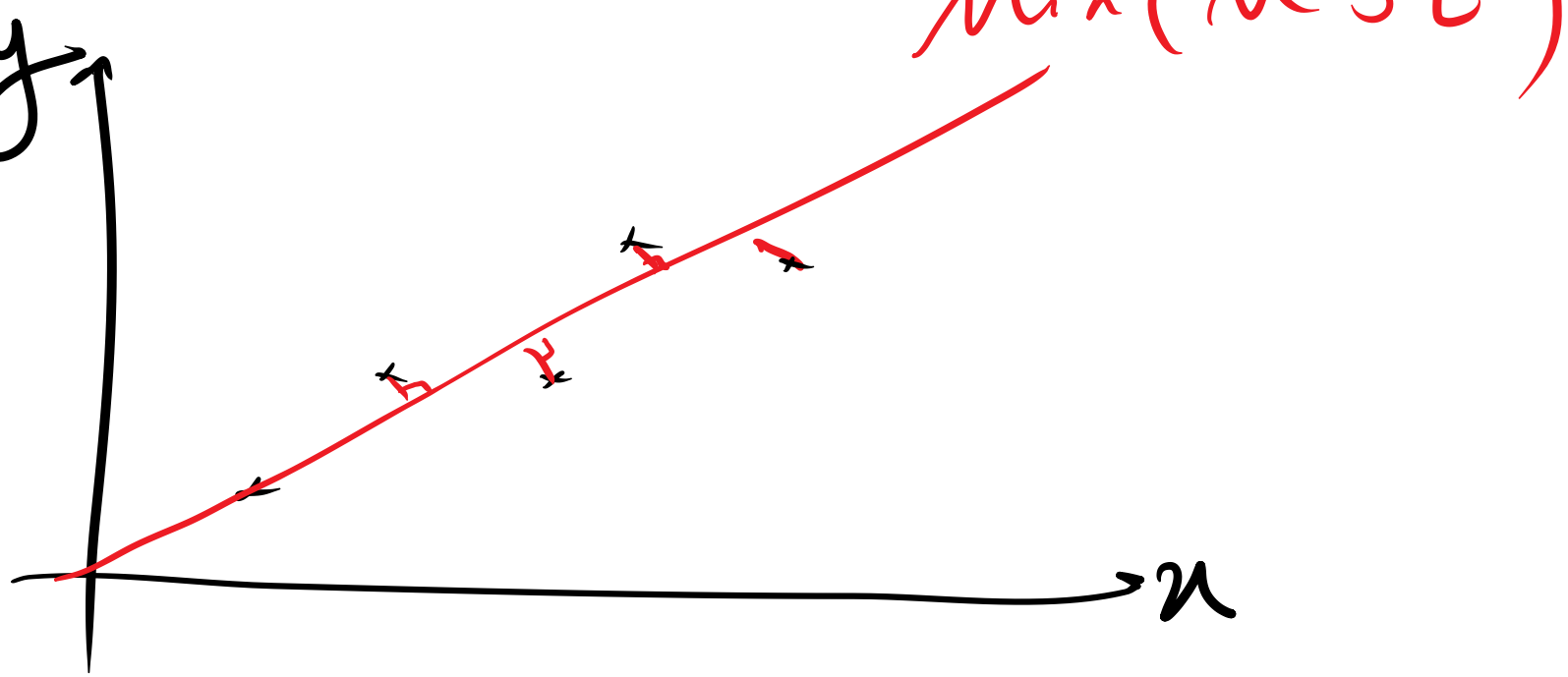
Regression

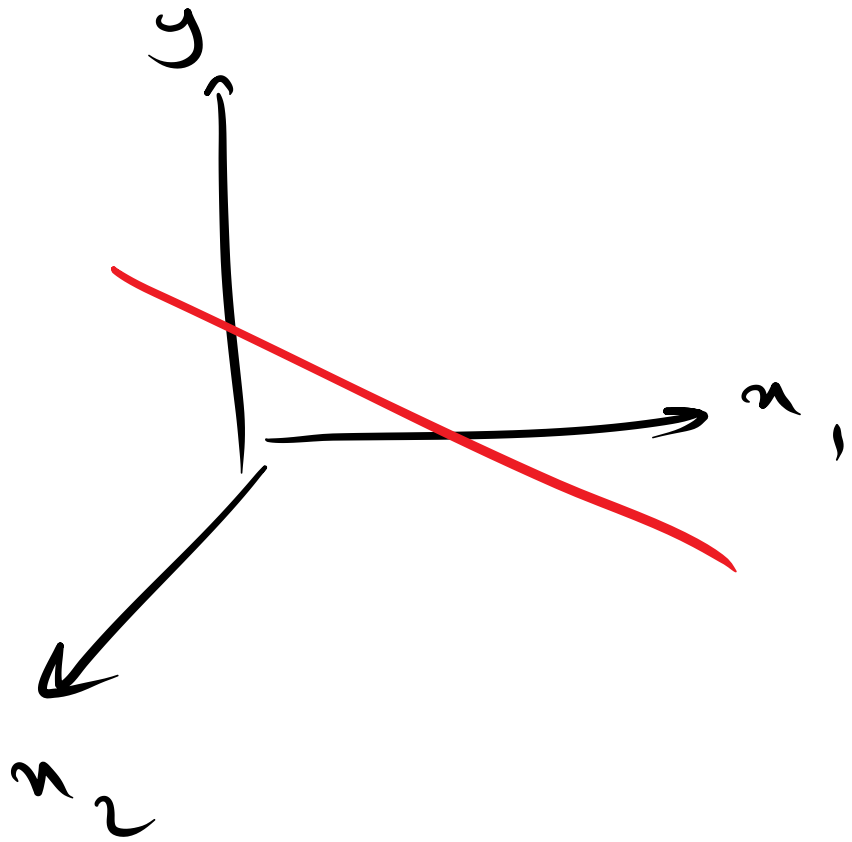
Linear Regression

$$\text{هزینه ارسال} = \alpha_1 \times \text{حجم} + \alpha_2 \times \text{وزن} + \alpha_3 \times \text{تعداد بسته‌های سفارش} + \alpha_4 \times \text{فاصله} + \alpha_5 \times \text{هزینه گمرک} + \alpha_6 \times \text{نوع وسیله نقلیه} + \alpha_7 \times \text{ارزش بسته} + \beta$$

