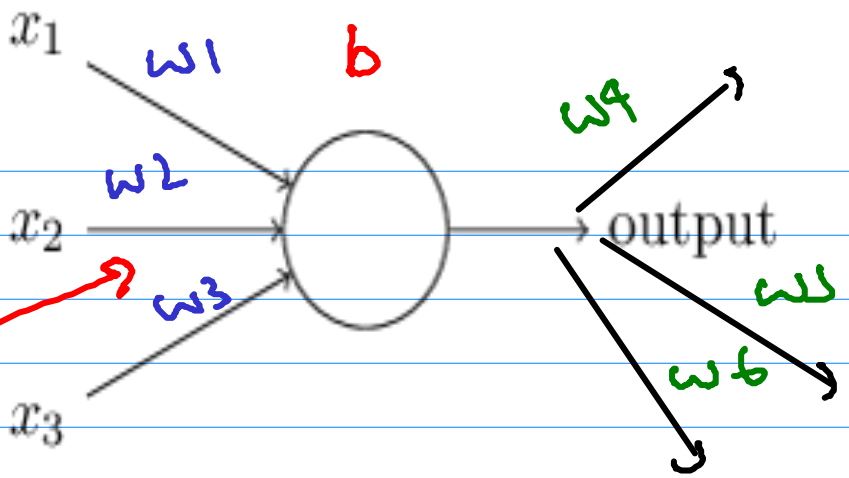
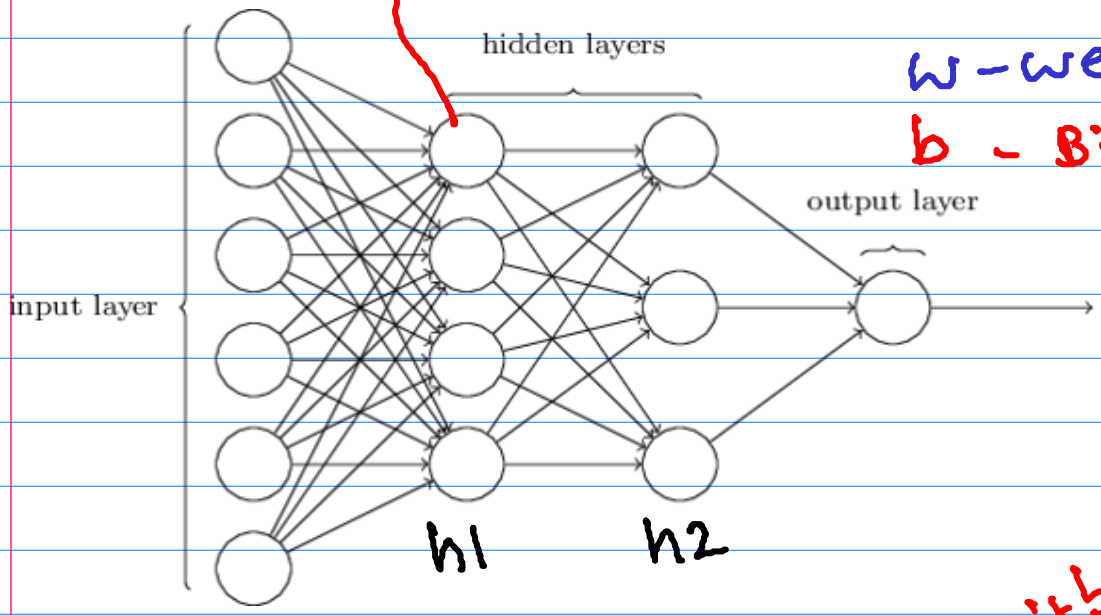
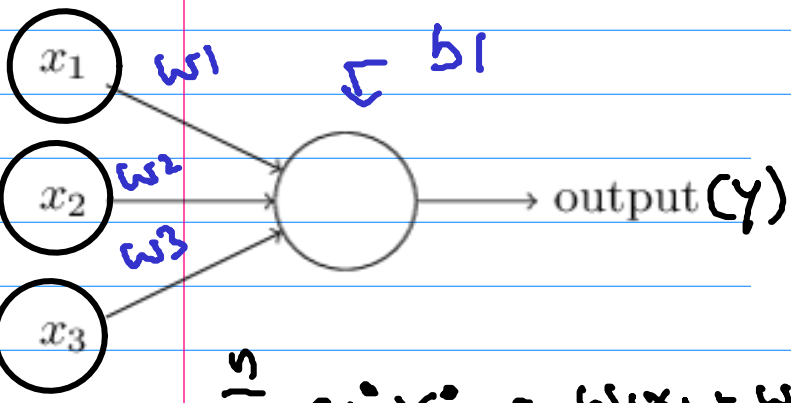
Perceptrone





