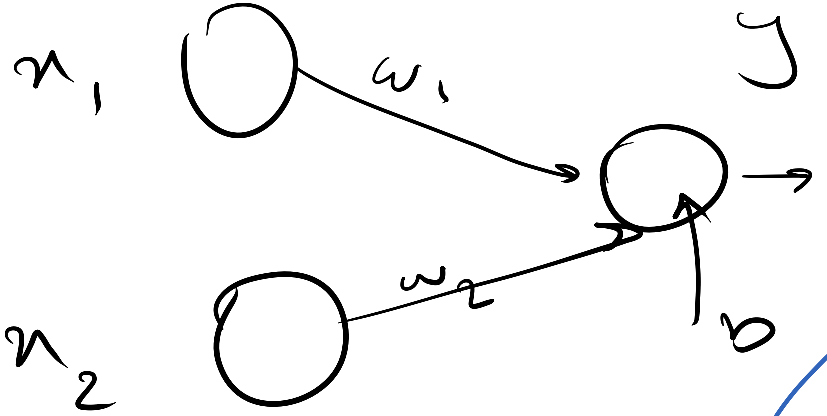
Loss : MSE

شبکه های عصبی



$$y = w_1x_1 + w_2x_2 + b$$

رگرسیون خطی

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

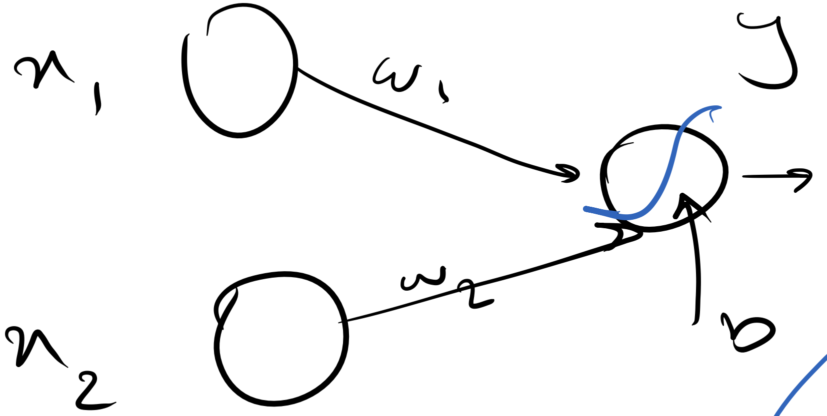
خطا

w_1	w_2	b	
1	2	0	← Random
0.6	1.2	-.1	

$$w_N = w_0 - \alpha E$$