Sup Box

$y = ax + b$




y
x 1
x 2

Ridge Regression : $Min(MSE + \alpha \|\omega_i\|)$

$$y = \omega_1 x_1 + \omega_2 x_2 + \dots + \omega_p x_p + \beta$$

Regularization

$\alpha \uparrow \longrightarrow$ underfit

$\alpha \downarrow \longrightarrow$ overfit

$$Ax = b \qquad \min(\|Ax - b\|)$$

$$y = w_1 x_1 + b$$

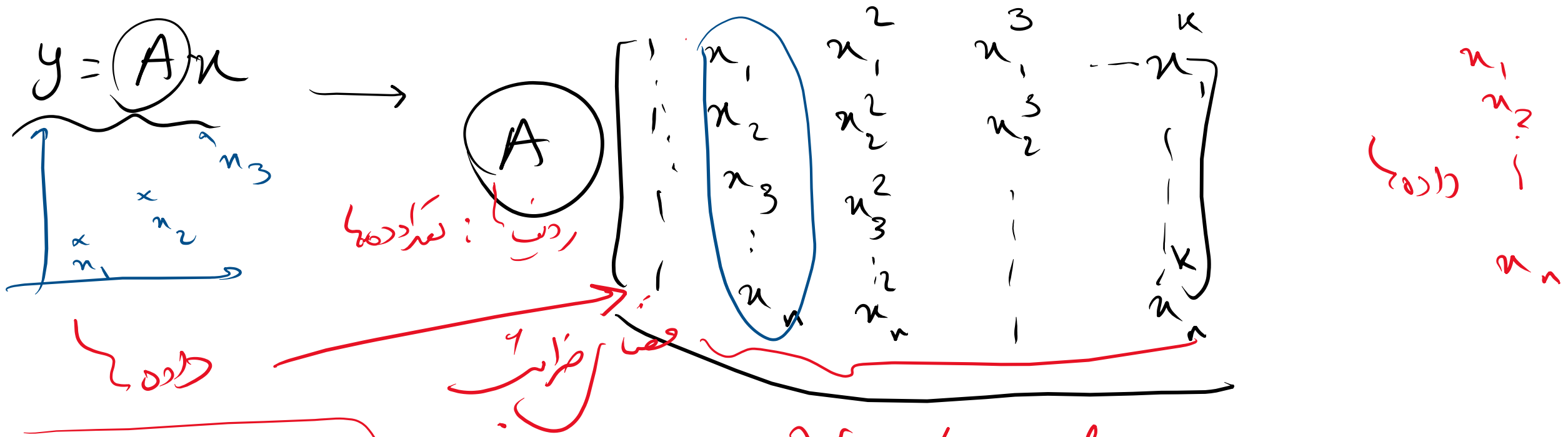
$$y = w_1 x_1^2 + w_2 x_1 + w_3$$

$$y = w_1 x_1^2 + w_2 x_1 + w_0$$

$$y = w_1 + w_2 x_1 + w_3 x_1^2 + w_4 x_1^3 + \cdots + w_{n+1} x_1^n$$

$$x = A^{\dagger} b$$

1 feature



$y = w_1 x_1 + b$

$k \quad k-1$

$y = w_1 x_1^{k-1} + w_2 x_1^{k-2} + w_3 x_1^{k-3} + \cdots + b$

features

- تعداد داده‌ها و ویژگی‌ها مرتبط.
- رگرسیون چندجمله‌ای
- اعمال رگرسیون خطی در فضای مرتبط.

$$y = w_1 x_1^2 + w_2 x_1 + w_3$$

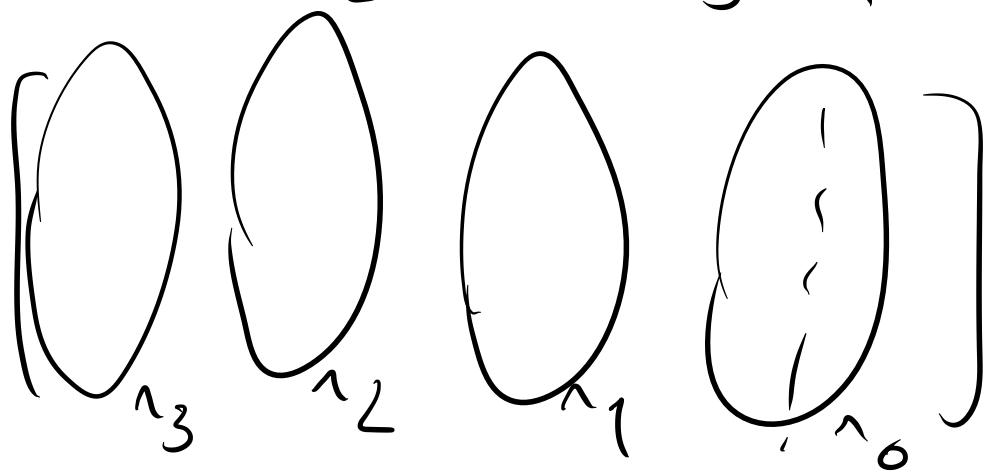
$$y = w_1 P + w_2 Q + R$$

$$\begin{bmatrix} P & Q & R \\ x_{1,1}^2 & x_{1,1} & 1 \\ x_{2,1}^2 & x_{2,1} & 1 \\ x_{3,1}^2 & x_{3,1} & 1 \\ \vdots & \vdots & \vdots \\ x_{N,1}^2 & x_{N,1} & 1 \end{bmatrix}$$

Vandermonde

$$\begin{bmatrix} x_1 \\ x_{1,1} \\ x_{2,1} \\ x_{3,1} \\ \vdots \\ x_{N,1} \end{bmatrix} \qquad \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix}$$

