Support Vector Machine

+1

$$a\vec{V}_1 \bullet \vec{V}_1 + b\vec{V}_2 \bullet \vec{V}_1 + c\vec{V}_3 \bullet \vec{V}_1 + d\vec{V}_4 \bullet \vec{V}_1 = +1$$

$$a\vec{V}_1 \bullet \vec{V}_2 + b\vec{V}_2 \bullet \vec{V}_2 + c\vec{V}_3 \bullet \vec{V}_2 + d\vec{V}_4 \bullet \vec{V}_2 = +1$$

$$a\vec{V}_1 \bullet \vec{V}_3 + b\vec{V}_2 \bullet \vec{V}_3 + c\vec{V}_3 \bullet \vec{V}_3 + d\vec{V}_4 \bullet \vec{V}_3 = -1$$

$$a\vec{V}_1 \bullet \vec{V}_4 + b\vec{V}_2 \bullet \vec{V}_4 + c\vec{V}_3 \bullet \vec{V}_4 + d\vec{V}_4 \bullet \vec{V}_4 = -1$$

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Support - Vector Networks

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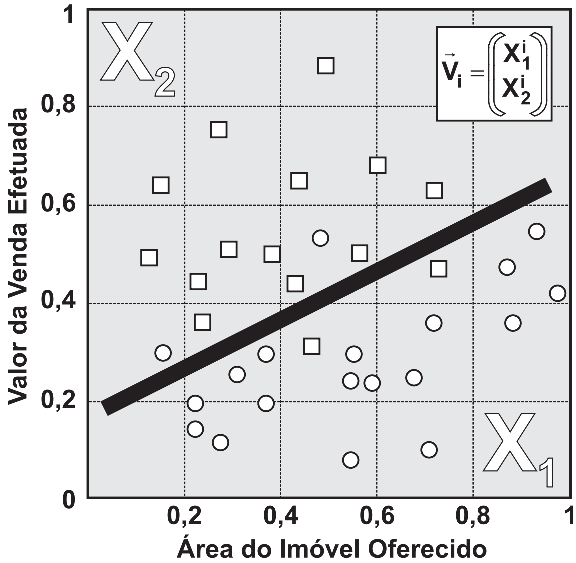
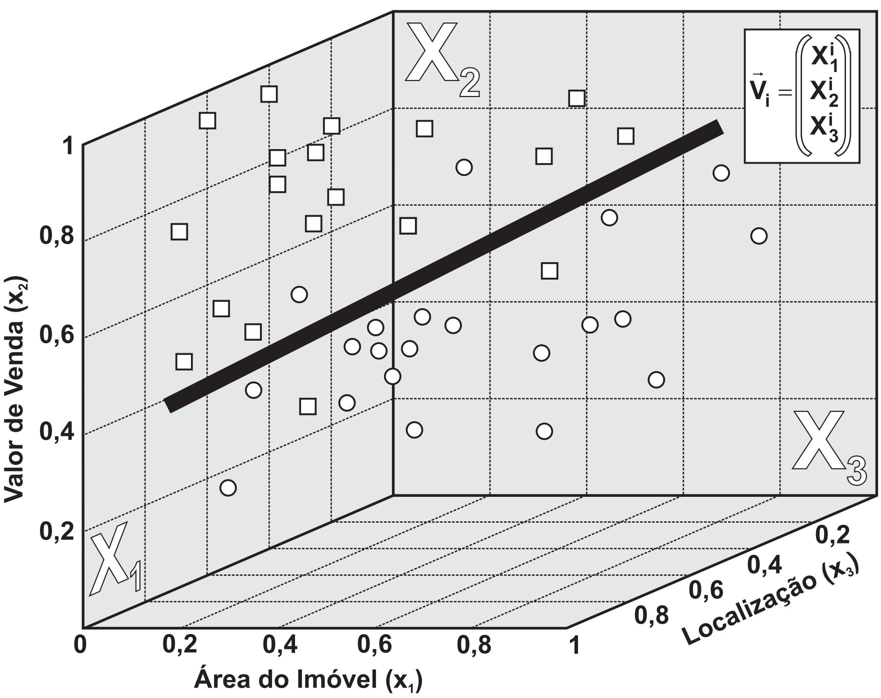
Support Vector Machine

