SVM

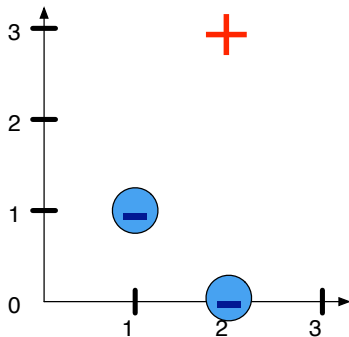## Data Science: Jordan Boyd-Graber
University of Maryland

Find the maximum margin hyperplane
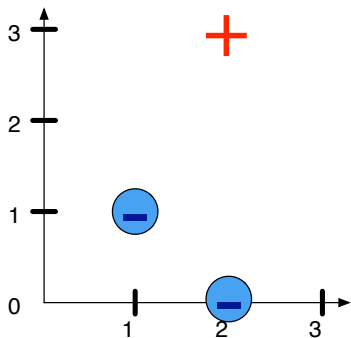
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Which are the support vectors?

Walkthrough example: building an SVM over the data shown

Working geometrically:

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- Set up system of equations

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

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

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

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

$$(5)$$

- Hint: don't give colinear points!

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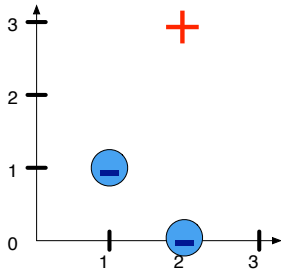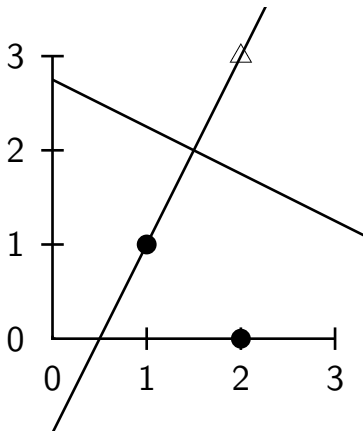- Set up system of equations

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$$\tag{5}$$

- Hint: don't give colinear points! The SVM decision boundary is:
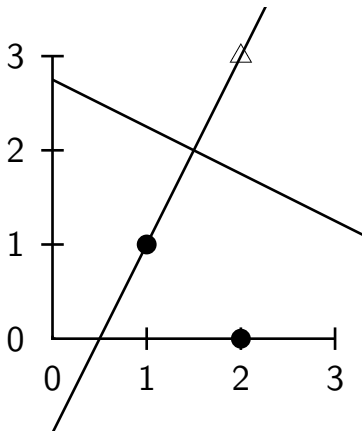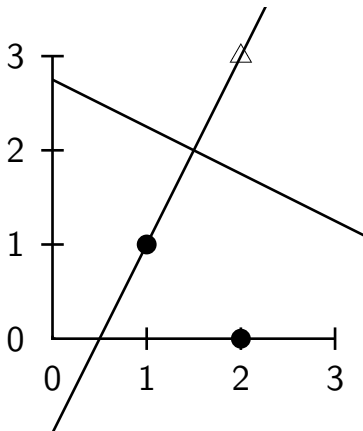
$$2 \qquad 4 \qquad 11$$

Cannonical Form

$$w_1 x_1 + w_2 x_2 + b$$

Cannonical Form

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

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$.4x_1 + .8x_2 - 2.2$

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

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- Weight vector

$$\frac{1}{\|w\|} = \frac{1}{\sqrt{\left(\frac{2}{5}\right)^2 + \left(\frac{4}{5}\right)^2}} = \frac{1}{\sqrt{\frac{20}{25}}} = \frac{5}{\sqrt{5}\sqrt{4}} = \frac{\sqrt{5}}{2} \tag{7}$$