w - weights → 24+12+36

b - Biase → 8



$$\text{output} = \begin{cases} 0 & \text{if } \sum_j w_j x_j \leq \text{threshold} \\ 1 & \text{if } \sum_j w_j x_j > \text{threshold} \end{cases}$$

Activation function

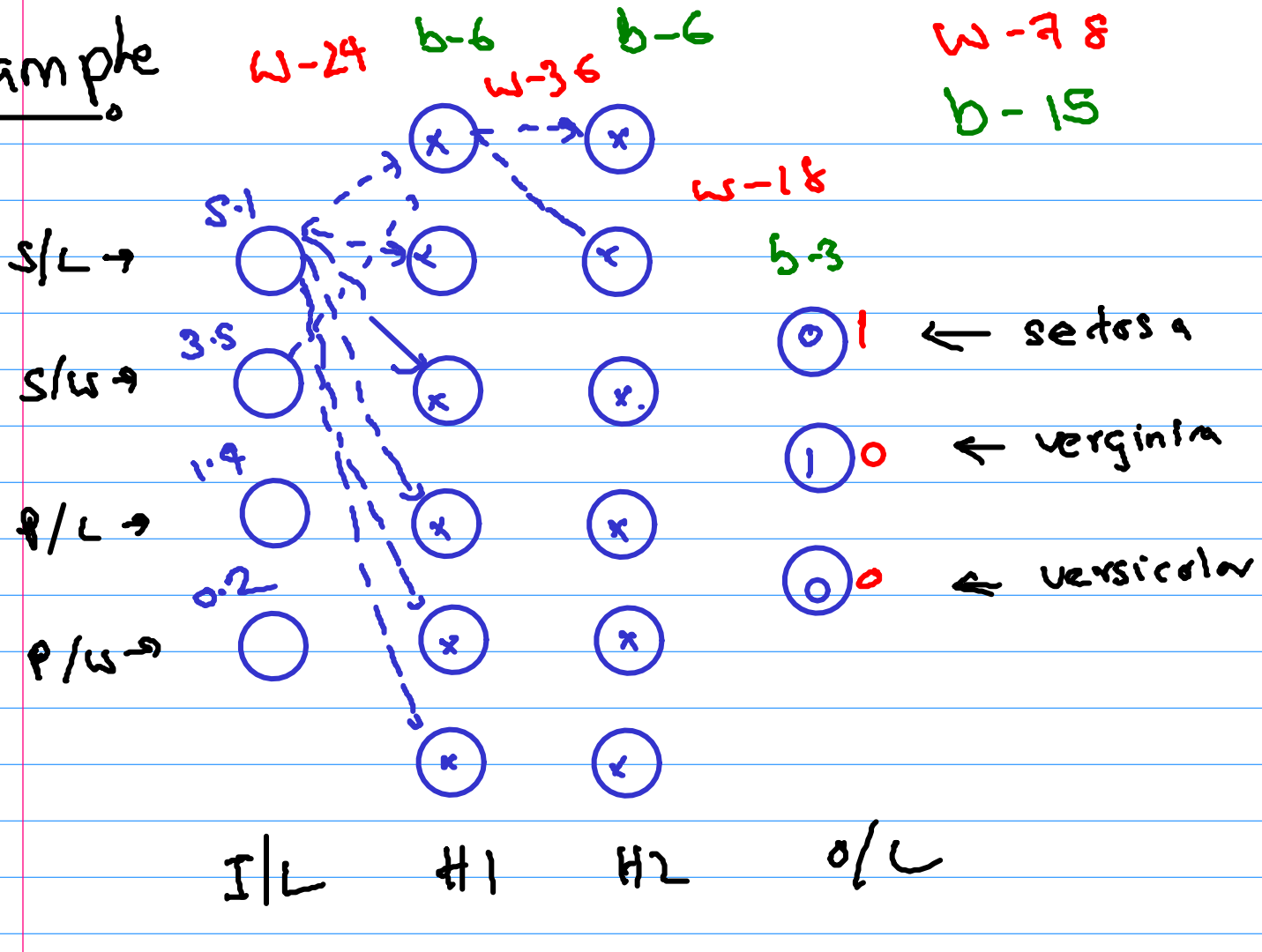
$$\sum_{i=1}^{n} w_i x_i + b \leq 0$$

$$X \leq 0 \rightarrow \sum_{i=1}^{n} w_i x_i \leq -b$$

$$\sum_{i=1}^{n} w_i x_i = w_1 x_1 + w_2 x_2 + w_3 x_3$$

