Department of Computer Science
UNIVERSITY OF COLORADO **BOULDER**

Support Vector Machines

Jordan Boyd-Graber
University of Colorado Boulder
LECTURE 9

Slides adapted from Tom Mitchell, Eric Xing, and Lauren Hannah

Content Questions

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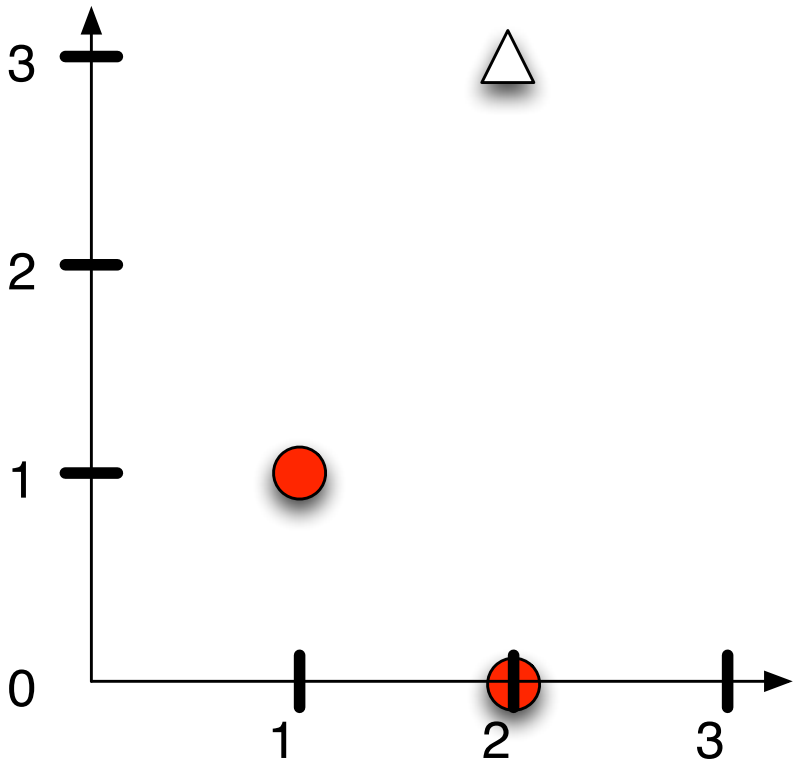
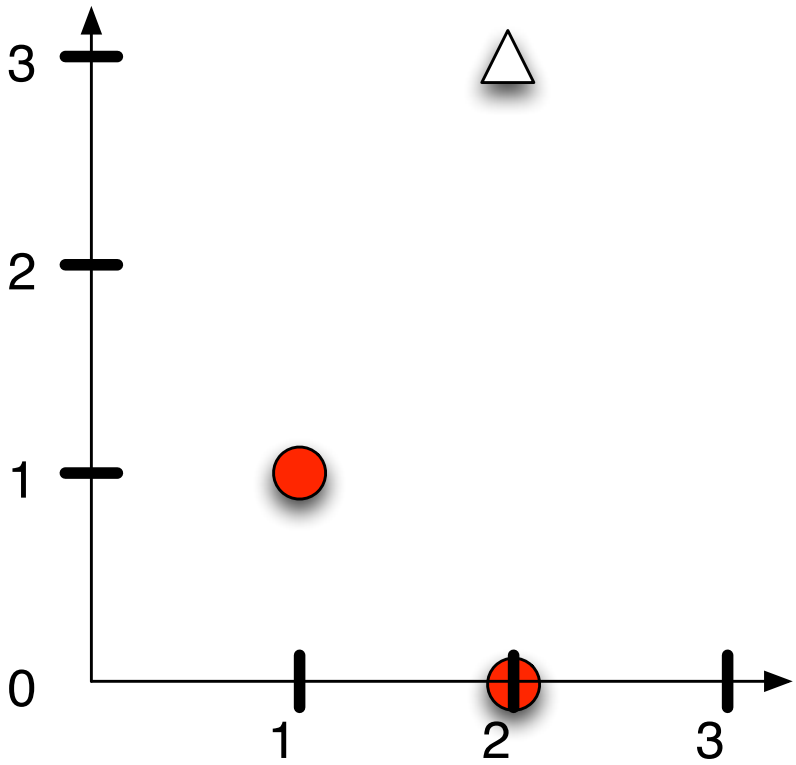
Administrative Questions

