PERCEPTRON

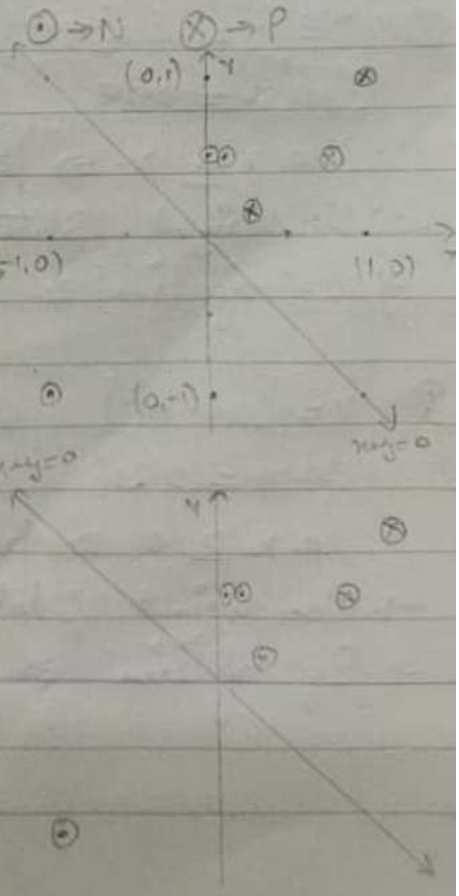
Algorithm Followed →

P ← inputs with label 1
N ← inputs with label -1

Initialize W;

while ! convergence do
  Pick x ∈ P ∪ N;
  if x ∈ P and $\sum_{i=0}^{n} w_i * x_i < 0$ then
    w = w + x;
  end
  if x ∈ N and $\sum_{i=0}^{n} w_i * x_i \geq 0$ then
    w = w - x;
  end
end

X = [[1, 1], [-1, -1], [0, 0.5], [0.1, 0.5], [0.2, 0.2], [0.9, 0.8]]
Y = [1, -1, -1, -1, 1, 1]
W = [1, 1]



(1) x = [1, 1] w = [1, 1] label = +1

w.x = 2

w.x ≥ 0 ⇒ pred = +1 (correct)

→ No Weight Update

→ Eq^n of line ⇒ 1.x + 1.y = 0

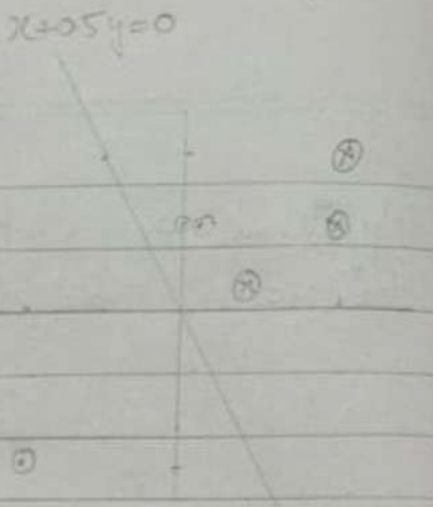
(2) x = [-1, -1] w = [1, 1] label = -1

w.x = -2

w.x < 0 ⇒ pred = -1 (correct)

→ No Weight Update

→ Eq^n of line ⇒ 1.x + 1.y = 0



③ $x = [0, 0.5]$ $w = [1\ 1]$ label = -1

$w.x = 0.5$

$w.x \geq 0 \Rightarrow$ pred = +1 (Error)

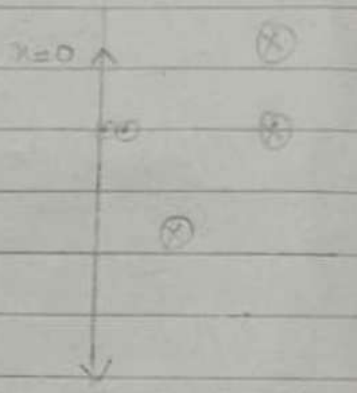
→ Weight update $w = w - x$

$= \begin{bmatrix}1\\1\end{bmatrix} - \begin{bmatrix}0\\0.5\end{bmatrix} \Rightarrow \begin{bmatrix}1\\0.5\end{bmatrix}$

→ Eq^n of line $\Rightarrow 1.x + 0.5y = 0$

$w = [1\ 0.5]$

④ $x = [0.1\ 0.5]$ $w = [1\ 0.5]$ label = -1



$w.x = 0.35$

$w.x \geq 0 \Rightarrow$ pred = +1 (Error)

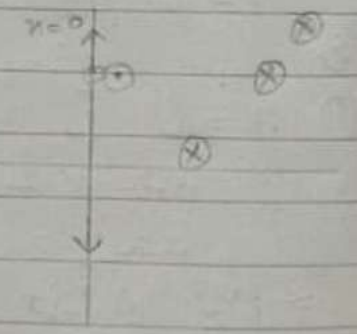
→ Weight Update $w = w - x$

$= \begin{bmatrix}1\\0.5\end{bmatrix} - \begin{bmatrix}0.1\\0.5\end{bmatrix} = \begin{bmatrix}0.9\\0\end{bmatrix}$