$$X = \sum_{i=1}^{n} w_i x_i + b_1 \qquad y = \begin{cases} 0 ; & z \leq 0 \\ 1 ; & z > 0 \end{cases}$$

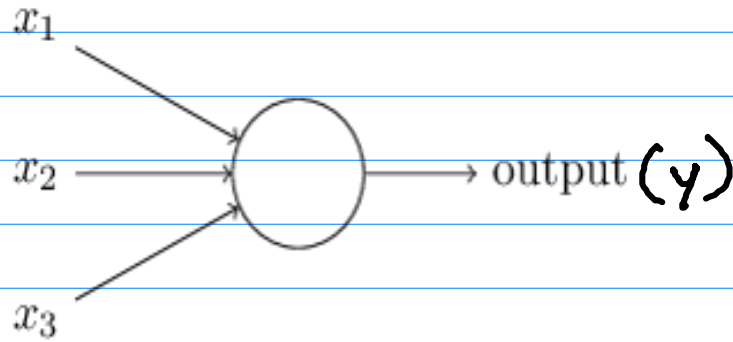
Example



Activation function

Linear

Non Linear



$$X = \left(\sum_{i=1}^{n} w_i x_i\right) + b$$

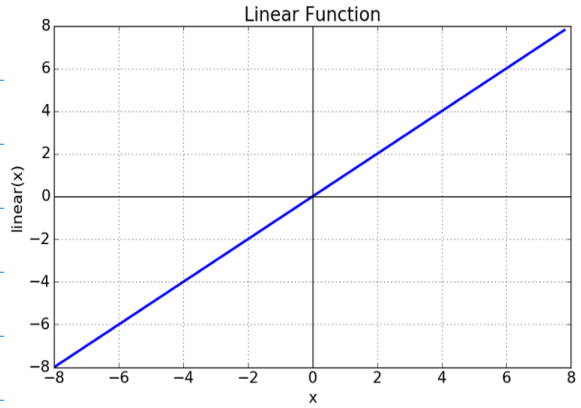
$$Y = F(X)$$

Activation Function

(i) classic Perceptron → $Y = \begin{cases} 0 ; & x \leq 0 \\ 1 ; & x > 0 \end{cases}$