Find the maximum margin hyperplane



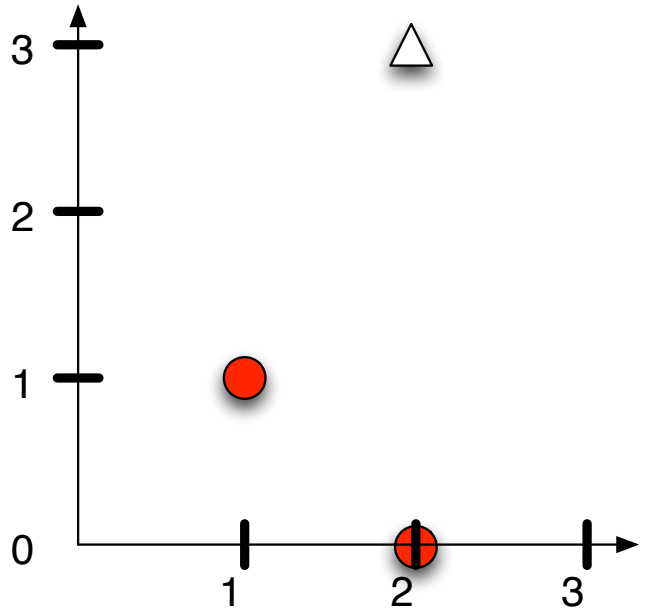
Find the maximum margin hyperplane



Which are the support vectors?

Walkthrough example: building an SVM over the data shown

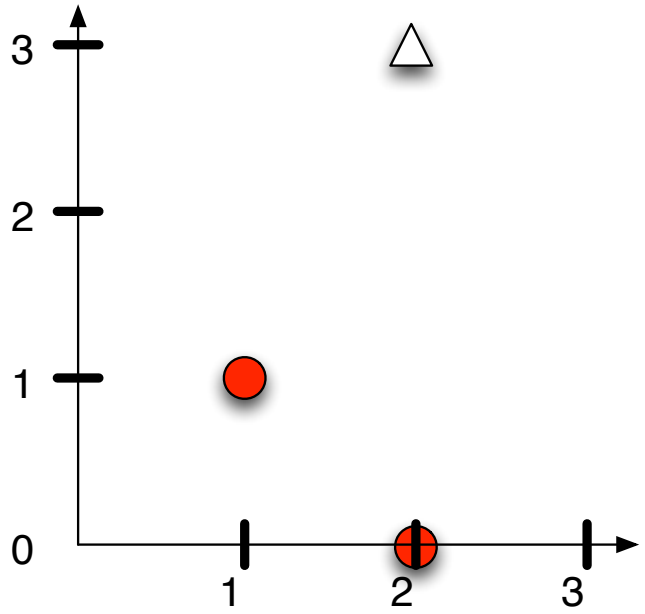
Working geometrically:



Walkthrough example: building an SVM over the data shown

Working geometrically:

- The maximum margin weight vector will be parallel to the shortest line connecting points of the two classes, that is, the line between $(1, 1)$ and $(2, 3)$, giving a weight vector of $(1, 2)$.



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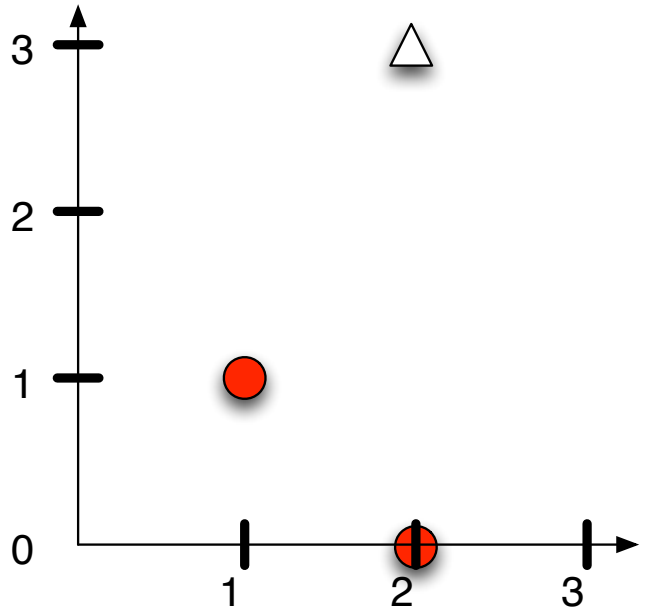
- The optimal decision surface is orthogonal to that line and intersects it at the halfway point. Therefore, it passes through $(1.5, 2)$.