1.0 Classificação de Dados (Quadrado/Circular)

1.1 Fronteira Divisória do Tipo Reta



1.2 Fronteira Divisória do Tipo Plano



X_1^i X_2^i X_3^i

X_1^j X_2^j X_3^j

Aplicação do Produto Escalar

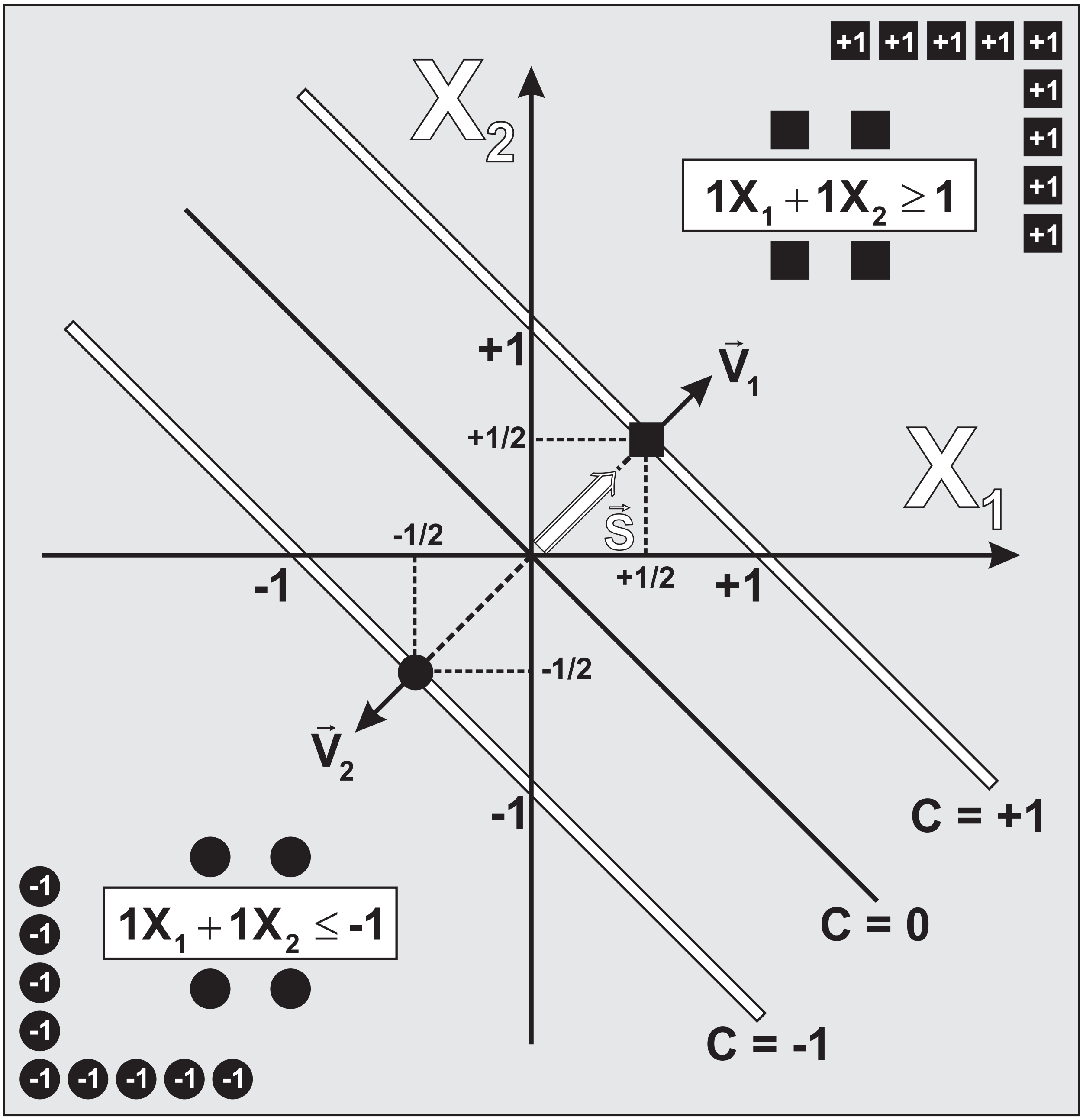
2.0 Hiperplanos e o Vetor Seleção $\vec{S}$