(ii) Linear Activation →

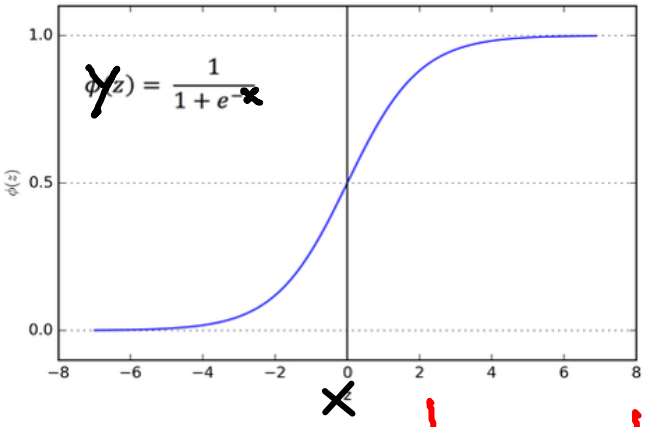
$$Y = X$$



Non linear.

(iii) Sigmoid Activation →

$$Y = \frac{1}{1+e^{-X}}$$



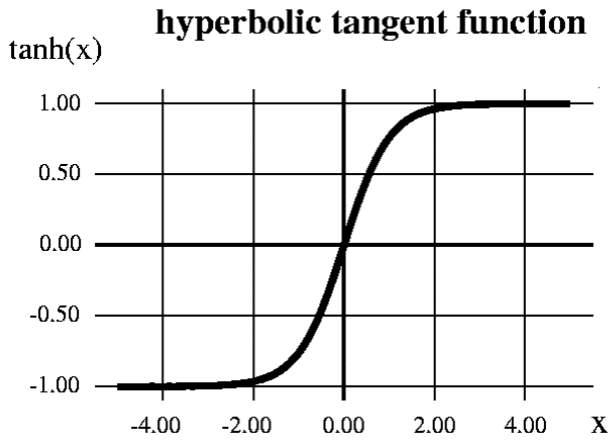
* $X \to \infty$; $Y = \frac{1}{1+e^{-\infty}} = \frac{1}{1+\frac{1}{e^{\infty}}} = \frac{1}{1+\frac{1}{\infty}} = 1$

* $X \to -\infty$; $Y = \frac{1}{1+e^{\infty}} = \frac{1}{1+\infty} = \frac{1}{\infty} = 0$

