KNN classification :- it is based on supervised learning Algo.

→ KNN, assume similarity b/w new cases and availability cases. it store all available data & classifies a new data point based on similarity

→ it is non parametric algo. which means it doesn't make any assumption on underlying data.

P_1	P_2	Class
7	7	Flase
7	4	false
3	4	True
1	4	True.

Perform KNN:.

$X(P_1 = 3, P_2 = 7)$, $k = 3$ → True

$D(x, i) = \sqrt{(3-7)^2 + (7-7)} = \sqrt{c} = 4$ → N_3 false

$D(x, ii) = \sqrt{(3-7)^2 - (7-4)} = 5$

$D(x, iii) = \sqrt{(3-3)^2 + (7-4)^2} = 3$ — N → True

$D(x, iv) = \sqrt{(3-1)^2 + (7-4)^2} = 3.6$ — N_2 — True.

2 True, 1 False = True.

KNN algorithms:-

K- nearest neighbours algorithm:-

Classification are used in KNN.
basic algo in classification.

IMDb Rating	Duration	जेनरी Genre
8.0 (mission impossible)	160	Action.
6.2 (sardar 2)	170	Action
7.2 (Rocky & rani)	168	comedy.
8.2 (OMG 2)	155	Comedy.

प्रिडिक्शन

• No predic the genre of "barbie" movie with IMDB rating 7.4 and duration 114 minutes

(Euclidean Distance)

