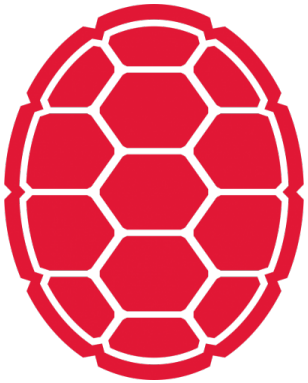
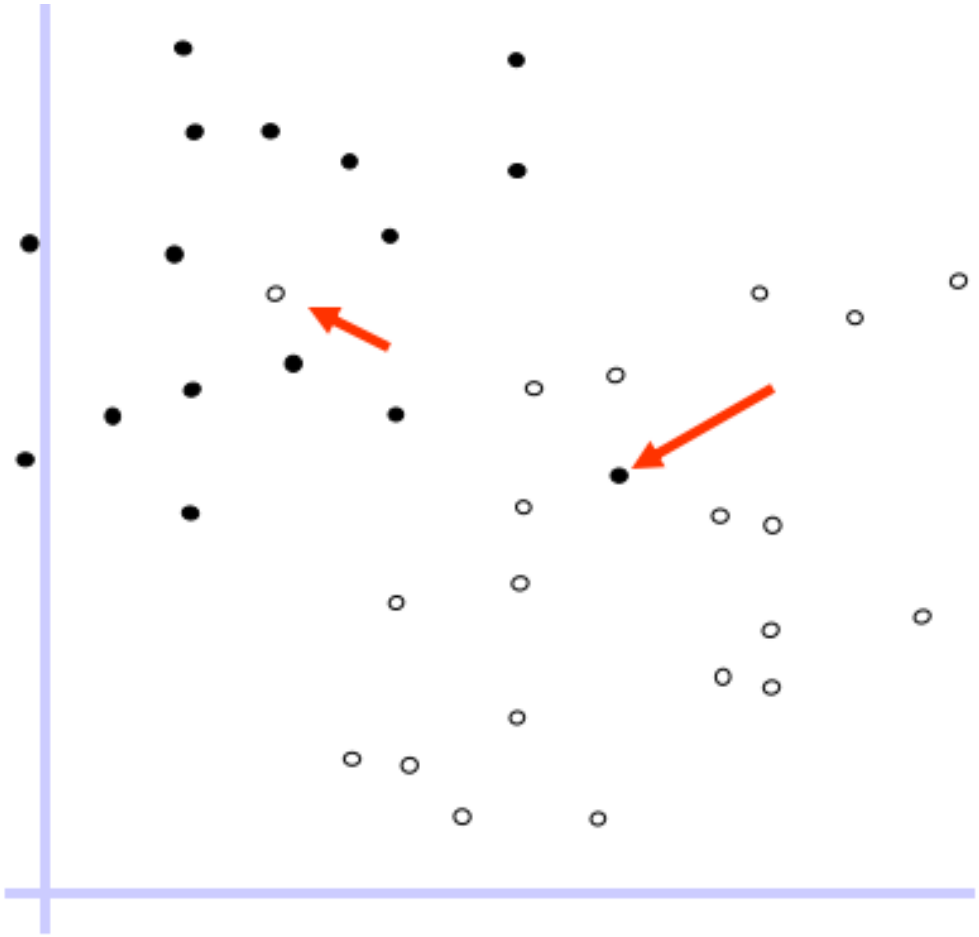