Loss : MSE

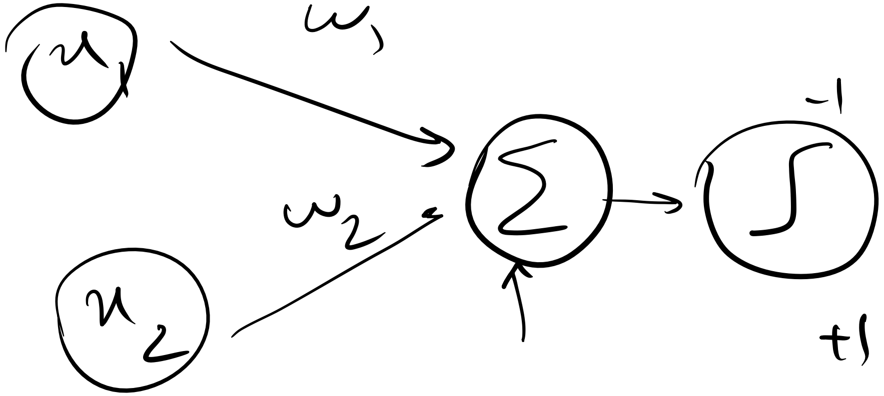
شبکه های عصبی



$$y = LS(w_1x_1 + w_2x_2 + b)$$

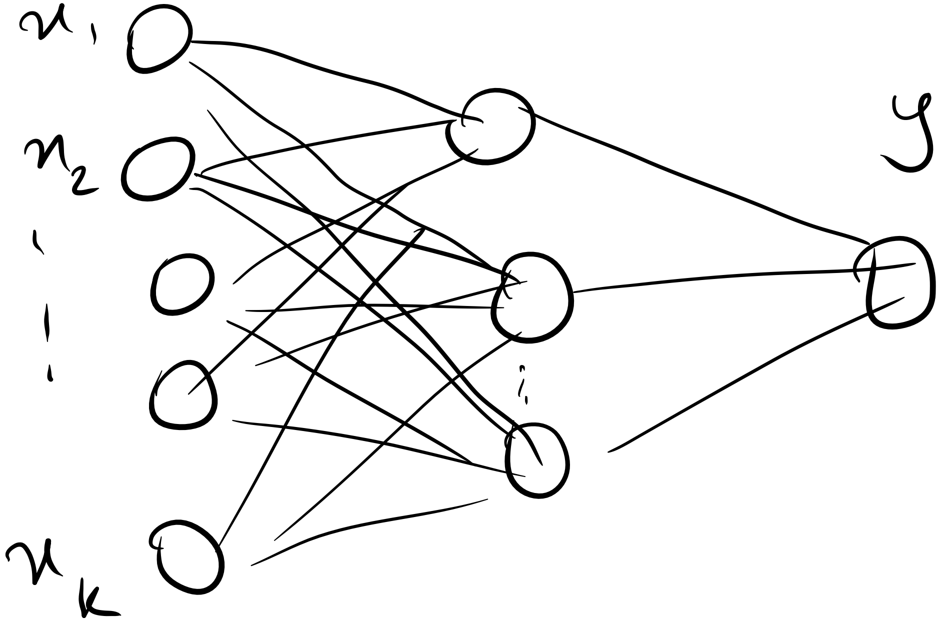
$$w_N = w_0 - \alpha E$$

perceptron

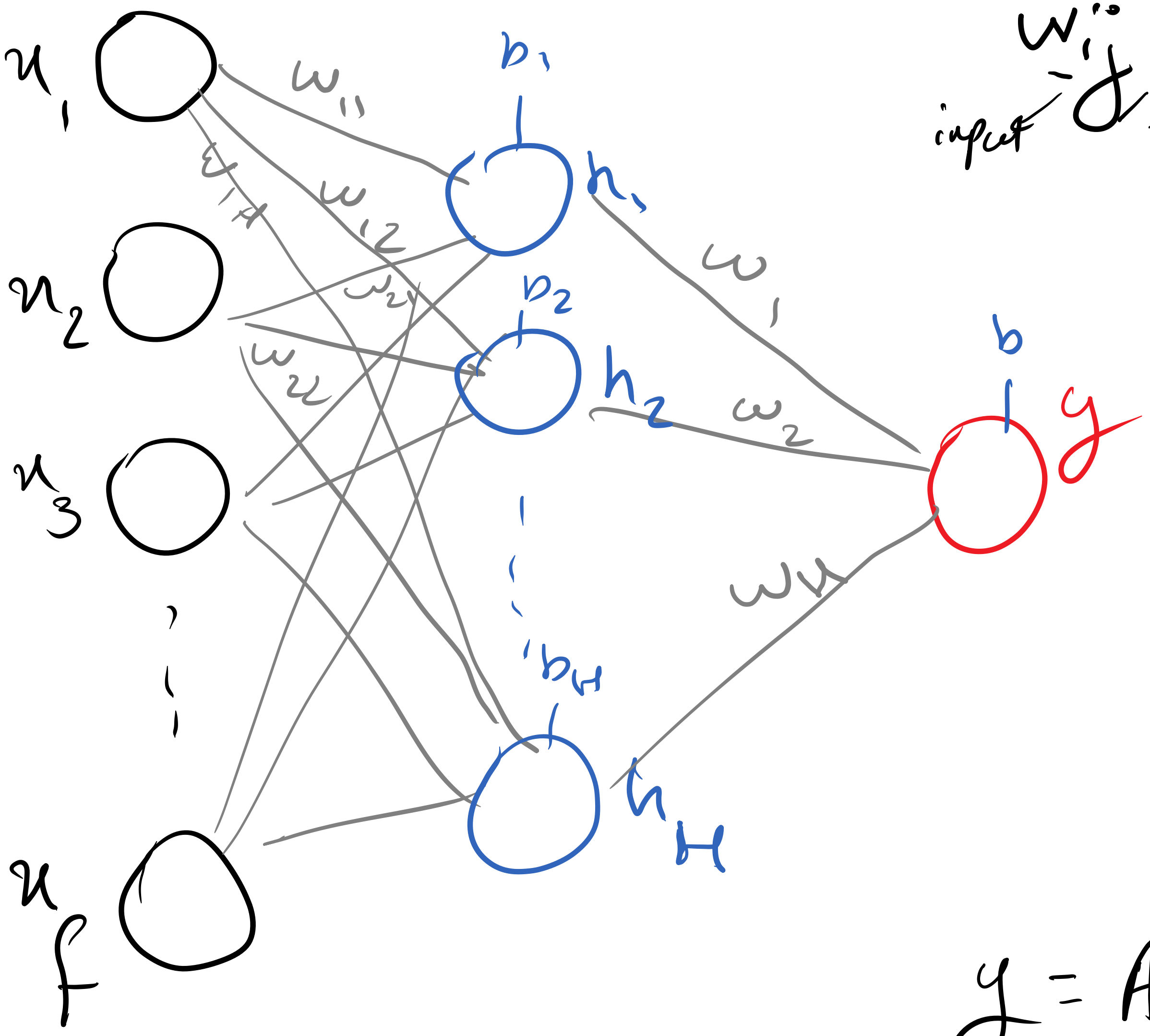


$$w_N = w_0 - x_i y_i$$

MLP



MLP