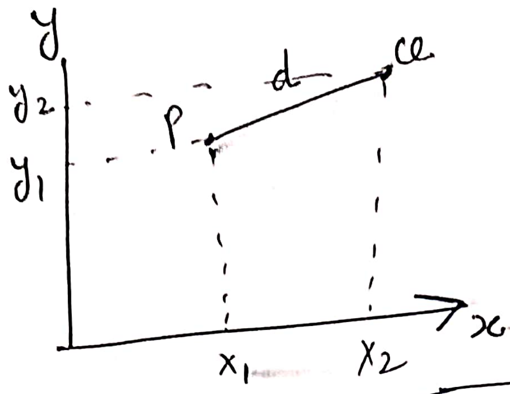
Step 1 Calculate Distance:-

Distance to (8.0, 160) = $\sqrt{(7.4)-(8.0)^2+(114-160)^2}$

Distance to (6.2, 160) = $\sqrt{(7.4-6.2)^2+(114-170)^2}$ =

Distance to (7.2, 168) = $\sqrt{(7.4-7.2)^2+(114-168)^2}$

Distance to (8.2, 155) = $\sqrt{(7.4-8.2)^2+(114-155)^2}$



$$d(P,q) = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

1) $\sqrt{((7.4)-(8.0))^2 + (114-160)^2} = \sqrt{0.36+2116} \simeq 46.00$

2 $\sqrt{(7.4)-(6.2))^2 + (114-170)^2} = \sqrt{1.44+3136} \simeq 56.01$

3 $\sqrt{(7.4 - 7.2)^2 + (114-168)^2} = \sqrt{0.04+2916} \simeq 54.4$

4 $\sqrt{(7.4)-(8.2))^2 + (114-155)^2} = \sqrt{0.64+1681} \simeq 41$

$k=1, k=3$ A CC ✓

Step 2 Select K Nearest Neigubors

Step 3 Majority voting classification

linear sum:-

S_1 S_2 S_3

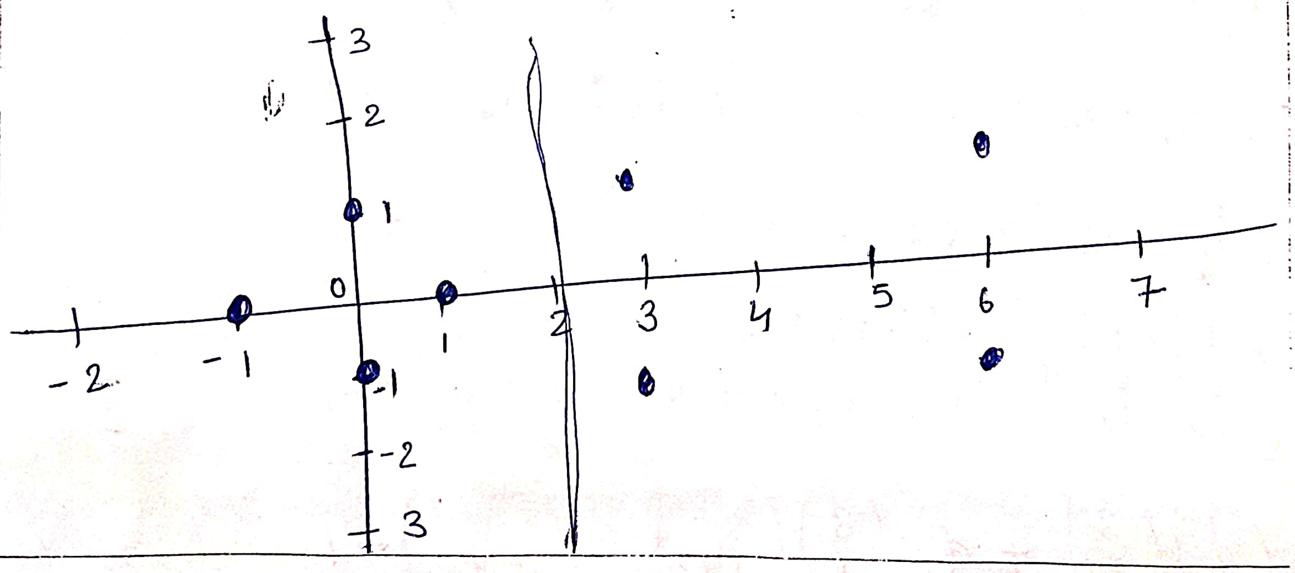
label data points:-

suppose

$$\left\{ \begin{pmatrix} 3 \\ 1 \end{pmatrix} \begin{pmatrix} 3 \\ -1 \end{pmatrix}, \begin{pmatrix} 6 \\ 1 \end{pmatrix}, \begin{pmatrix} 6 \\ -1 \end{pmatrix} \right\}$$

the following negatively lablel datapoints

$$\left(\begin{pmatrix} 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ -1 \end{pmatrix}, \begin{pmatrix} -1 \\ 0 \end{pmatrix} \right)$$



three support vectors:-

$\{ s_1 = \begin{pmatrix}1\\0\end{pmatrix}, \; s_2 = \begin{pmatrix}3\\1\end{pmatrix}, \; s_3 = \begin{pmatrix}3\\-1\end{pmatrix} \}$

each vector is augmented with a 1 as a input bias.

- so, $s_1 = \begin{pmatrix}1\\0\end{pmatrix}$ then $\tilde{s}_1 = \begin{pmatrix}1\\0\\1\end{pmatrix}$

- Similarly,

- $s_2 = \begin{pmatrix}3\\1\end{pmatrix}$, then $\tilde{s}_2 = \begin{pmatrix}3\\1\\1\end{pmatrix}$

and $s_3 = \begin{pmatrix}3\\-1\end{pmatrix}$ then $\tilde{s}_3 = \begin{pmatrix}3\\-1\\1\end{pmatrix}$

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

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

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

$$\alpha_1 \begin{pmatrix}1\\0\\1\end{pmatrix}\begin{pmatrix}1\\0\\1\end{pmatrix} + \alpha_2 \begin{pmatrix}3\\1\\1\end{pmatrix}\begin{pmatrix}1\\0\\1\end{pmatrix} + \alpha_3 \begin{pmatrix}3\\-1\\1\end{pmatrix}\begin{pmatrix}1\\0\\1\end{pmatrix} = -1$$

$$\alpha_1 \begin{pmatrix}1\\0\\1\end{pmatrix}\begin{pmatrix}3\\1\\1\end{pmatrix} + \alpha_2 \begin{pmatrix}3\\1\\1\end{pmatrix}\begin{pmatrix}3\\1\\1\end{pmatrix} + \alpha_3 \begin{pmatrix}3\\-1\\1\end{pmatrix}\begin{pmatrix}3\\1\\1\end{pmatrix} = 1$$

$$\alpha_1 \begin{pmatrix}1\\0\\1\end{pmatrix}\begin{pmatrix}3\\-1\\1\end{pmatrix} + \alpha_2 \begin{pmatrix}3\\1\\1\end{pmatrix}\begin{pmatrix}3\\-1\\1\end{pmatrix} + \alpha_3 \begin{pmatrix}3\\-1\\1\end{pmatrix}\begin{pmatrix}3\\-1\\1\end{pmatrix} = 1$$

$$\alpha_1(1+0+1) + \alpha_2(3+0+1) + \alpha_3(3+0+1) = -1$$

$$\alpha_1(3+0+1) + \alpha_2(9+1+1) + \alpha_3(9-1+1) = 1$$

$$\alpha_1(3+0+1) + \alpha_2(9-1+1) + \alpha_3(9+1+1) = 1$$

$$2\alpha_1 + 4\alpha_2 + 4\alpha_3 = -1$$

$$4\alpha_1 + 11\alpha_2 + 9\alpha_3 = 1$$

$$4\alpha_1 + 9\alpha_2 + 11\alpha_3 = 1$$

$$\alpha_1 = -3.5$$

$$\alpha_2 = 0.75$$

$$\alpha_3 = 0.75$$

$$\bar{w} = \sum \alpha_i \bar{s}_i$$

$$= -3.5\begin{pmatrix}1\\0\\1\end{pmatrix} + 0.75\begin{pmatrix}3\\1\\1\end{pmatrix} + 0.75\begin{pmatrix}3\\-1\\1\end{pmatrix}$$

$$= \begin{pmatrix}1\\0\\-2\end{pmatrix}$$

- finally, remembering that our vectors are argumented with a bias.
- we can equate the last entry $\bar{w}$ as the hyperplane offset b and write the separa

$y = wx + b$ with $w\begin{pmatrix}1\\0\end{pmatrix}$ and $b = -2$.