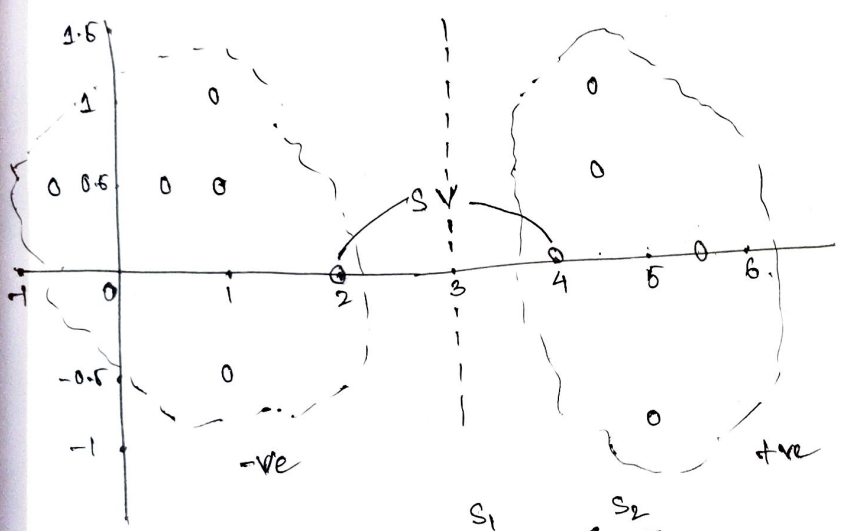
Support Vector Machine :-

1. Linear all the points on plane
2. Find the support vectors.
3. Add the bias (b) value in vector to convert from 2D to 3D
4. Consider parameter for every support vectors like α_1, α_2
5. Find linear Eq.
6. Find Eq for hyperplane

(1, 0.8), (1,1), (1, -0.5), (0.5, 0.8), (0.8, 0.5), (2,0), (4,0), (4.5, 1)
(4.5, 0.5), (5, -1), (5.5, 0).



Support vectors = $\begin{matrix} S_1 & S_2 \\ \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix} & \begin{bmatrix} 4 \\ 0 \\ 1 \end{bmatrix} \\ \alpha_1 & \alpha_2 \end{matrix}$

$(\alpha_1 \cdot S_1 \cdot S_1) + (\alpha_2 \cdot S_2 \cdot S_1) = -1$

$(\alpha_1 \cdot S_1 \cdot S_2) + (\alpha_2 S_2 \cdot S_2) = +1.$

$\alpha_1 [2\ 0\ 1][2\ 0\ 1] + \alpha_2 [4\ 0\ 1][2\ 0\ 1] = -1$

$\alpha_1 [2\ 0\ 1][4\ 0\ 1] + \alpha_2 [4\ 0\ 1][4\ 0\ 1] = +1.$

$6\alpha_1 + 9\alpha_2 = -1$

$9\alpha_1 + 17\alpha_2 = +1.$

$45\alpha_1 + 81\alpha_2 = -9.$

$45\alpha_1 + 85\alpha_2 = +5$

$-4\alpha_2 = 14.$

$\alpha_2 = 3.5$

$\alpha_1 = -6.5$

$\vec{w} = \alpha_1 s_1 + \alpha_2 s_2$

$= -6.5 \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix} + 3.5 \begin{bmatrix} 4 \\ 0 \\ 1 \end{bmatrix}$

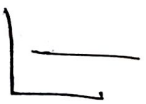
$= \begin{bmatrix} -13 \\ 0 \\ -6.5 \end{bmatrix} + \begin{bmatrix} 14 \\ 0 \\ 3.5 \end{bmatrix}$

$= \begin{bmatrix} 1 \\ 0 \\ -3 \end{bmatrix}$ ⟶ bias $(b) = -3$.

$\therefore b + 3 = 0$.

If $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ → Vertical line is.

$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ → Horizontal



$\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ → diagonal (45°)