→ Eq^n of line $\Rightarrow 0.9x + 0.y = 0$

→ $w = [0.9\ 0] \Rightarrow x = 0$

⑤ $x = [0.2\ 0.2]$ $w = [0.9\ 0]$ label = 1



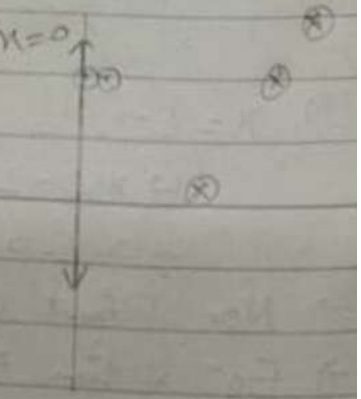
$w.x = 0.18$

$w.x \geq 0 \Rightarrow$ pred = +1 (Correct)

→ No Weight Update

→ Eq^n of line $\Rightarrow x = 0$

⑥ $x = [0.9\ 0.5]$ $w = [0.9\ 0]$ label = 1



$w.x = 0.81$

$w.x \geq 0 \Rightarrow$ pred = +1 (Correct)

→ No weight Update

→ Eq^n of line $\Rightarrow x = 0$

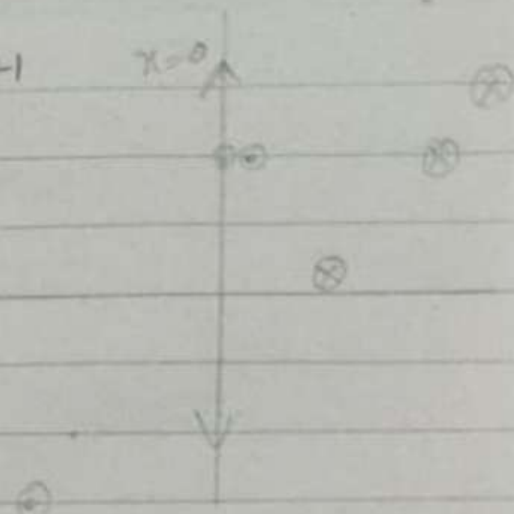
⑦. $x = [1 \quad 1]$ $w = [0.9 \quad 0]$ label = +1

$w \cdot x = 0.9$

$w \cdot x \geq 0 \Rightarrow$ pred = +1 (Correct)

→ No Weight Update

→ Eq^n of line $\Rightarrow$ $x = 0$



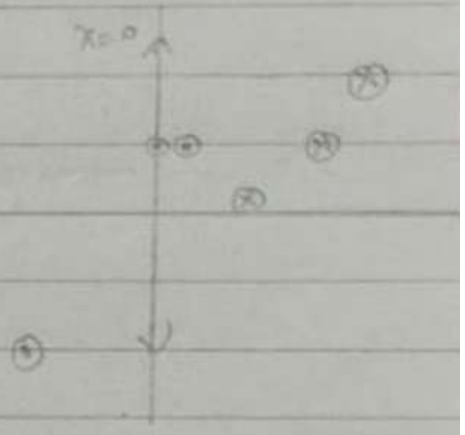
⑧ $x = [-1 \quad -1]$ $w = [0.9 \quad 0]$ label = -1

$w \cdot x = -0.9$

$w \cdot x < 0 \Rightarrow$ pred = -1 (Correct)

→ No weight Update

→ Eq^n of line $\Rightarrow$ $x = 0$



⑨ $x = [0 \quad 0.5]$ $w = [0.9 \quad 0]$ label = -1

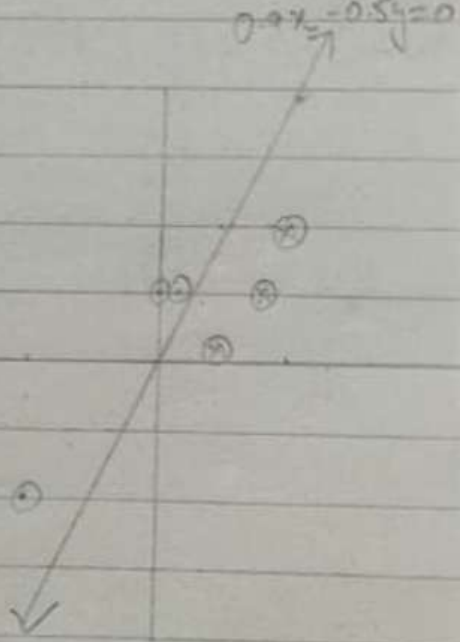
$w \cdot x = 0$

$w \cdot x \geq 0 \Rightarrow$ pred = +1 (Error)

→ Weight Update $w = w - x$

$$= \begin{bmatrix} 0.9 \\ 0 \end{bmatrix} - \begin{bmatrix} 0 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 0.9 \\ -0.5 \end{bmatrix}$$

→ Eq^n of line $\Rightarrow$ $0.9x - 0.5y = 0$



** The Decision Boundary Is classifying all points correctly ⇒ Reached Convergence.