$$y = w_1 x_1^3 + w_2 x_1^2 + w_3 x_1 + w_4$$

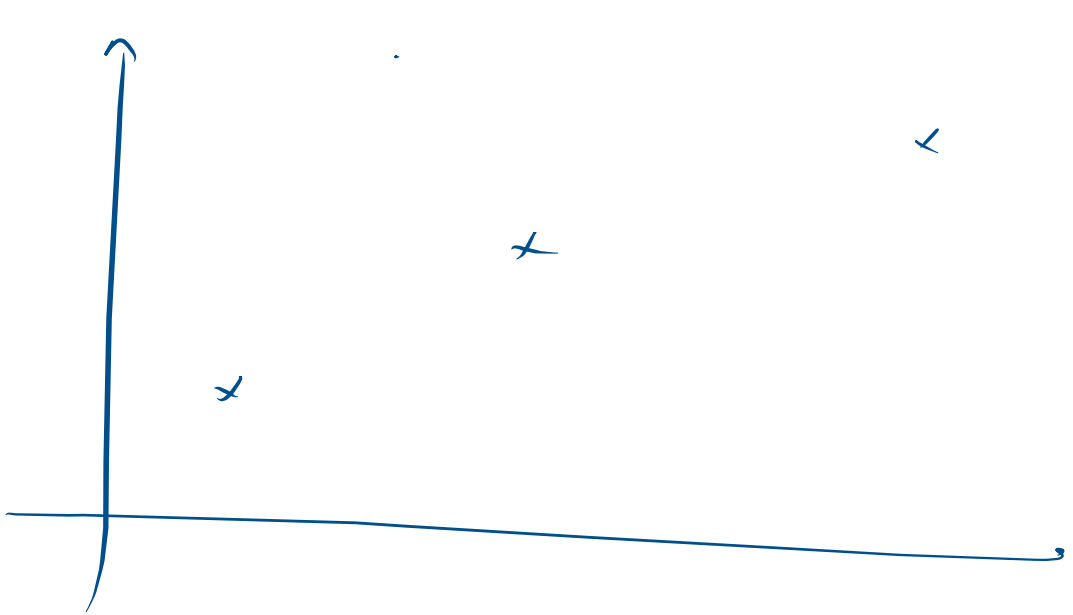


$$y = w_1 x_1^2 + w_2 x_2^2 + w_3 x_1 + w_4 x_2 + w_5 x_1 x_2 + w_6$$

رگرسیون چندجمله‌ای درجه 2 روی 2 ورودی

رگرسیون چندجمله‌ای درجه 3 روی 2 ورودی

$$y = w_8 x_1^3 + w_9 x_2^3 + w_9 x_1^2 + w_2 x_2^2 + w_3 x_1 + w_4 x_2 + w_5 x_1 x_2 + w_6 x_1 x_2^2 + w_7 x_1 x_2 + w_8$$



$$A \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = b$$

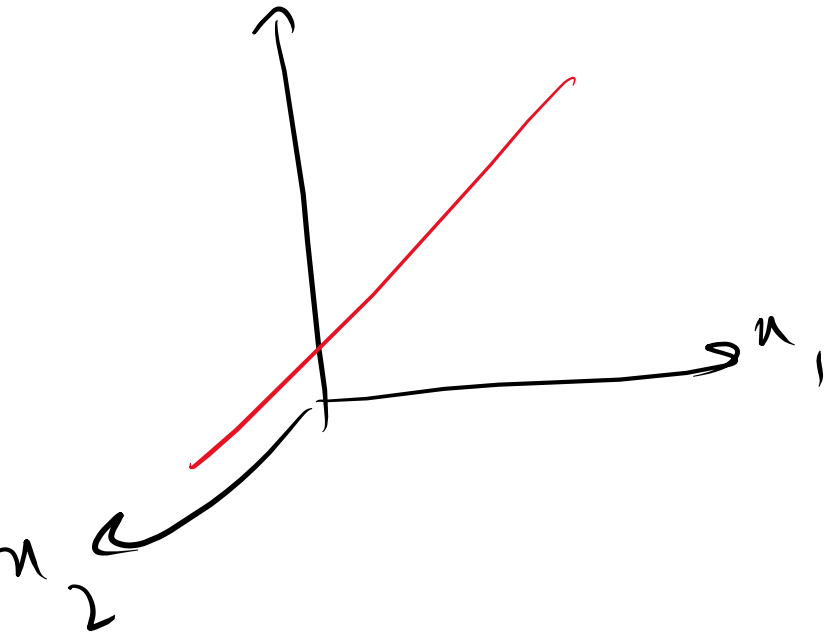
$$\min \left(\| Ax - b \| \right)$$

$$y = w_1 x_1 + w_2 x_2 + b$$

$$A : \begin{bmatrix} & \\ & \\ & \end{bmatrix}$$

features $\begin{cases} x_1 \\ x_2 \\ \vdots \end{cases}$

$$y = w_1 x_1^2 + w_2 x_2^2 + w_3 x_1 + w_4 x_2 + b + w_5 x_1 x_2$$



$y = A x$

$n \times 1$ $\quad n \times 6$

$x_1 \quad x_2$

ستون دوم

$$y = w_0 + w_1 x_1 + w_2 x_2 + w_3 x_1 x_2 + w_4 x_1^2 + w_5 x_2^2$$

$$\begin{bmatrix} | & x_{1,1} & x_{1,2} & x_{1,1}x_{1,2} & x_{1,1}^2 & x_{1,2}^2 \\ | & | & | & | & | & | \\ | & x_{n,1} & x_{n,2} & x_{n,1}x_{n,2} & x_{n,1}^2 & x_{n,2}^2 \end{bmatrix}$$

