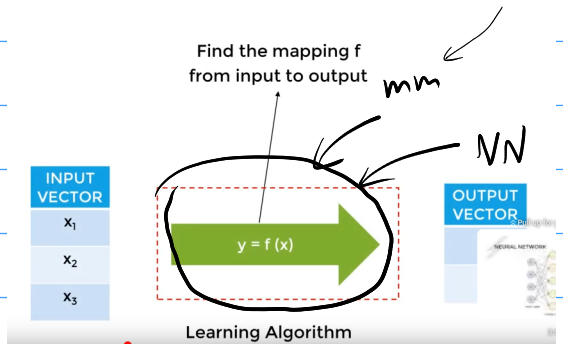
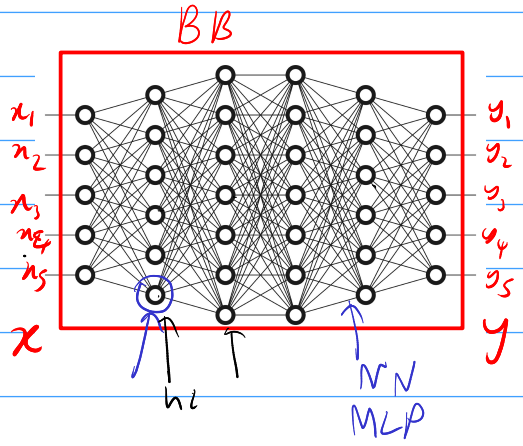
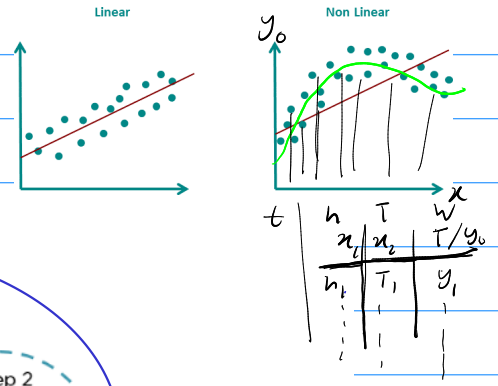
2.0 Foward Pass in Neural Networks





2.1 Neuron or perceptron

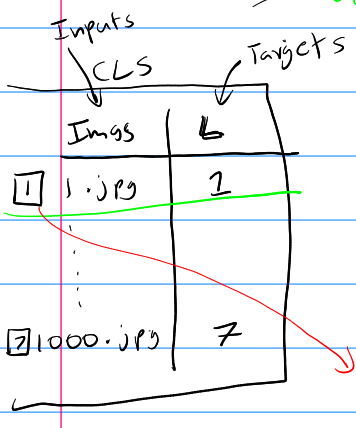


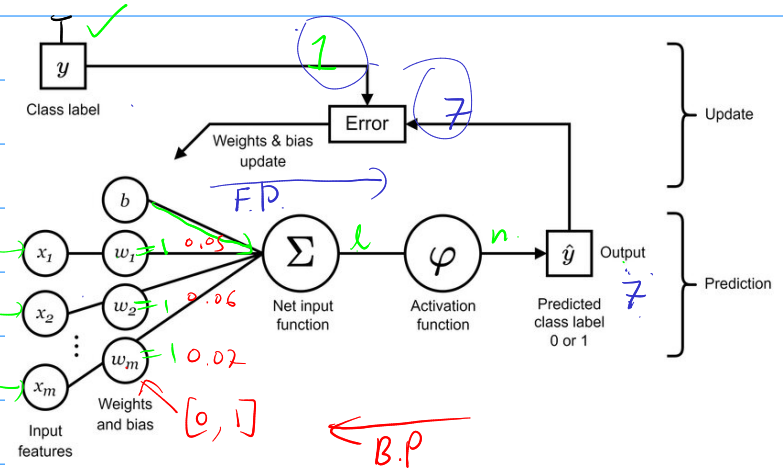
$$\hat{y}_0 = w_1x_1 + w_2x_2 + \cdots + w_nx_n + b = \sum_{i=1}^{n} w_i x_i + b$$