w_{ij}: input i $\rightarrow$ hidden j

w_j: hidden j $\rightarrow$ output

$$h_1 = Af_1\left(\sum_{i=1}^{f} w_{i1} \times x_i + b_1\right)$$

$$h_j = Af_1\left(\sum_{i=1}^{f} w_{ij} x_i + b_j\right)$$

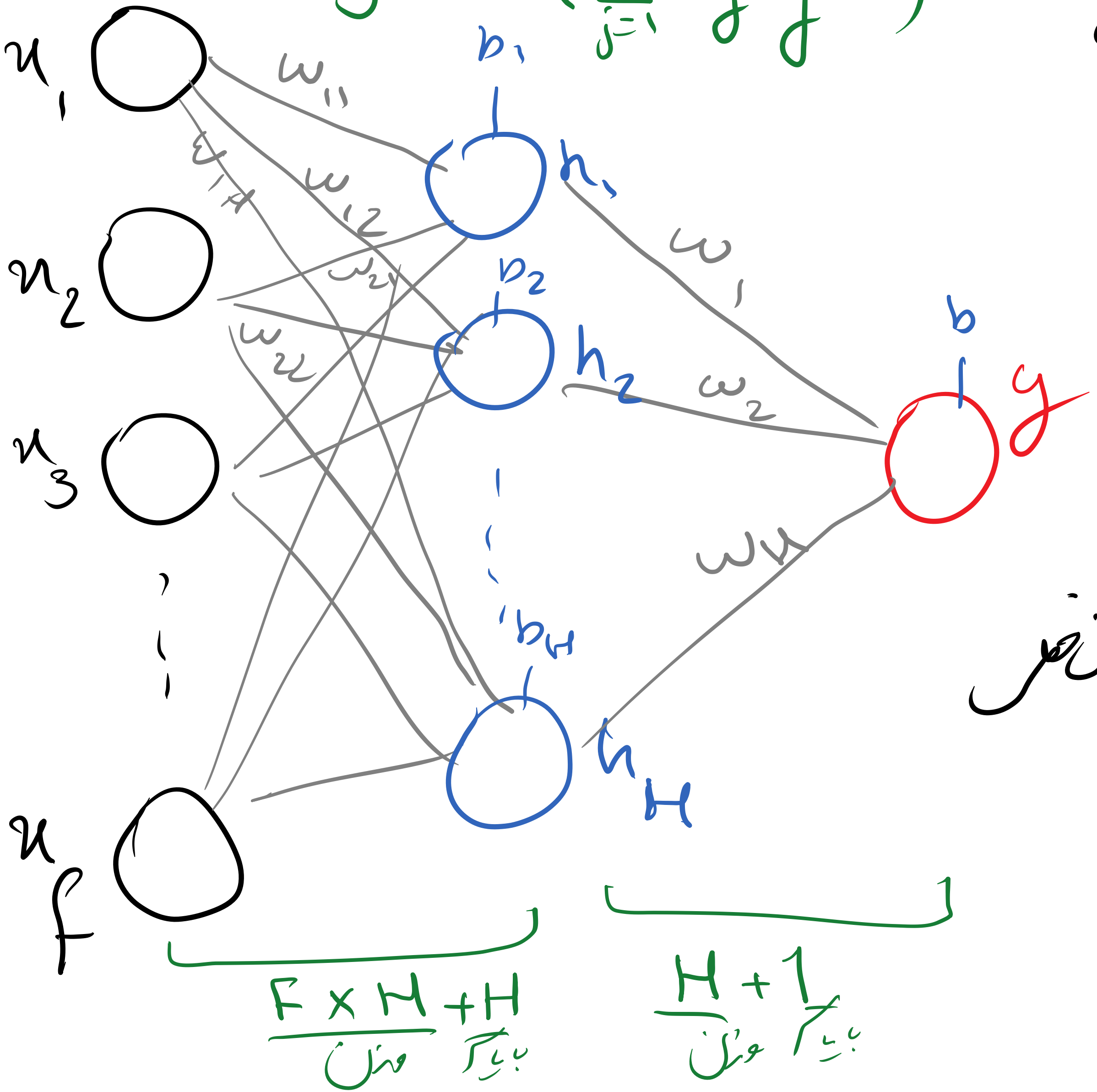
$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$