(iii) tanh activation

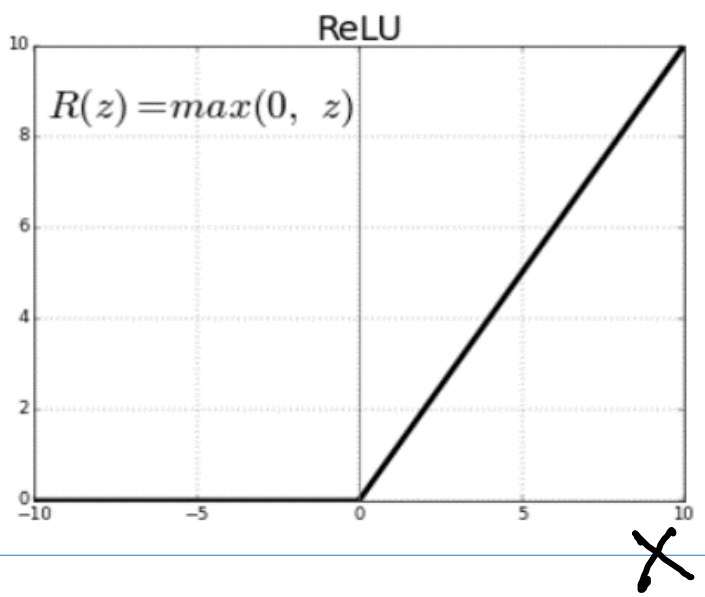
$$y = \frac{1 - e^{-2x}}{1 + e^{2x}}$$

$$-1 \leq y \leq 1$$

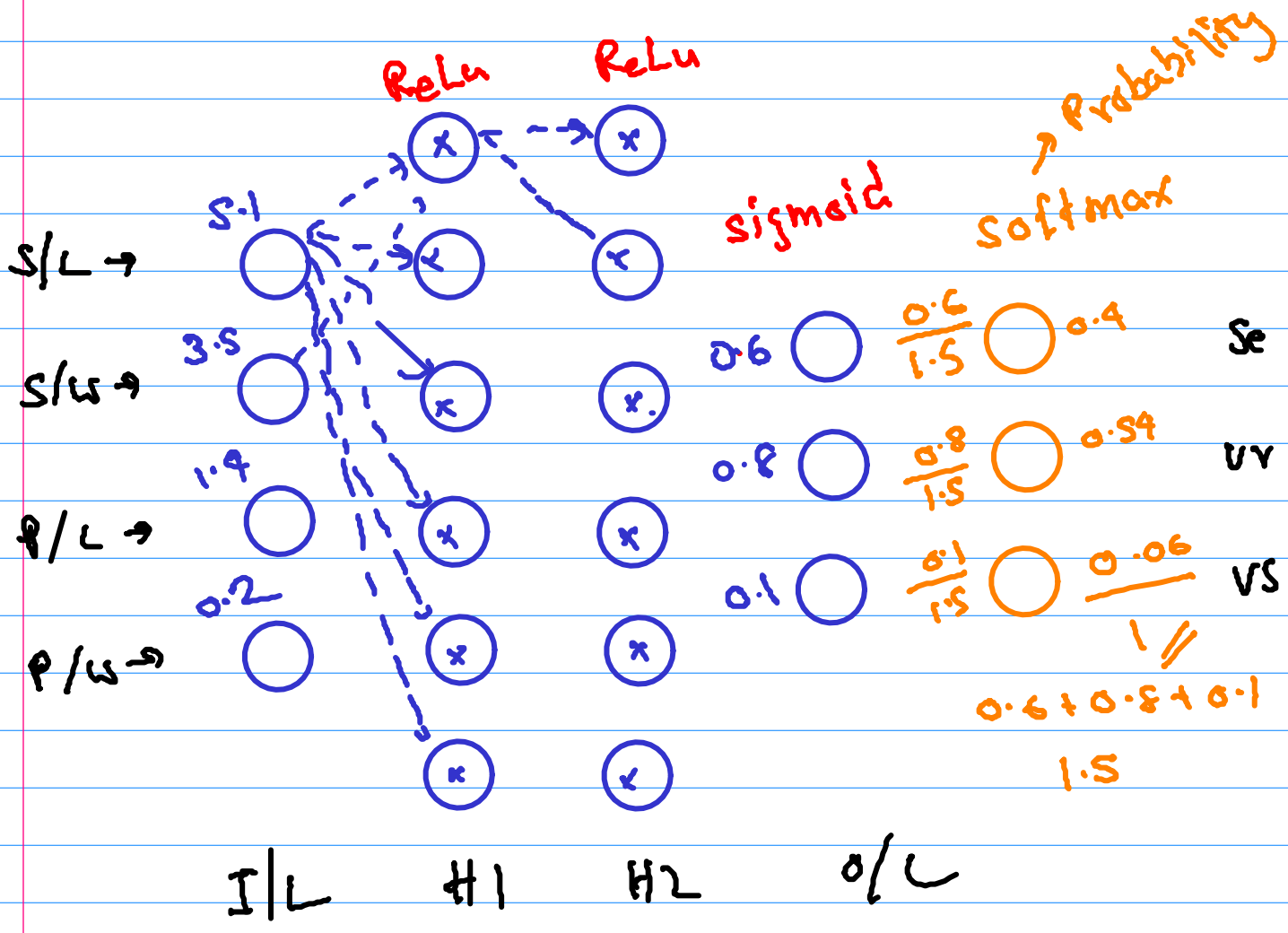


(iii) ReLu activation

$$y = \begin{cases} 0; & x \leq 0 \\ x; & x > 0 \end{cases}$$