Seja a equação geral de um hiperplano da classe linear;

$$AX_1 + BX_2 = C \Rightarrow 1X_1 + 1X_2 = C$$

Inclinação do Hiperplano: A, B   Inclinação do Hiperplano: 1,1

três retas particulares (C = 0, +1, -1) associadas a duas inequações (≥,≤):



Support Vectors $(\vec{V}_1, \vec{V}_2)$ e Vetor Seleção $(\vec{S})$

Support $\vec{V}_1=\begin{pmatrix}1\\3\\1\end{pmatrix}$ $\vec{V}_2=\begin{pmatrix}1\\1\\1\end{pmatrix}$ $\vec{V}_3=\begin{pmatrix}3\\3\\1\end{pmatrix}$ $\vec{V}_4=\begin{pmatrix}3\\1\\1\end{pmatrix}$ Vector

$$a\vec{V}_1\circ\vec{V}_1+b\vec{V}_2\circ\vec{V}_1+c\vec{V}_3\circ\vec{V}_1+d\vec{V}_4\circ\vec{V}_1=-1(\text{classe}\bigcirc)$$

$$a\vec{V}_1\circ\vec{V}_2+b\vec{V}_2\circ\vec{V}_2+c\vec{V}_3\circ\vec{V}_2+d\vec{V}_4\circ\vec{V}_2=-1(\text{classe}\bigcirc)$$

$$a\vec{V}_1\circ\vec{V}_3+b\vec{V}_2\circ\vec{V}_3+c\vec{V}_3\circ\vec{V}_3+d\vec{V}_4\circ\vec{V}_3=+1(\text{classe}\square)$$

$$a\vec{V}_1\cdot\vec{V}_4+b\vec{V}_2\circ\vec{V}_4+c\vec{V}_3\circ\vec{V}_4+d\vec{V}_4\circ\vec{V}_4=+1(\text{classe}\square)$$

$$a\begin{pmatrix}1\\3\\1\end{pmatrix}\circ\begin{pmatrix}1\\3\\1\end{pmatrix}+b\begin{pmatrix}1\\1\\1\end{pmatrix}\circ\begin{pmatrix}1\\3\\1\end{pmatrix}+c\begin{pmatrix}3\\3\\1\end{pmatrix}\circ\begin{pmatrix}1\\3\\1\end{pmatrix}+d\begin{pmatrix}3\\1\\1\end{pmatrix}\circ\begin{pmatrix}1\\3\\1\end{pmatrix}=-1$$

$$a\begin{pmatrix}1\\3\\1\end{pmatrix}\circ\begin{pmatrix}1\\1\\1\end{pmatrix}+b\begin{pmatrix}1\\1\\1\end{pmatrix}\circ\begin{pmatrix}1\\1\\1\end{pmatrix}+c\begin{pmatrix}3\\3\\1\end{pmatrix}\circ\begin{pmatrix}1\\1\\1\end{pmatrix}+d\begin{pmatrix}3\\1\\1\end{pmatrix}\circ\begin{pmatrix}1\\1\\1\end{pmatrix}=-1$$

$$a\begin{pmatrix}1\\3\\1\end{pmatrix}\circ\begin{pmatrix}3\\3\\1\end{pmatrix}+b\begin{pmatrix}1\\1\\1\end{pmatrix}\circ\begin{pmatrix}3\\3\\1\end{pmatrix}+c\begin{pmatrix}3\\3\\1\end{pmatrix}\circ\begin{pmatrix}3\\3\\1\end{pmatrix}+d\begin{pmatrix}3\\1\\1\end{pmatrix}\circ\begin{pmatrix}3\\3\\1\end{pmatrix}=+1$$

$$a\begin{pmatrix}1\\3\\1\end{pmatrix}\circ\begin{pmatrix}3\\1\\1\end{pmatrix}+b\begin{pmatrix}1\\1\\1\end{pmatrix}\circ\begin{pmatrix}3\\1\\1\end{pmatrix}+c\begin{pmatrix}3\\3\\1\end{pmatrix}\circ\begin{pmatrix}3\\1\\1\end{pmatrix}+d\begin{pmatrix}3\\1\\1\end{pmatrix}\circ\begin{pmatrix}3\\1\\1\end{pmatrix}=+1$$

$$\begin{cases}11a+5b+13c+7d=-1\\5a+3b+7c+5d=-1\\13a+7b+19c+13d=+1\\7a+5b+13c+11d=+1\end{cases}$$