$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$

$$h_j = Af_1\left(\sum_{i=1}^{F} w_{ij} x_i + b_j\right)$$

$x_0 = 1$

$w_0 \to b$



مشتق پذیر → Af

✓Af_1 → رگرسیون غیرخطی

$Af_1 \times 1$ → رگرسیون خطی

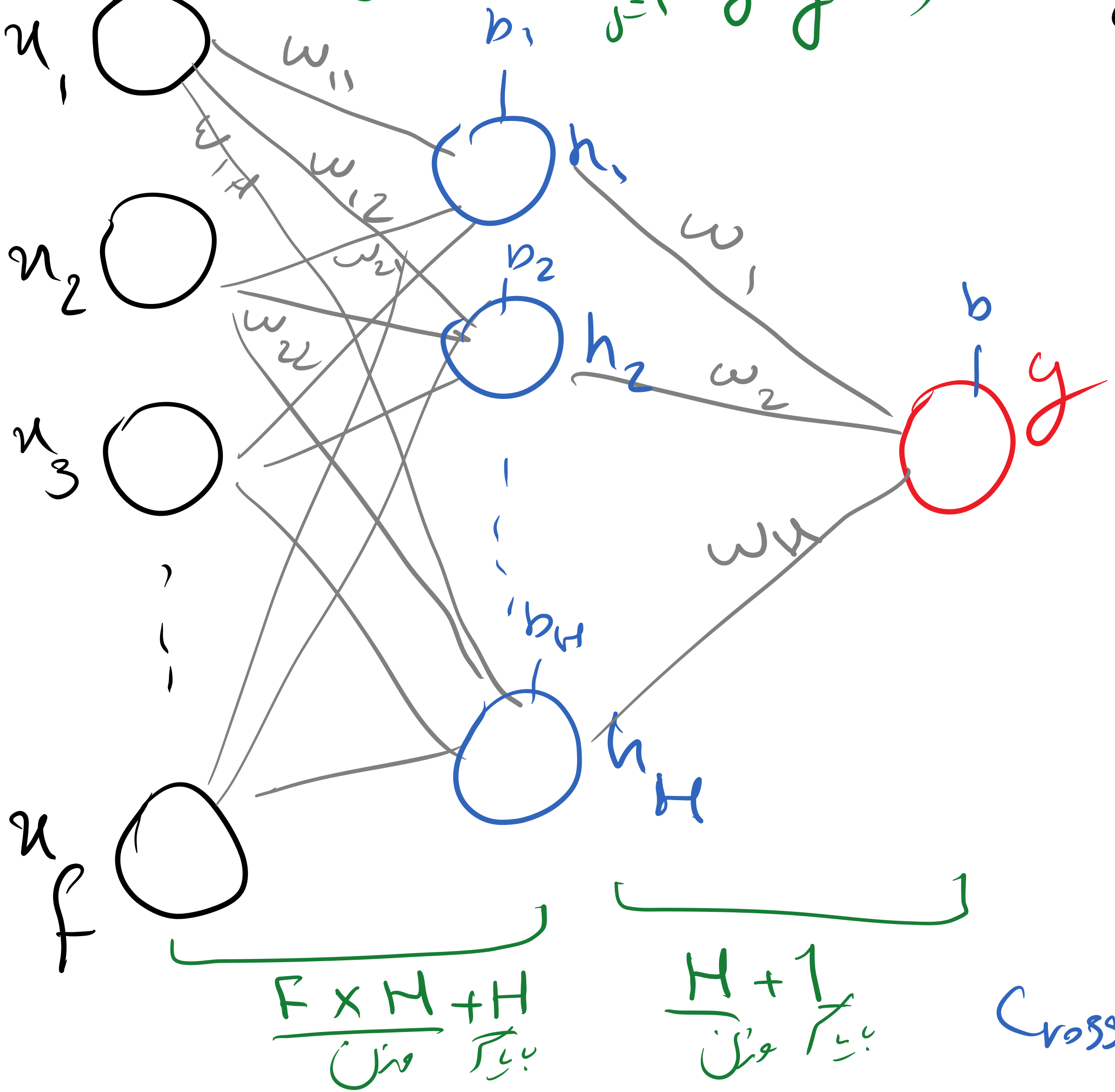
رگرسیون → Af_2 گرادیان ثابت

دسته بندی → Af_2 گرادیان محدود

Sigmoid tanh) → دسته بندی غیرخطی

Af_y → پیچیده " "

