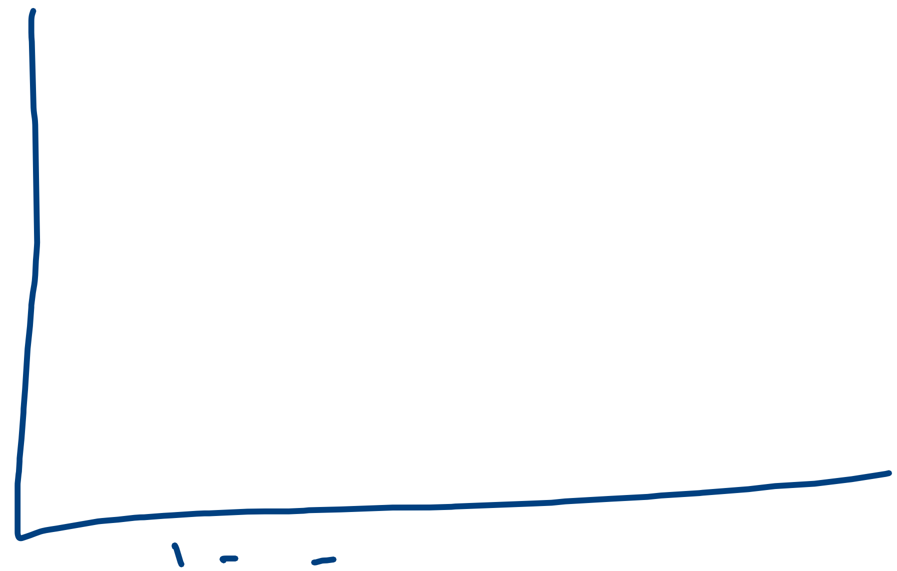
0.49

x

[a b c d e]

shape (5)

[[a]
[b]
[c]
[d]] → (5, 1)



$y = 3x + 5$

$m = 3$

$b = 5$

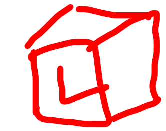
Linear Regression is heavily effected by outlier's

x_1	x_2	
		5
		9
1	4	5
2	4	5
3	3	[illegible]
4	5	[illegible]
5	7	6
6	8	

x_1	x_2	x_3
•	•	•
•	•	•
•	•	•

$$\begin{bmatrix} m_1 \\ m_2 \\ m_3 \end{bmatrix}$$

$$\boxed{y = m_1 x_1 + c}$$



$$y = m_1 x_1 + m_2 x_2 + c$$

$d \rightarrow$ dimensions

$$y = \boxed{m_1 x_1 + m_2 x_2 \text{----} m_d x_d + c}$$

$\uparrow$ m_0

hyperplane

$$\boxed{y = w^T x + b}$$

$\uparrow$ w_0

$$\overset{w^T}{\begin{bmatrix} a & b & c & d \end{bmatrix}} \cdot \overset{x^T}{\begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}}$$

