SVM

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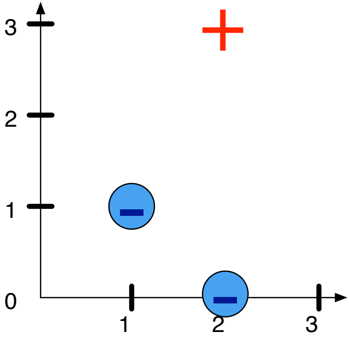
SLIDES ADAPTED FROM HINRICH SCHÜTZE

Find the maximum margin hyperplane



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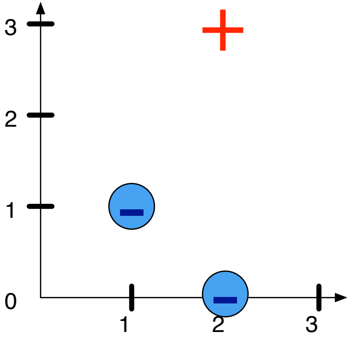

Which are the support vectors?

Walkthrough example: building an SVM over the data shown

Working geometrically:

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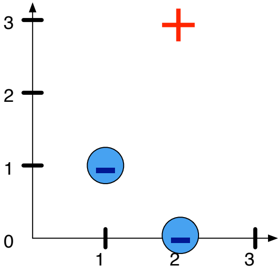
- Set up system of equations (don't do colinear)

$$w_1 + w_2 + b = -1 \quad (1)$$

$$\frac{3}{2}w_1 + 2w_2 + b = 0 \quad (2)$$

$$\frac{11}{4}w_2 + b = 0 \quad (3)$$

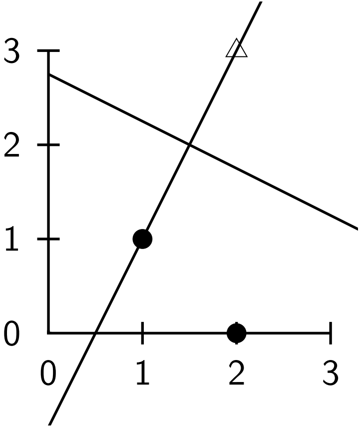
$$2w_1 + 3w_2 + b = +1 \quad (4)$$



The SVM decision boundary is:

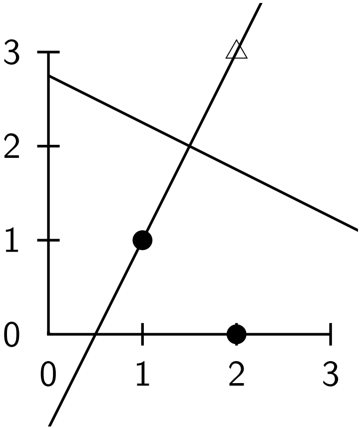
$$0 = \frac{2}{5}x + \frac{4}{5}y - \frac{11}{5}$$

Cannonical Form



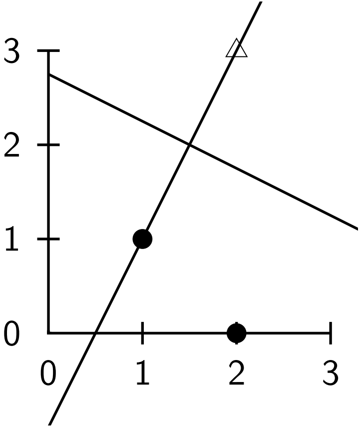
$$w_1 x_1 + w_2 x_2 + b$$

Cannonical Form



$$.4x_1 + .8x_2 - 2.2$$

Cannonical Form



$.4x_1 + .8x_2 - 2.2$

- $.4 \cdot 1 + .8 \cdot 1 - 2.2 = -1$
- $.4 \cdot \frac{3}{2} + .8 \cdot 2 = 0$
- $.4 \cdot 2 + .8 \cdot 3 - 2.2 = +1$

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- Weight vector

$$\frac{1}{||w||}=\frac{1}{\sqrt{\left(\frac{2}{5}\right)^2+\left(\frac{4}{5}\right)^2}}=\frac{1}{\sqrt{\frac{20}{25}}}=\frac{5}{\sqrt{5}\sqrt{4}}=\frac{\sqrt{5}}{2} \tag{6}$$