$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$



$$h_j = Af_1\left(\sum_{i=1}^{F} w_{ij} x_i + b_j\right)$$

$$\boxed{\begin{array}{l} x_0 = 1 \\ w_0 \rightarrow b \end{array}}$$

اکثرا

رگرسیون : Loss : MSE $+ \alpha \|w\|$

دسته‌بندی : Loss : $\rightarrow$ BCE دوطبقه

$\rightarrow$ CCE چندطبقه

$+ \alpha \|w\|$

Entropy: $\sum_{i} p_i \log(p_i)$

Cross Entropy: $\sum_{i=1} y_i \log(p(\hat{y}_i))$

رگرسیون

$\hat{y}_i$: خروجی مورد انتظار	1.5	1.2	.2	1
y_i : خروجی شبکه	1.6	1.5	.7	3

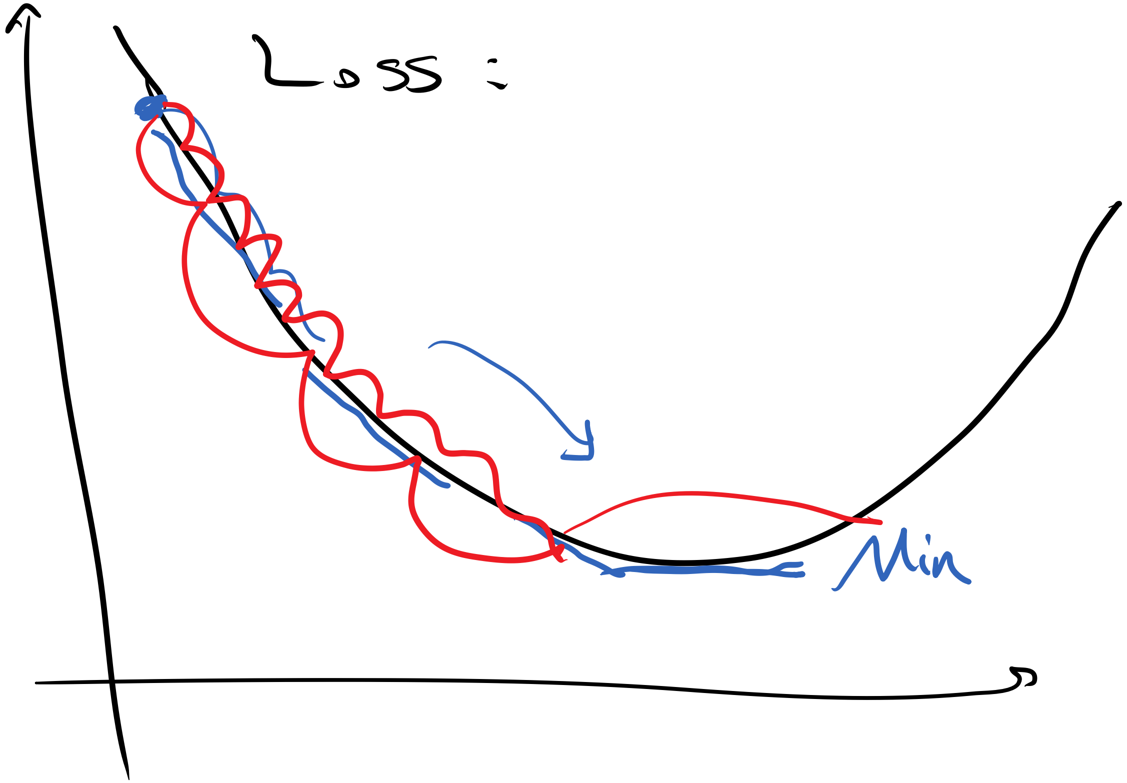
$\uparrow$ MSE

دسته‌بندی

$\hat{y}_i$	1	4	4	3	2
y_i	1	2	1	3	3
		[illegible]	[illegible]		

Cross Entropy

Gradient Descent : $W_N = W_0 - \underset{\sim}{\eta} \boxed{\frac{\partial L}{\partial w}}$



Error Back propagation

پس انتشار خطا

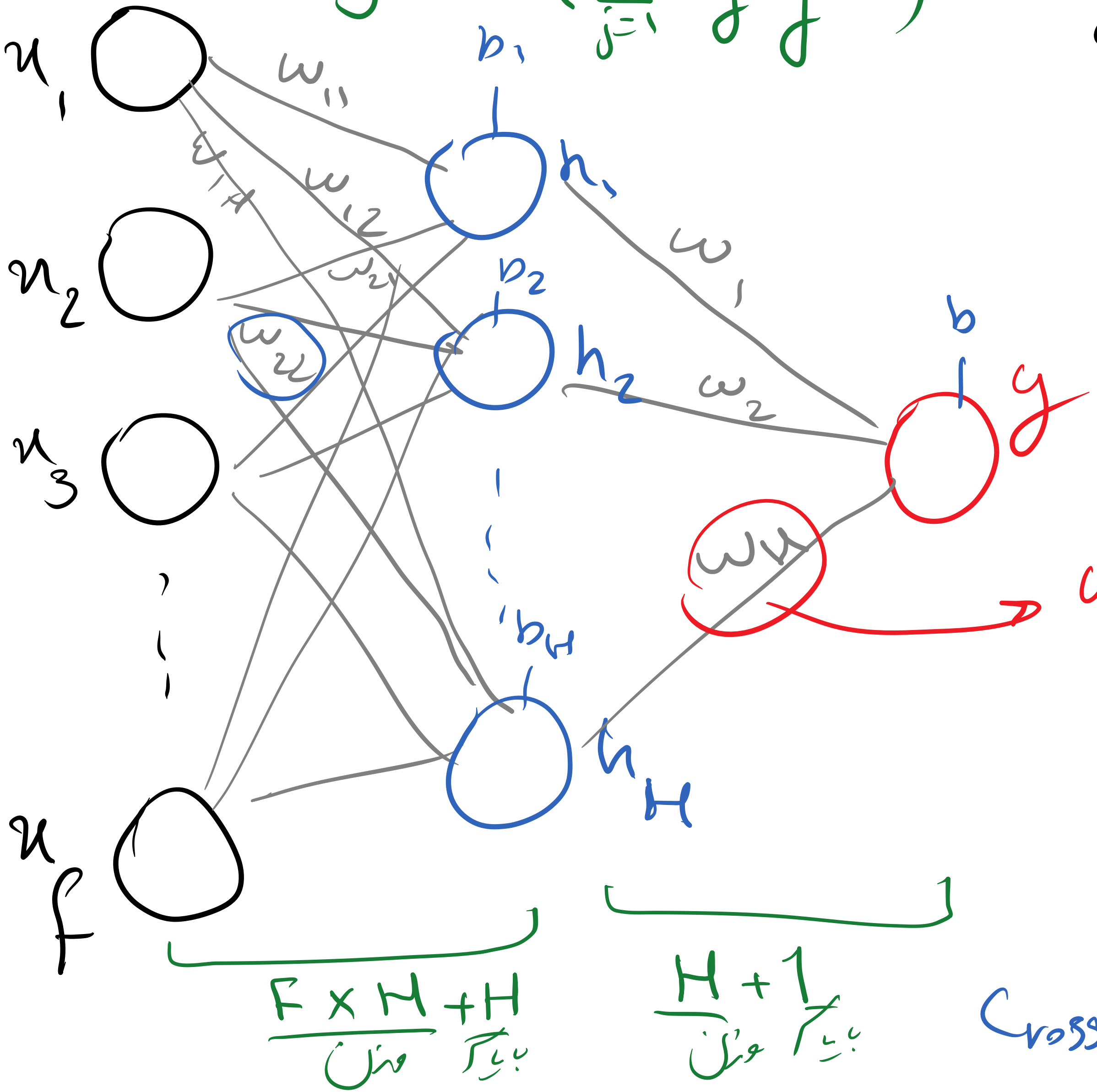
$l_r \begin{cases} \xrightarrow{\text{fixed}} \\ \xrightarrow{\text{invscaling}} \propto \frac{1}{t^{pow}} \\ \propto \text{Loss} \quad \text{Adaptive} \end{cases}$