سطر دوم

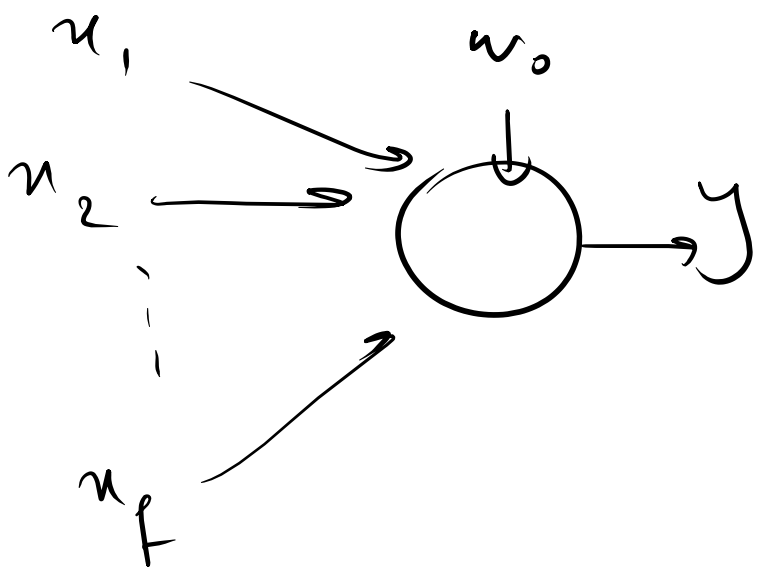
مثال صورت

$X_{100\times 3}$ → PCA → $X_{100\times 2}$ → LR / PR → w_1 w_2

Logistic Regression → classification مسئله 2

LR ↘

$$y = w_1 x_1 + w_2 x_2 + w_3 x_3 + \dots + w_p x_p + w_0$$



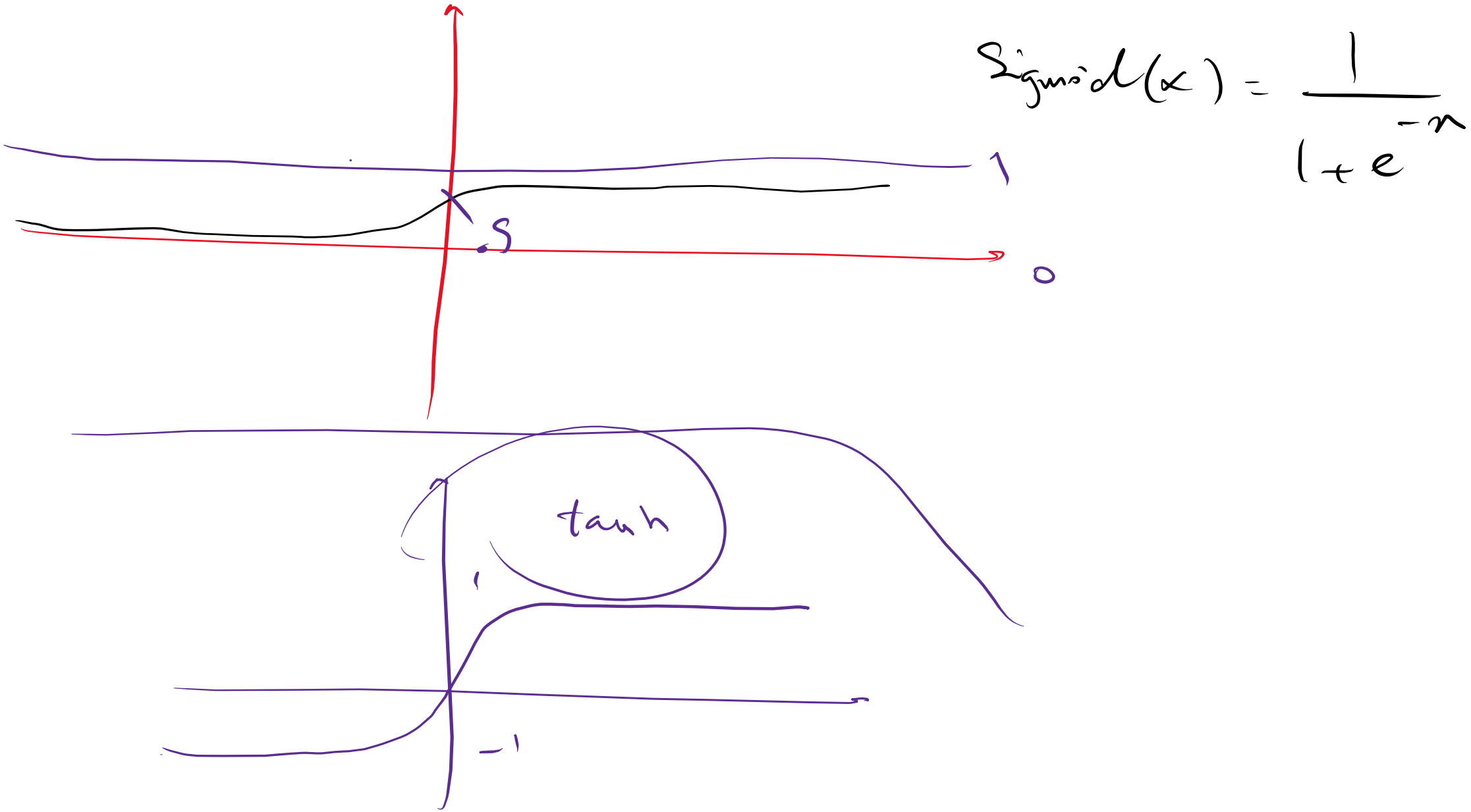
$$y = \text{Logistic}\left(\sum_{i=0}^{p} w_i x_i\right)$$

