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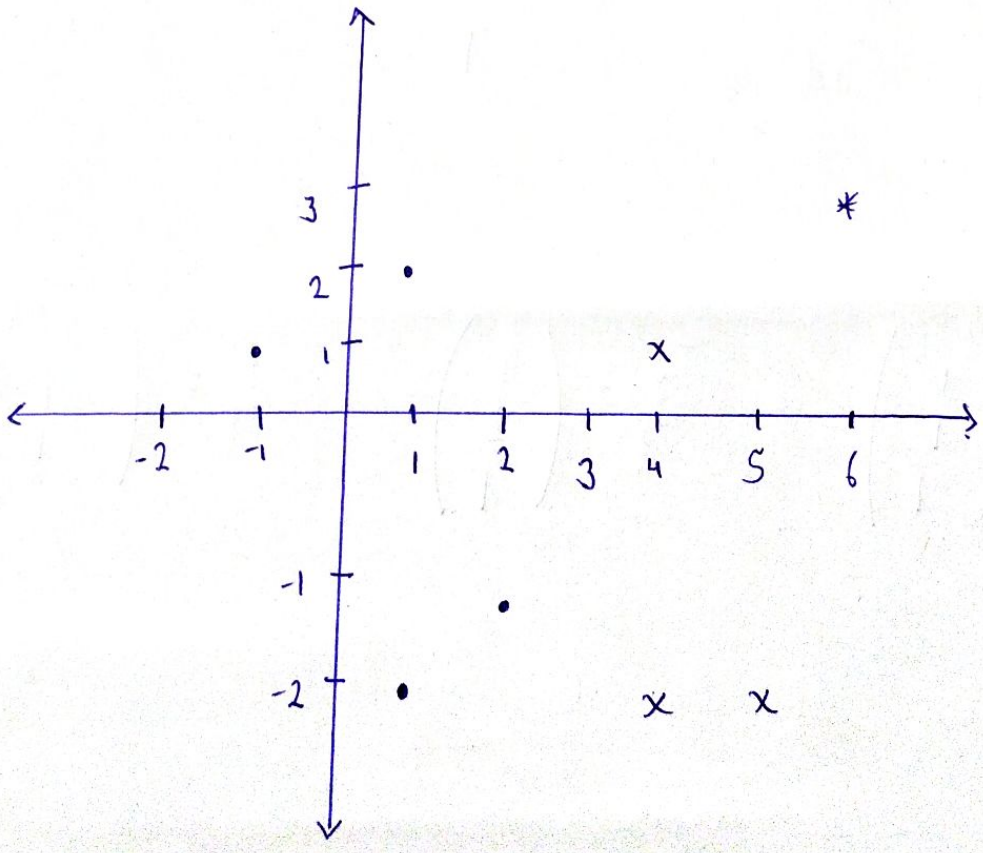
Data Mining Assignment-2

Question.) Find the separating hyperplane for the following dataset using SVM.

$D = (S_1, S_2)$

S1 → (4, 1) (4, -2) (5, -2) (6, 3)

S2 → (1, 2) (2, -1) , (1, -2) (-1, 1)



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It's clearly visible that (2,-1) lies on the support vector for negative class and (4,1), (4,-2) lies on the support vector of positive class

This can be shown as

$$S_1 = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \qquad S_2 = \begin{pmatrix} 4 \\ -2 \end{pmatrix} \qquad S_3 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$

Now, we can get the augmented vector by adding the bias.

$$\bar{S}_1 = \begin{pmatrix} 4 \\ 1 \\ -1 \end{pmatrix} \qquad \bar{S}_2 = \begin{pmatrix} 4 \\ -2 \\ 1 \end{pmatrix} \qquad \bar{S}_3 = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$$

Now, we get the three equations using the augmented vectors

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$$\alpha_1 \bar{S}_1 \bar{S}_1 + \alpha_2 S_2 S_1 + \alpha_3 S_3 S_1 = 1$$

$$\alpha_1 S_2 S_1 + \alpha_2 S_2 S_2 + \alpha_3 S_2 S_3 = 1$$

$$\alpha_1 S_1 S_3 + \alpha_2 S_2 S_3 + \alpha_3 S_2 S_3 = -1$$

$$\alpha_1 (18) + \alpha_2 (15) + \alpha_3 (8) = 1$$

$$\alpha_1 (15) + \alpha_2 (21) + \alpha_3 (11) = 1$$

$$\alpha_1 (8) + \alpha_2 (11) + \alpha_3 (6) = -1$$

on evaluating the above equation we get

$$\boxed{\alpha_1 = \frac{1}{6}}$$

$$\boxed{\alpha_2 = \frac{10}{3}}$$

$$\boxed{\alpha_3 = \frac{-13}{2}}$$

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hyperplane.

$$w = \sum_{1}^{3} \alpha_i \times \bar{s}_i$$

$$\Rightarrow \frac{1}{6}\begin{pmatrix} 4 \\ 1 \\ 1 \end{pmatrix} + \frac{10}{3}\begin{pmatrix} 4 \\ -2 \\ 1 \end{pmatrix} + \left(\frac{-13}{2}\right)\begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 1 \\ 0 \\ -3 \end{pmatrix}$$

(1,0) is the slope.

& -3 is the offset