$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$

$$h_j = Af_1\left(\sum_{i=1}^{F} w_{ij} x_i + b_j\right)$$

$x_0 = 1$

$w_0 \rightarrow b$



$$w_{22_N} = w_{22_O} - \eta \frac{\partial L}{\partial w_{22}} \rightarrow \frac{\partial L}{\partial y} \times \frac{\partial y}{\partial Af_2} \times \frac{\partial Af_2}{\partial h_2} \times \frac{\partial h_2}{\partial Af_1} \times \partial Af$$

$$w_{H_N} = w_{H_O} - \eta \frac{\partial L}{\partial w_H}$$

$$\frac{\partial L}{\partial y} \times \frac{\partial y}{\partial Af_2} \times \frac{\partial Af_2}{\partial w_H}$$

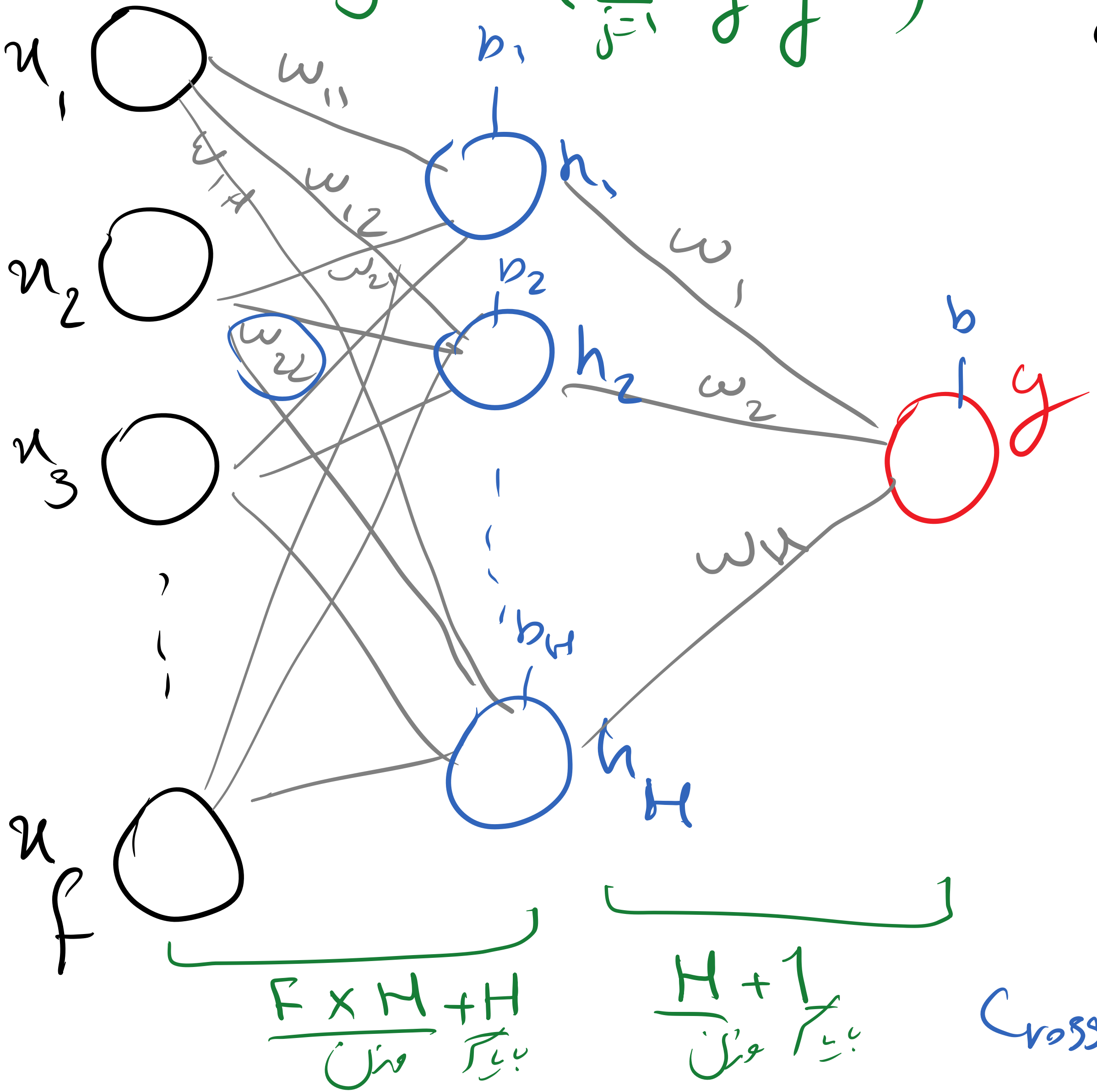
Cross

$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$

$$h_j = Af_1\left(\sum_{i=1}^{F} w_{ij} x_i + b_j\right)$$

$x_0 = 1$

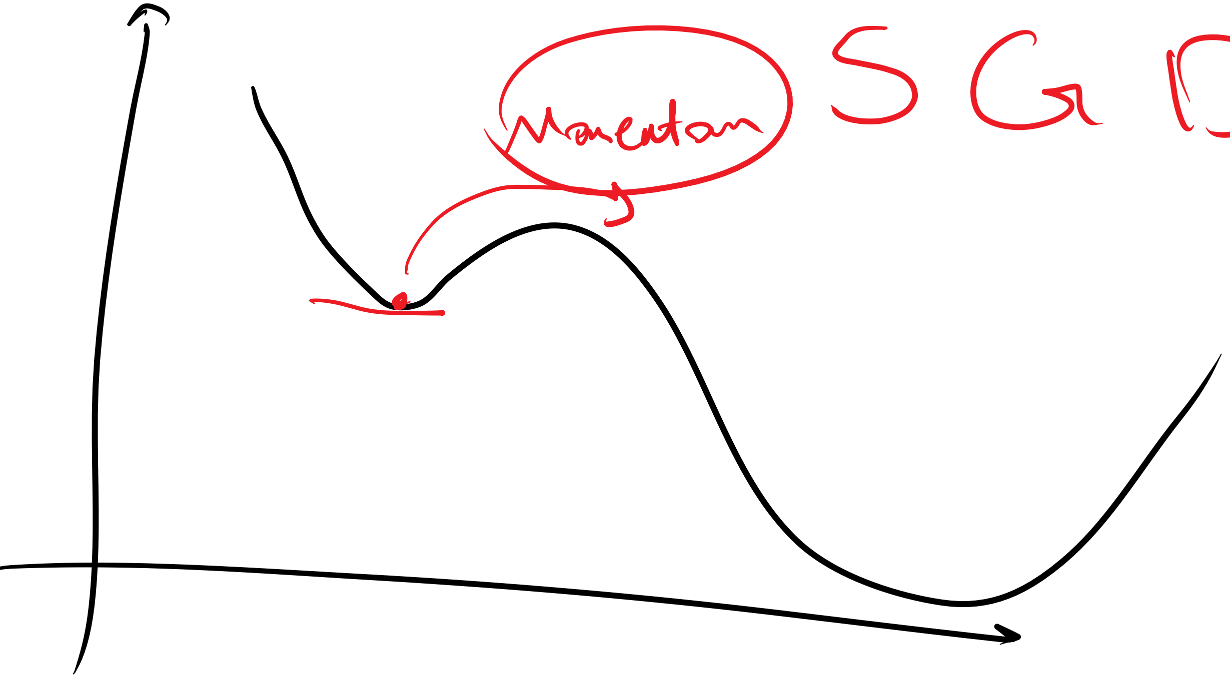
$w_0 \to b$



$$w_{22_N} = w_{22_0} - \eta \frac{\partial L}{\partial w_{22}}$$

$$\frac{\partial L}{\partial w_{22}} = \frac{\partial L}{\partial y} \times \frac{\partial y}{Af_2} \times \frac{\partial Af_2}{\partial h_2} \times \frac{\partial h_2}{\partial Af_1} \times \frac{\partial Af_1}{\partial w_{22}}$$