Loss Functions



Loss

* cross entropy loss

Predicted

- 0.4
- 0.54
- 0.06

Actual

- 1
- 0
- 0

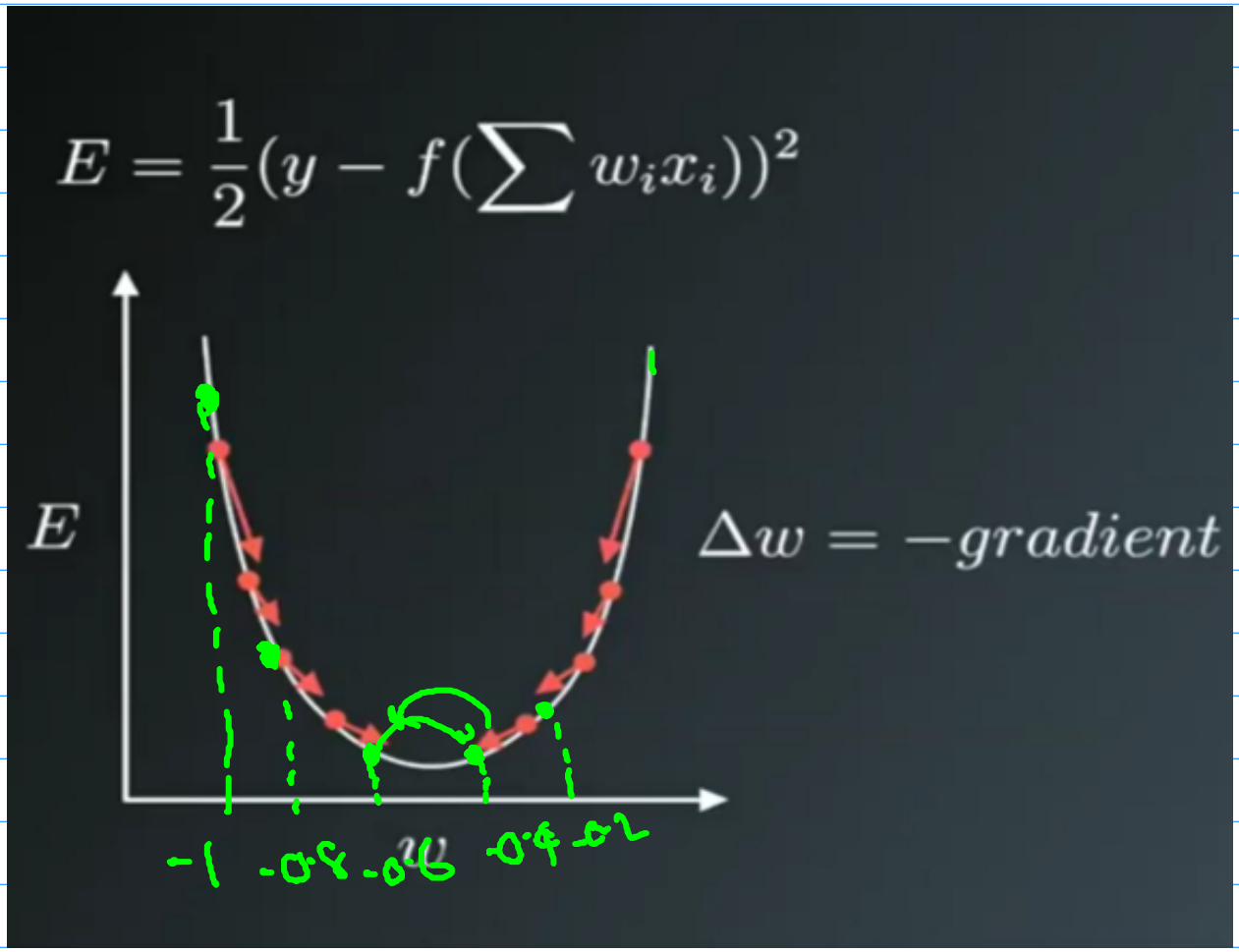
Loss

$$\mathcal{L} = -\frac{1}{n}\sum_{i=1}^{n}\left[y^{(i)}\log(\hat{y}^{(i)}) + (1-y^{(i)})\log(1-\hat{y}^{(i)})\right]$$