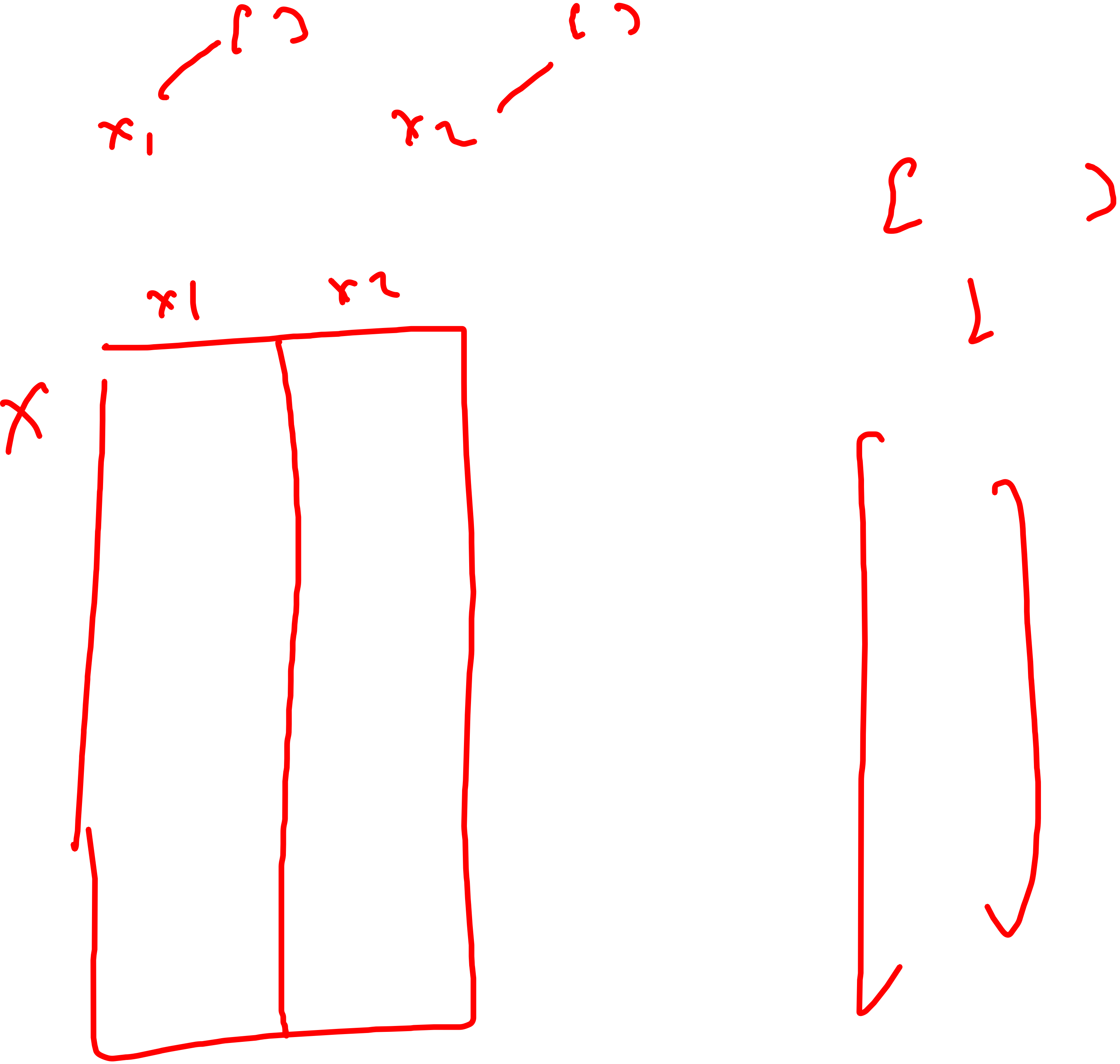
$$\begin{bmatrix} a \times 1 + 2b + 3c + 4d \end{bmatrix}$$

$$\overset{w^T}{\begin{bmatrix} a & b & c & d \end{bmatrix}} \overset{X}{\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}}$$

$$w^T x \longrightarrow \begin{bmatrix} 1a + 2b + 3c + 4d \end{bmatrix}$$

vector $\rightarrow \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$

$X^T \rightarrow \begin{bmatrix} a & \text{b} & c & \text{d} \end{bmatrix}$



x1
x2
x1
x2
X

$$y = w^T x + b$$

x_1	x_2	x_3	x_4
3	7	8	4
•	•	•	•
•	•	•	•

$w^T x$

$w^T x + b$

y

y_1

y_2

y_3

$$\begin{bmatrix} w_1 & w_2 & w_3 & w_4 \end{bmatrix}$$

$$y_1 = 3w_1 + 7w_2 + 8w_3 + 4w_4 + b$$

$$\begin{bmatrix} a & b \\ a & b \\ a & b \end{bmatrix} \quad \begin{bmatrix} a & b \end{bmatrix}$$