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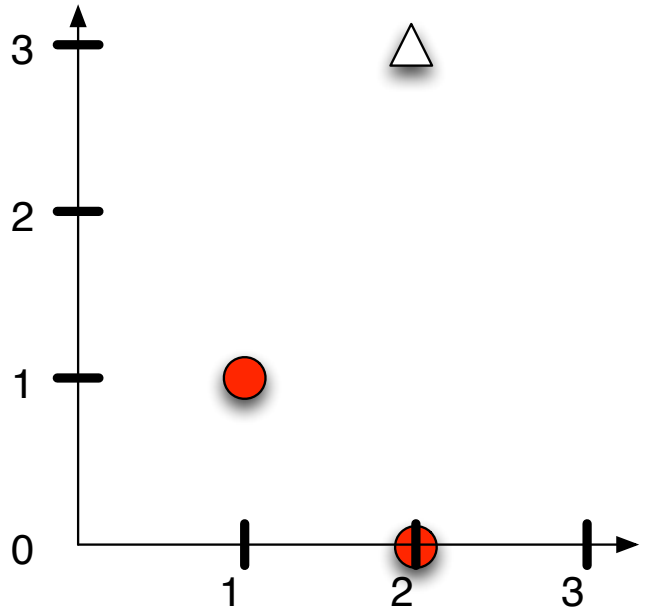
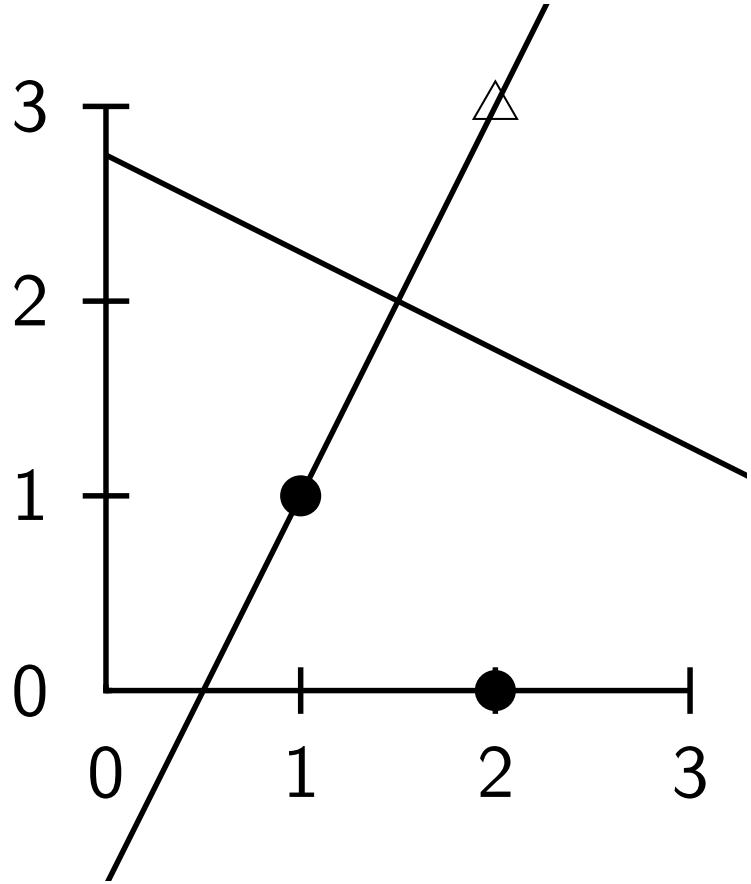
- The SVM decision boundary is:



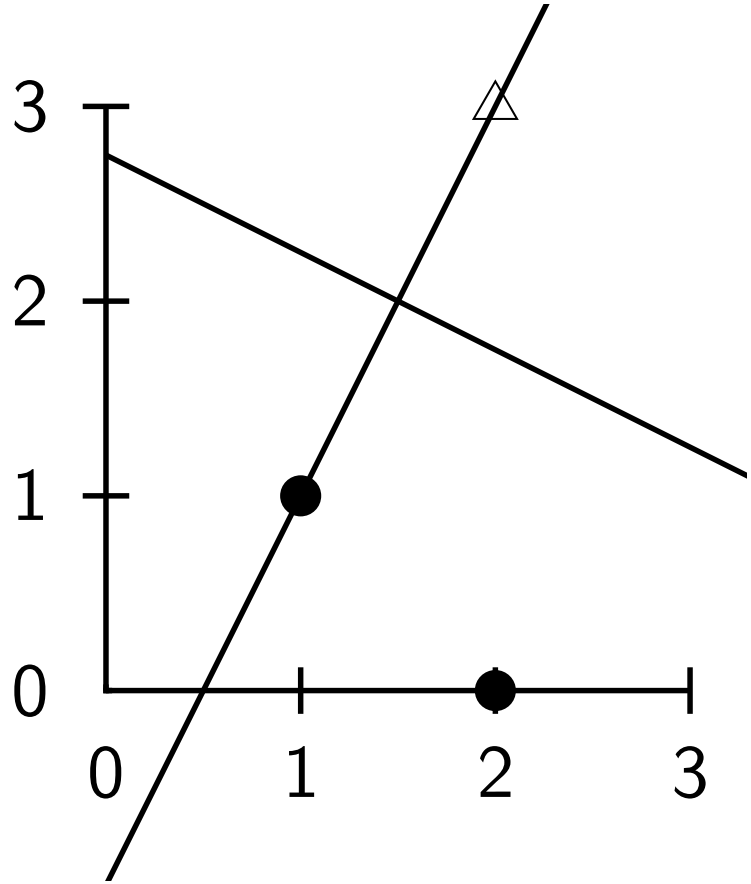
$$0 = \frac{1}{2}x + y - \frac{11}{4} \Leftrightarrow 0 = \frac{2}{5}x + \frac{4}{5}y - \frac{11}{5}$$

Cannonical Form



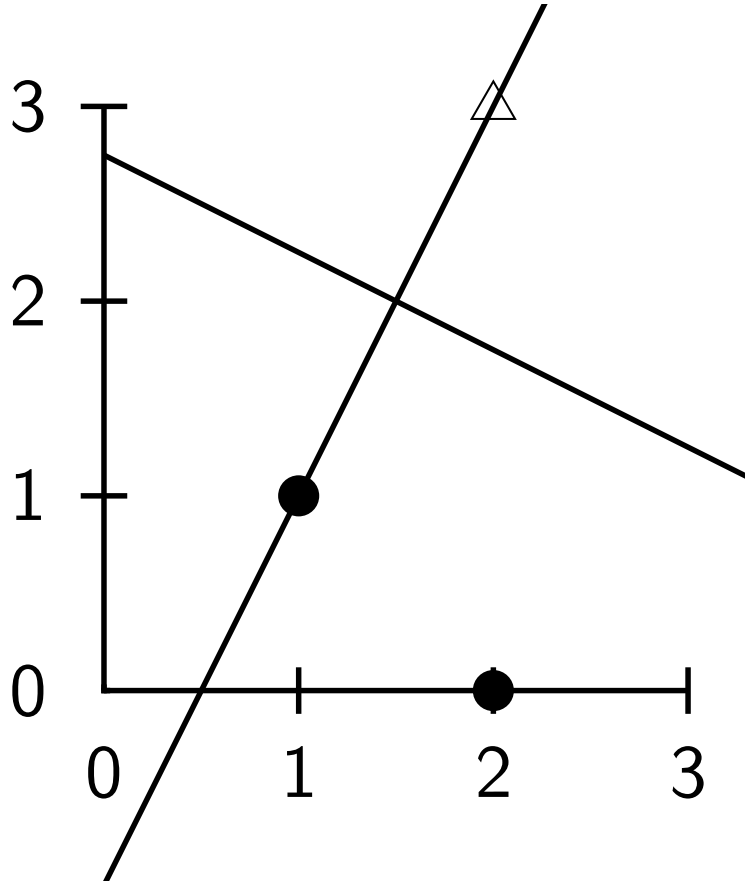
$$w_1 x_1 + w_2 x_2 + b$$

Cannonical Form



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

Cannonical Form



$.4x_1 + .8x_2 - 2.2$

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