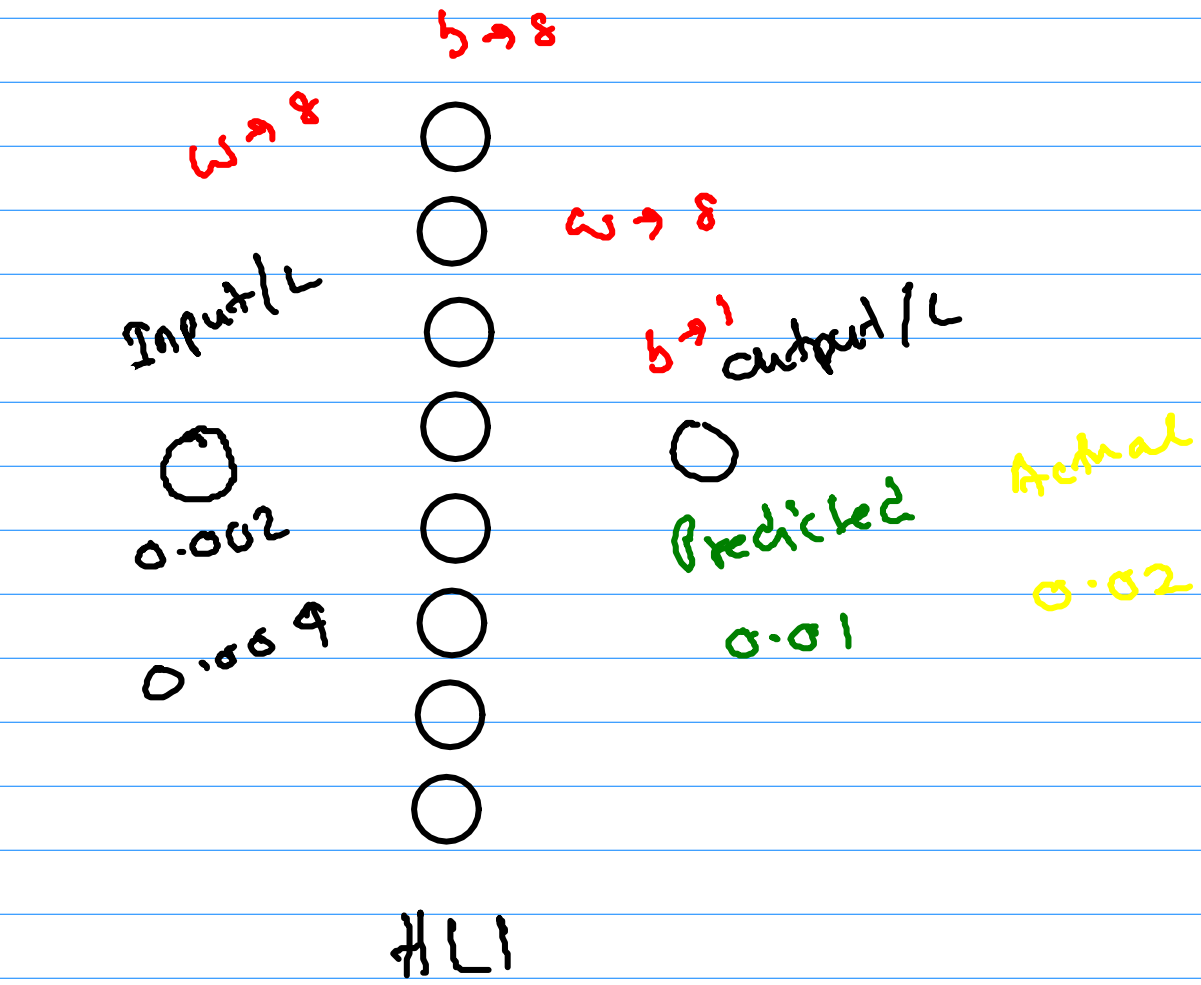
$y \rightarrow$ actual

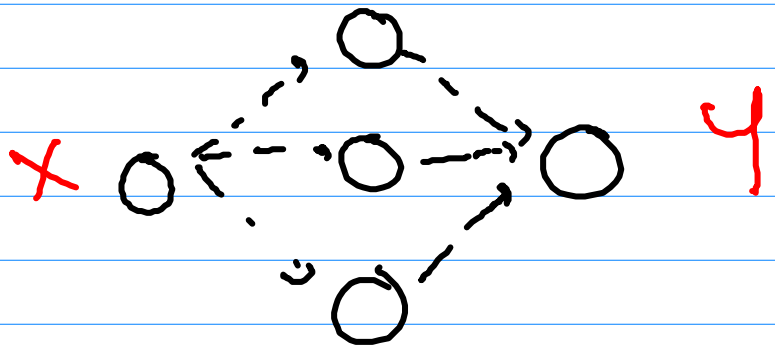
$\hat{y}$ - predicted

$$L = \frac{-1}{3}\Big[\,1\log(0.4) + (1-1)\log(1-0.4) +$$