Cross



SGD

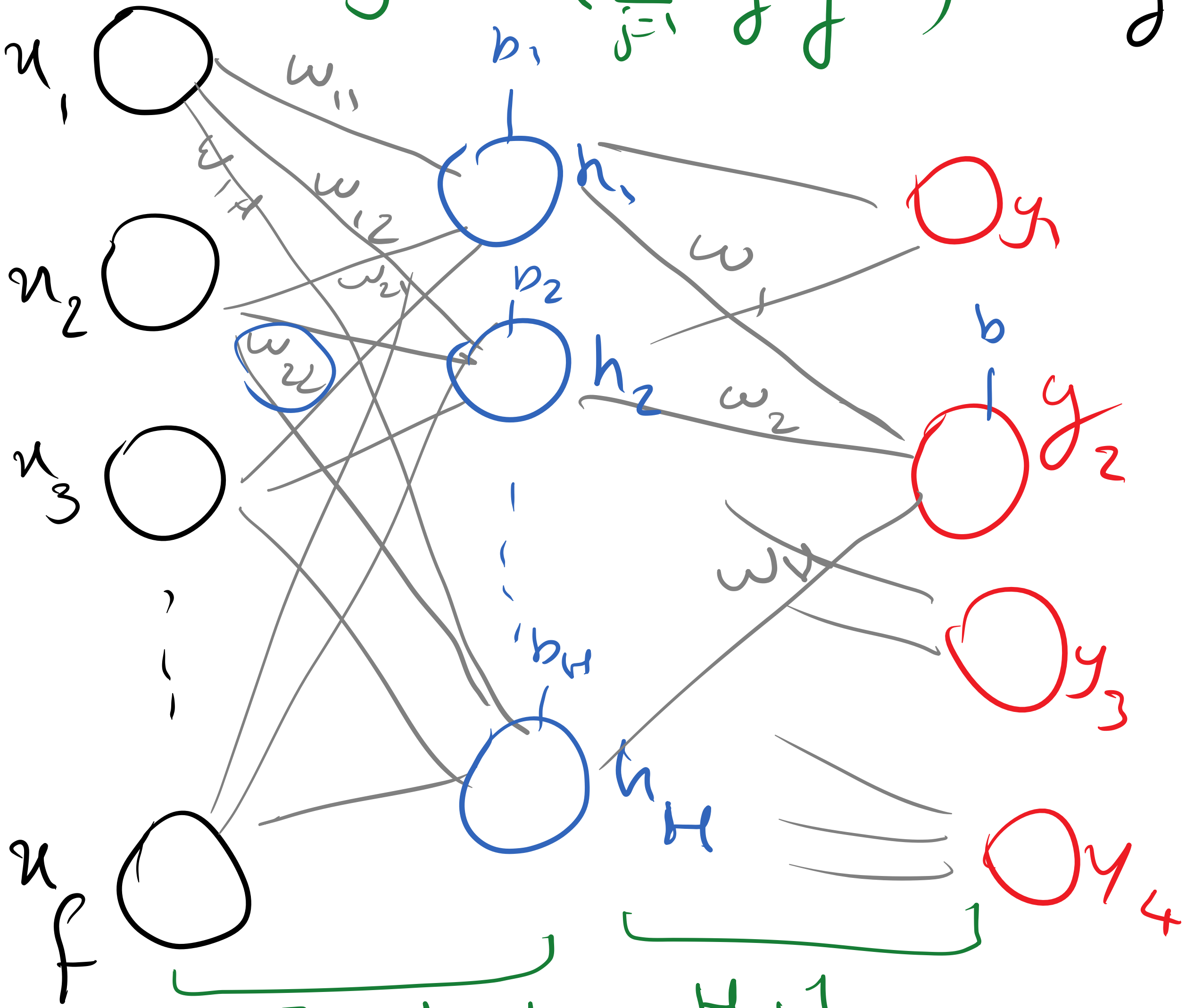
Adam

$$y = Af_2\left(\sum_{j=1}^{H} w_j h_j + b\right)$$

$$h_j = Af_1\left(\sum_{i=1}^{F} w_{ij} x_i + b_j\right)$$

$x_0 = 1$

$w_0 \to b$



$\underbrace{F \times H}_{\text{وزن}} + \underbrace{H}_{\text{بایاس}}$

$\underbrace{H}_{\text{وزن}} + \underbrace{1}_{\text{بایاس}}$

Cross

4 classes:

	C4	C3	C2	C1
1 →	0	0	0	1
	0	0	1	0
	0	1	0	0
	1	0	0	0

one hot Encoding

$$\begin{array}{cccccccccc} & & & & & c_1 & c_2 & \text{③} & c_4 & \\ .2 & .4 & .7 & .1 & \rightarrow & 0 & 0 & 1 & 0 & \rightarrow \text{③} \\ .1 & .9 & .4 & .1 & \rightarrow & 0 & 1 & 0 & 0 & \rightarrow \text{②} \\ .1 & .9 & .8 & .2 & \rightarrow & 0 & 1 & 1 & 0 & ? \\ & & & & & .03 & .6 & .3 & .07 & \end{array}$$

$$\frac{e^{.1} \quad e^{.9} \quad e^{.8} \quad e^{.2}}{e^{.1}+e^{.9}+e^{.8}+e^{.2}}$$

$$\text{Softmax}(t_k) = \frac{e^{t_k}}{\sum_{i=1}^{n} e^{t_i}}$$