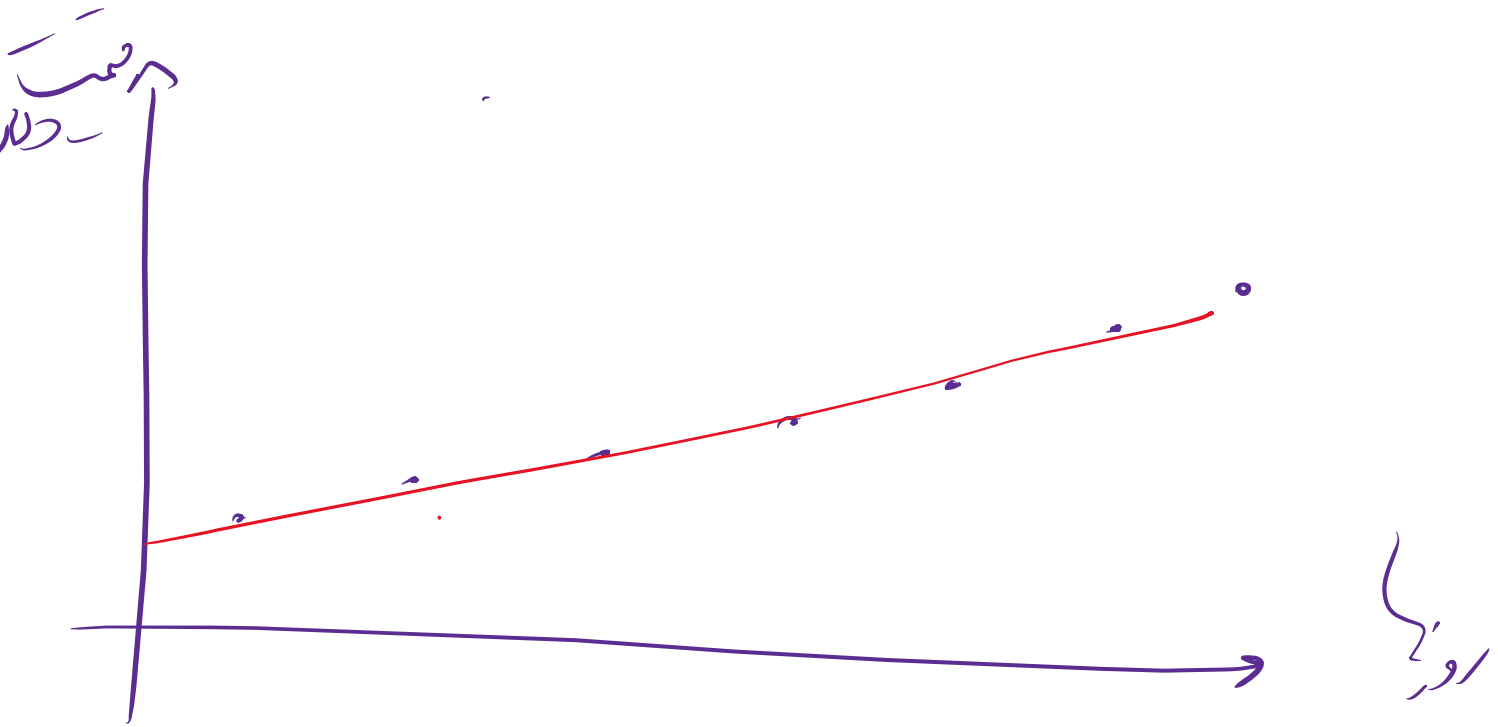
Sigmoid

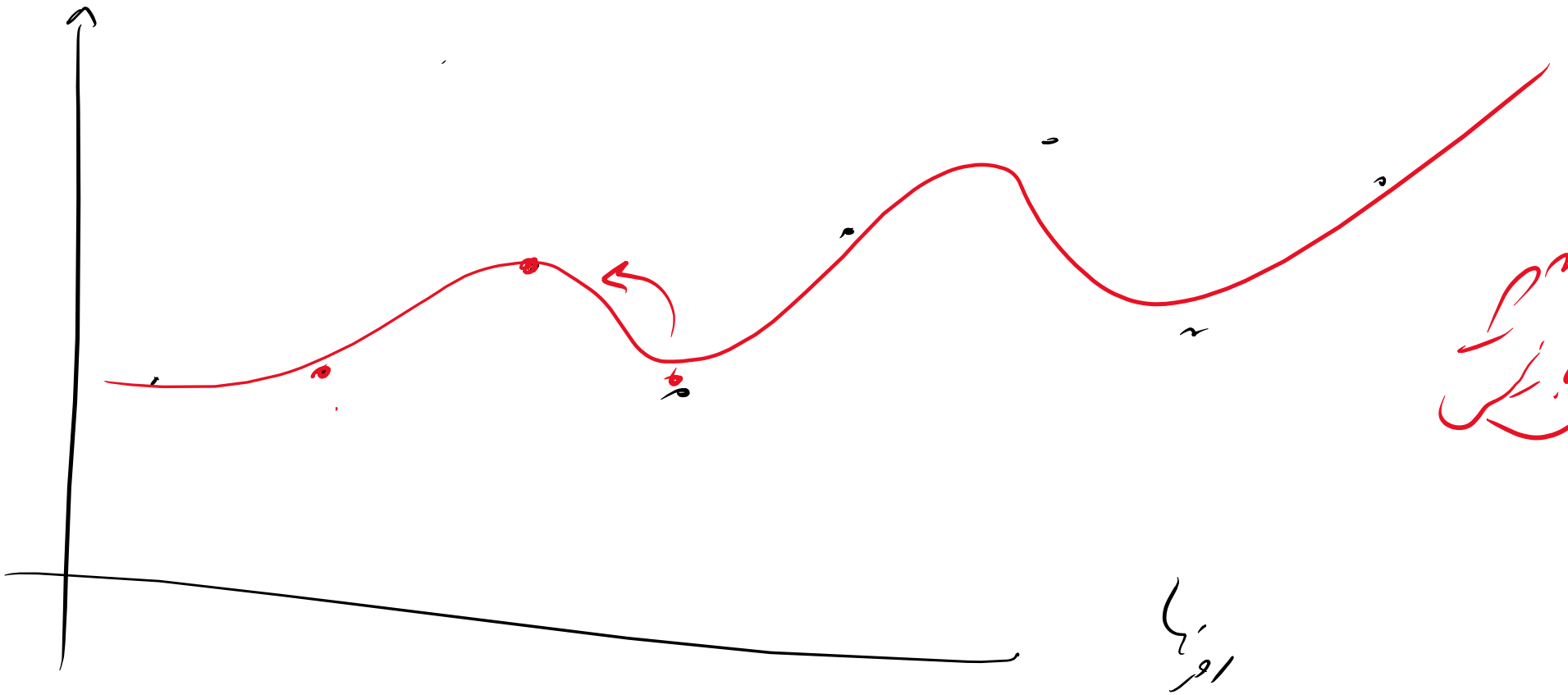
y: 0 یا 1

0 1

$x_0 = 1$


Sigmoid(x) = 1 / (1 + e^{-x})
1
0
tanh
1
-1



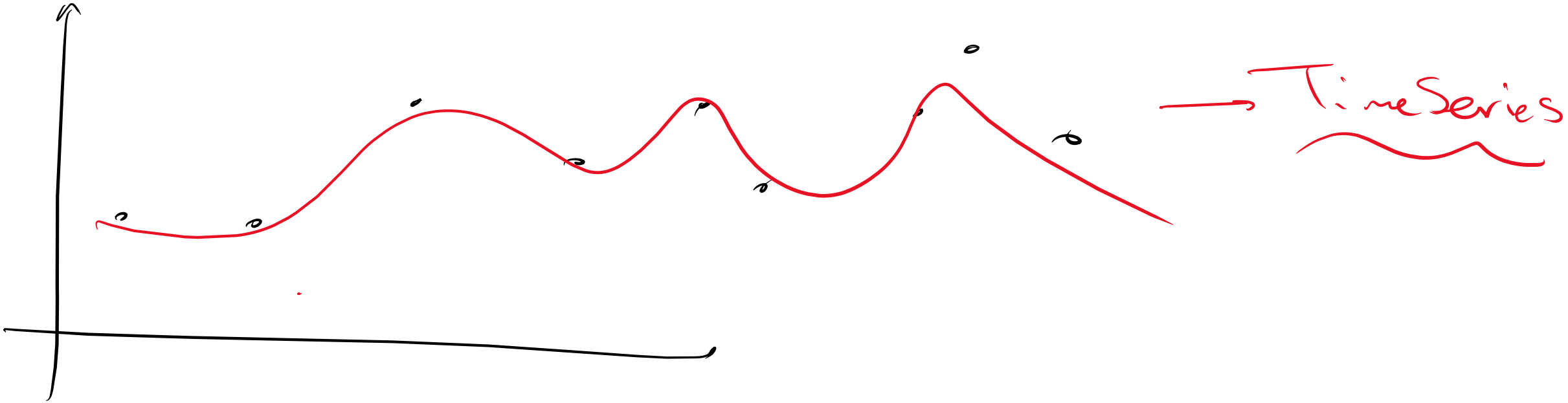