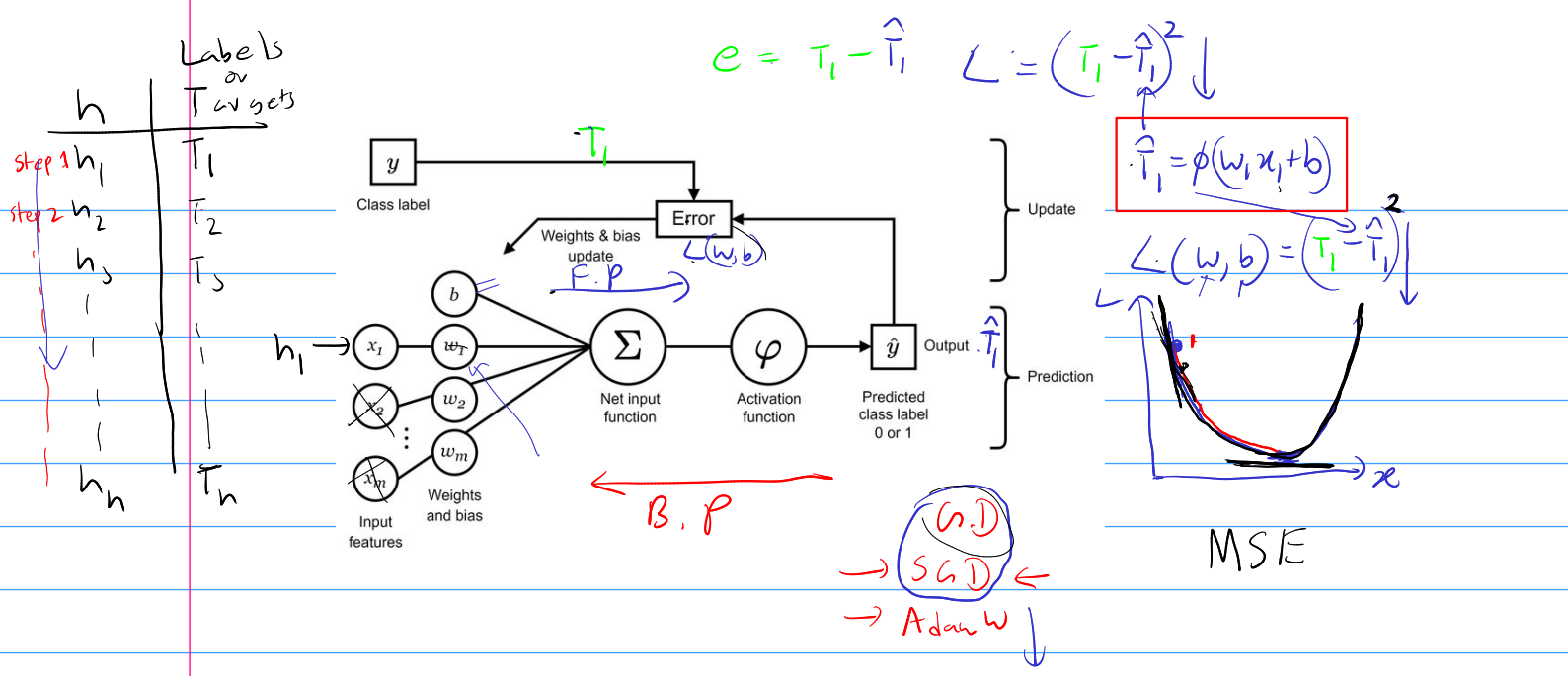
$$\hat{y}_0 = w_1x_1 + b$$

$$y_0 = mx + c$$

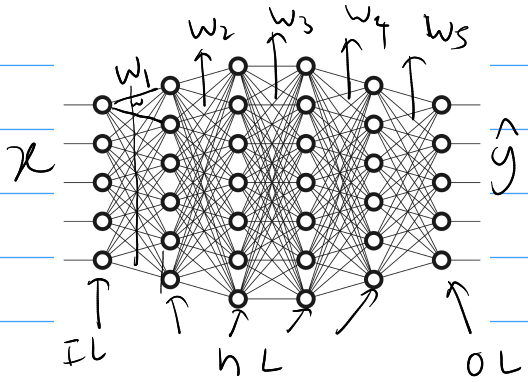
$$\hat{Y} = g\left(\sum_{i=1}^{n} w_i x_i + b\right)$$

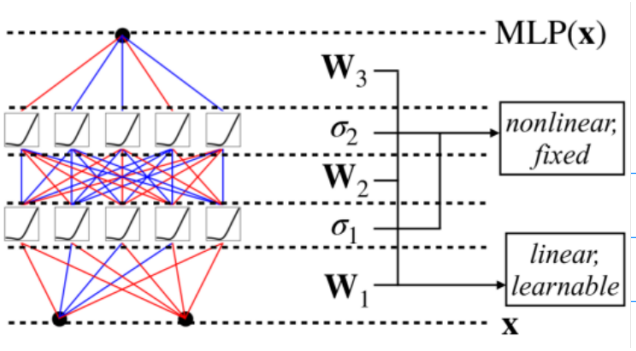




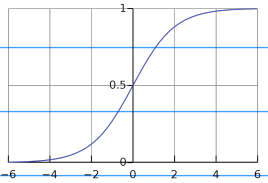

Labels or Targets
h
Step 1
Step 2
h_1
h_2
h_3
h_n
T_1
T_2
T_3
T_n
$e = T_1 - \hat{T}_1$
$L = (T_1 - \hat{T}_1)^2$
$\hat{T}_1 = \phi(w_1 x_1 + b)$
$L(w, b) = (T_1 - \hat{T}_1)^2$
y
Class label
T_1
Error
Weights & bias update
$L(w, b)$
F. P
Update
b
x_1
w_1
x_2
w_2
x_m
w_m
h_1
Input features
Weights and bias
Σ
Net input function
φ
Activation function
$\hat{y}$
Predicted class label 0 or 1
Output $\hat{T}_1$
Prediction
B. P
G.D
S.G.D
Adam W
L
w
MSE

2.2 Neural Network or Multi Layer Perceptron





$$\mathrm{MLP}(\mathbf{x}) = (\mathbf{W}_3 \circ \sigma_2 \circ \mathbf{W}_2 \circ \sigma_1 \circ \mathbf{W}_1)(\mathbf{x})$$



$$W_1 = [w_1 \; \cdots \; w_n] \qquad x = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}$$

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

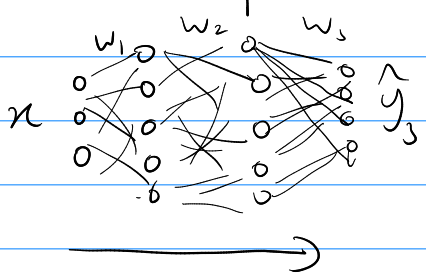
$$y_1 = \sigma_1(W_1 x + b_1)$$

$$y_2 = \sigma_2(W_2 y_1 + b_2)$$

$$y_3 = \sigma_3(W_3 y_2 + b_3)$$

$$y_n = \sigma_n(W_n y_{n-1} + b_n)$$

$$\hat{y} = \sigma_3(W_3\, \sigma_2(W_2\, \sigma_1(W_1 x + b)))$$



$$(f \circ g)(x) = f(g(x))$$