Solução Sistema

$$a=+1{,}0 \quad b=-4{,}5 \quad c=0 \quad d=+1{,}5$$

$$S=\left[a\vec{V}_1+b\vec{V}_2+c\vec{V}_3+d\vec{V}_4\right]\circ\vec{V}$$

Operação de Separação

$$S=\left[1{,}0\begin{pmatrix}1\\3\\1\end{pmatrix}-4{,}5\begin{pmatrix}1\\1\\1\end{pmatrix}+0\begin{pmatrix}3\\3\\1\end{pmatrix}+1{,}5\begin{pmatrix}3\\1\\1\end{pmatrix}\right]\circ\begin{pmatrix}X_1\\X_2\\1\end{pmatrix}=\begin{bmatrix}1\\0\\-2\end{bmatrix}\circ\begin{pmatrix}X_1\\X_2\\1\end{pmatrix}$$

$$S=1\circ X_1+0\circ X_2-2$$

Função Separadora - FSV

$$S_1=1\circ1+0\circ3-2=-1,\bigcirc \qquad S_3=1\circ3+0\circ3-2=+1,\square$$

$$S_2=1\circ1+0\circ1-2=-1,\bigcirc \qquad S_4=1\circ3+0\circ1-2=+1,\square$$

6.0 Support Vectors e seu Banco de Dados: $\vec{V}n$

$$[n_4^1 \; n_4^2 \; n_4^3 \; n_4^4 \; n_4^5 \; n_4^6 \; \vdots \; 1] \qquad \vec{V}^4 = 1 \qquad [n_4^1 \; n_4^2 \; n_4^3 \; n_4^4 \; n_4^5 \; n_4^6 \; \vdots]$$

$$[n_8^1 \; n_8^2 \; n_8^3 \; n_8^4 \; n_8^5 \; n_8^6 \; \vdots \; 1] \qquad \vec{V}^8 = 1 \qquad [n_8^1 \; n_8^2 \; n_8^3 \; n_8^4 \; n_8^5 \; n_8^6 \; \vdots]$$

$$[n_3^1 \; n_3^2 \; n_3^3 \; n_3^4 \; n_3^5 \; n_3^6 \; \vdots \; 1] \qquad \vec{V}^3 = 1 \qquad [n_3^1 \; n_3^2 \; n_3^3 \; n_3^4 \; n_3^5 \; n_3^6 \; \vdots]$$

$$[n_7^1 \; n_7^2 \; n_7^3 \; n_7^4 \; n_7^5 \; n_7^6 \; \vdots \; 1] \qquad \vec{V}^7 = 1 \qquad [n_7^1 \; n_7^2 \; n_7^3 \; n_7^4 \; n_7^5 \; n_7^6 \; \vdots]$$

$$[n_2^1 \; n_2^2 \; n_2^3 \; n_2^4 \; n_2^5 \; n_2^6 \; \vdots \; 1] \qquad \vec{V}^2 = 1 \qquad [n_2^1 \; n_2^2 \; n_2^3 \; n_2^4 \; n_2^5 \; n_2^6 \; \vdots]$$

$$[n_6^1 \; n_6^2 \; n_6^3 \; n_6^4 \; n_6^5 \; n_6^6 \; \vdots \; 1] \qquad \vec{V}^6 = 1 \qquad [n_6^1 \; n_6^2 \; n_6^3 \; n_6^4 \; n_6^5 \; n_6^6 \; \vdots]$$

$$[n_1^1 \; n_1^2 \; n_1^3 \; n_1^4 \; n_1^5 \; n_1^6 \; \vdots \; 1] \qquad \vec{V}^1 = 1 \qquad [n_1^1 \; n_1^2 \; n_1^3 \; n_1^4 \; n_1^5 \; n_1^6 \; \vdots]$$

$$[n_5^1 \; n_5^2 \; n_5^3 \; n_5^4 \; n_5^5 \; n_5^6 \; \vdots \; 1] \qquad \vec{V}^5 = 1 \qquad [n_5^1 \; n_5^2 \; n_5^3 \; n_5^4 \; n_5^5 \; n_5^6 \; \vdots]$$