RNN

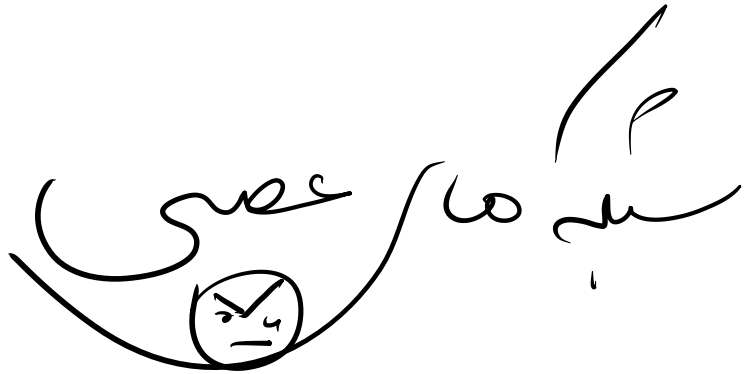
LSTM

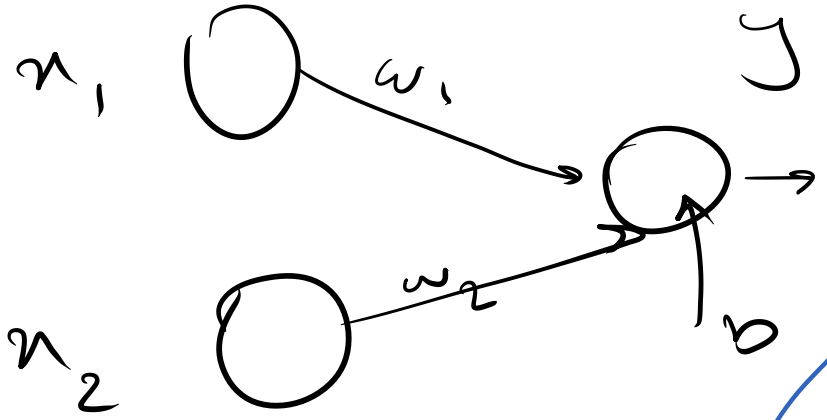
GRU

Transformer


TimeSeries

Loss : MSE





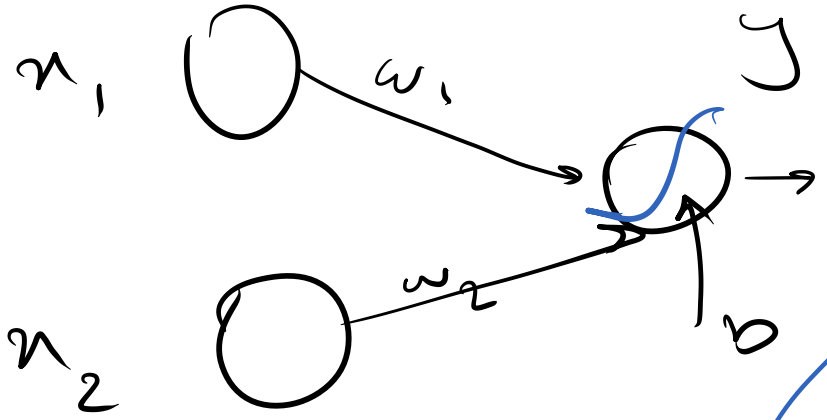
$$y = w_1 x_1 + w_2 x_2 + b$$

$$w_N = w_0 - \alpha E$$

y	x_1	x_2	y'
4	2	3	8
6	3	5	7.7
2	1	0	
5	3	1	

w_1	w_2	b
1	2	0
0.6	1.2	-.1

Loss : MSE



$$y = LS(w_1 x_1 + w_2 x_2 + b)$$

$$w_N = w_0 - \alpha E$$