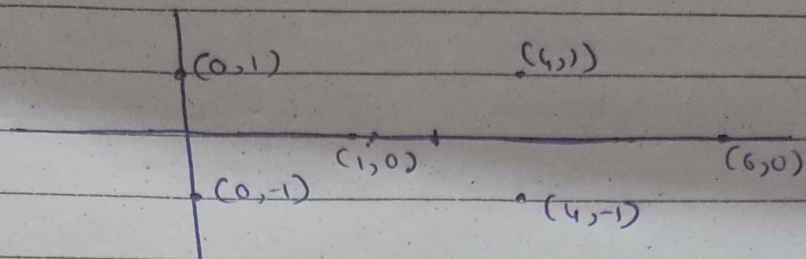


Lab 6. SVM

e) Points  $(4,1)$ ,  $(4,-1)$  &  $(6,0)$  belong to the class of points  $(1,0)$ ,  $(0,1)$  &  $(0,-1)$  belong to the class. Draw an optimal hyperplane



$$s_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$s_2 = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$$

$$s_3 = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$$

$$\tilde{s}_1 = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$$

$$\tilde{s}_2 = \begin{pmatrix} 4 \\ 1 \\ 1 \end{pmatrix}$$

$$\tilde{s}_3 = \begin{pmatrix} 4 \\ -1 \\ 1 \end{pmatrix}$$

$$\alpha_1 \tilde{s}_1 \tilde{s}_1 + \alpha_2 \tilde{s}_2 \tilde{s}_2 + \alpha_3 \tilde{s}_3 \tilde{s}_3 = -1$$

$$\alpha_1 \tilde{s}_2 \tilde{s}_1 + \alpha_2 \tilde{s}_2 \tilde{s}_2 + \alpha_3 \tilde{s}_3 \tilde{s}_2 = 0$$

$$\alpha_1 \tilde{s}_3 \tilde{s}_1 + \alpha_2 \tilde{s}_3 \tilde{s}_2 + \alpha_3 \tilde{s}_3 \tilde{s}_3 = 1$$

$$2\alpha_1 + 5\alpha_2 + 5\alpha_3 = -1, \quad 5\alpha_1 + 8\alpha_2 + 6\alpha_3 = 1, \quad 5\alpha_1 + 16\alpha_2 + 18\alpha_3 = 1$$

$$\alpha_1 = -\frac{22}{9}, \quad \alpha_2 = \frac{7}{18}, \quad \alpha_3 = \frac{7}{18}$$

$$w = \sum \alpha_i s_i = \begin{pmatrix} -\frac{22}{9} \\ \frac{7}{18} \\ -\frac{22}{9} \end{pmatrix} + \begin{pmatrix} \frac{28}{18} \\ \frac{7}{18} \\ \frac{7}{18} \end{pmatrix} + \begin{pmatrix} \frac{28}{18} \\ -\frac{7}{18} \\ \frac{7}{18} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{2}{3} \\ \frac{7}{9} \\ 0 \end{pmatrix}$$

$$w = gx + b \quad y = wx + b$$

$$\frac{1}{10}x_1^2 + 0x_2 + \left(\frac{-31}{20}\right) = 0$$

$$x_1^2 + x_2^2$$

$$x_1 = 2.5 \quad x_2 = 0$$