$$0\log(0.54) + (1-0)\log(1-0.54) +$$
$$0\log(0.06) + (1-0)\log(1-0.06)\,\Big]$$

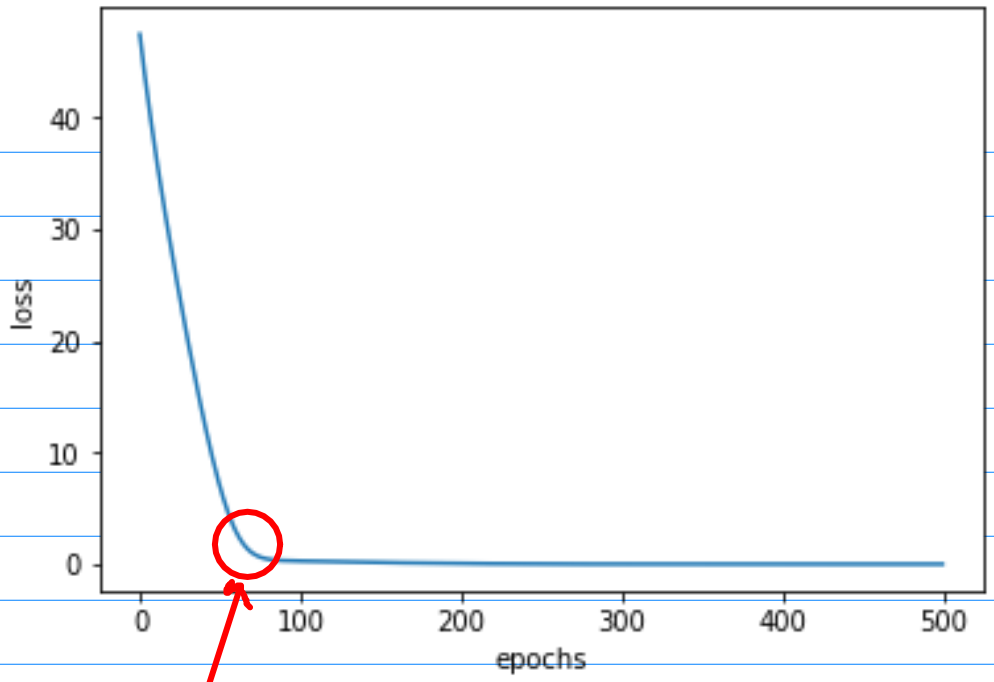


2.0 Simple FFNN





Loss.



convergence

ANN for Iris Flower