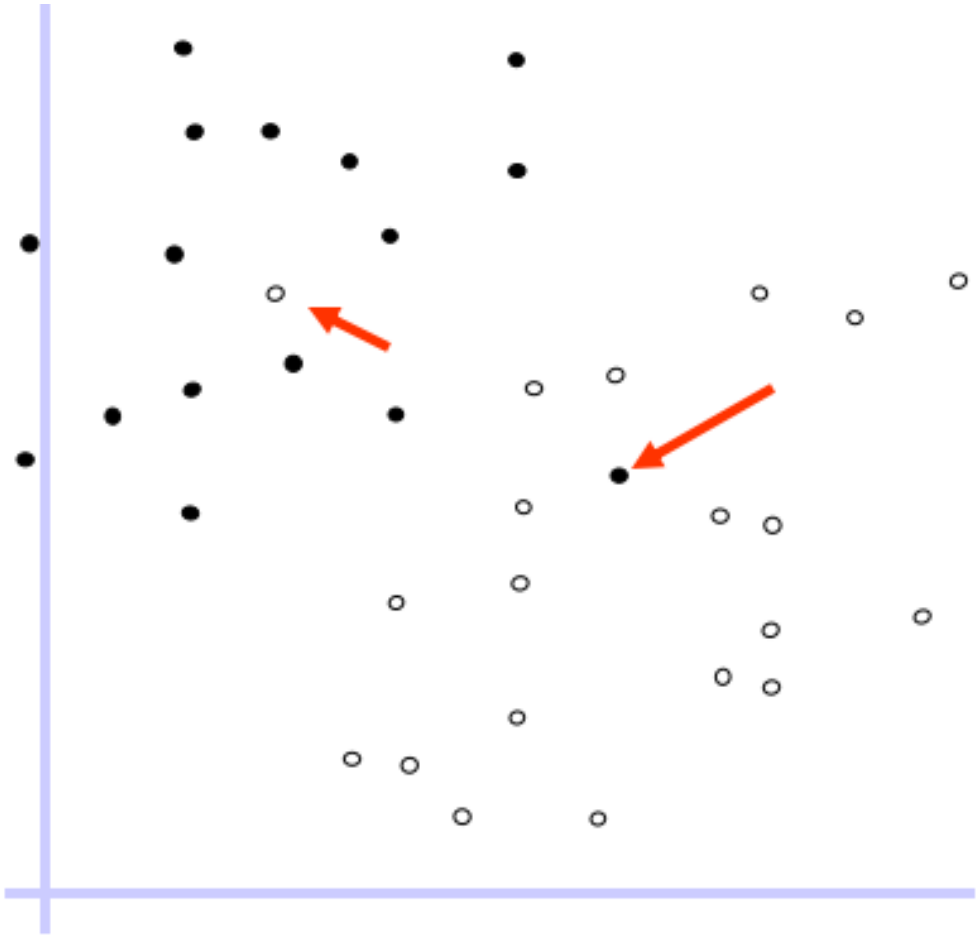
SVM

Data Science: Jordan Boyd-Graber
University of Maryland
SLIDES ADAPTED FROM JERRY ZHU

Can SVMs Work Here?

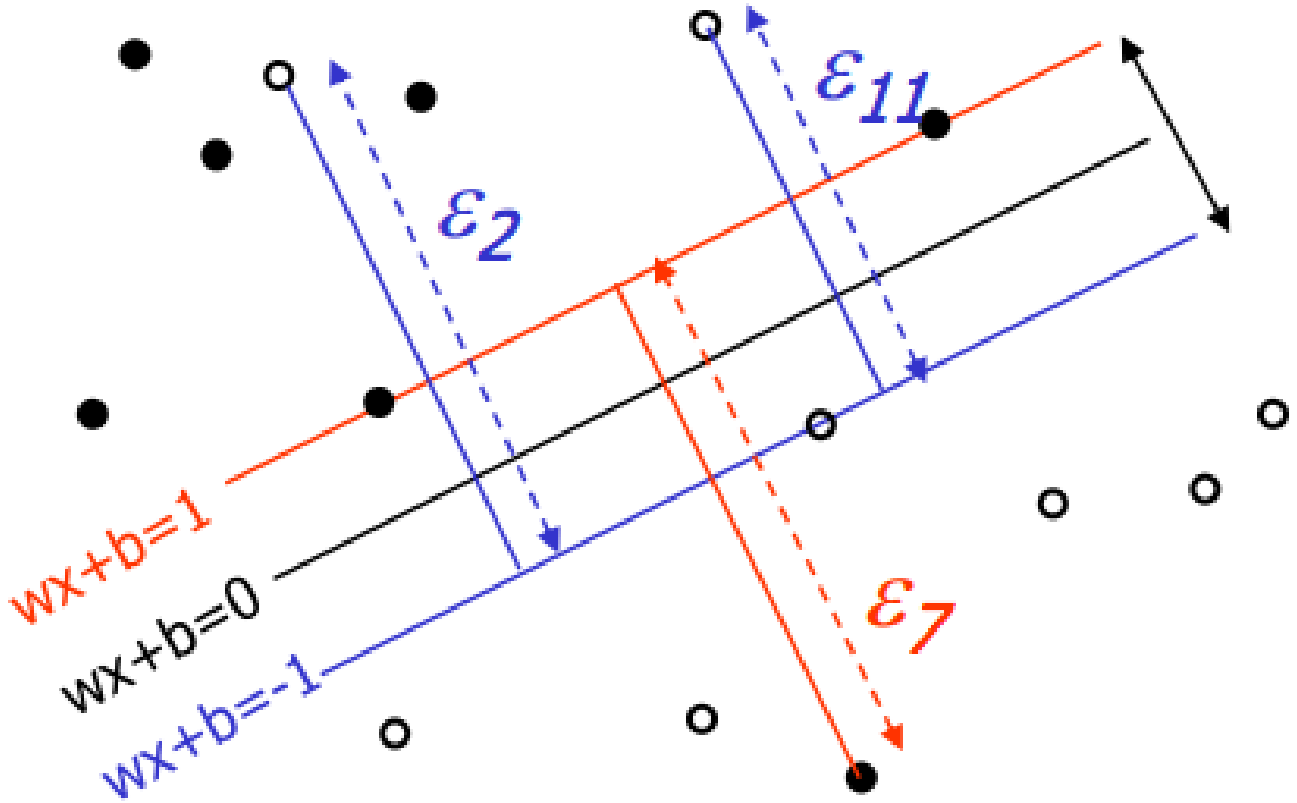


Can SVMs Work Here?



$$y_i(w \cdot x_i + b) \geq 1 \tag{1}$$

Trick: Allow for a few bad apples



New objective function

$$\min_{w,b,\xi} \frac{1}{2}||w||^2 + C\sum_{i=1} \xi_i{}^p \tag{2}$$

subject to $y_i(w \cdot x_i + b) \geq 1 - \xi_i \wedge \xi_i \geq 0, i \in [1, m]$

New objective function

$$\min_{w,b,\xi} \frac{1}{2}||w||^2 + C\sum_{i=1} \xi_i{}^p \tag{2}$$

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- Standard margin

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- Standard margin
- How wrong a point is (slack variables)

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- Standard margin
- How wrong a point is (slack variables)
- Tradeoff between margin and slack variables

New objective function

$$\min_{w,b,\xi} \frac{1}{2}||w||^2 + C\sum_{i=1} \xi_i{}^p \tag{2}$$

subject to $y_i(w \cdot x_i + b) \geq 1 - \xi_i \wedge \xi_i \geq 0, i \in [1, m]$

- Standard margin
- How wrong a point is (slack variables)
- Tradeoff between margin and slack variables
- How bad wrongness scales

Aside: Loss Functions

- Losses measure how bad a mistake is
- Important for slack as well

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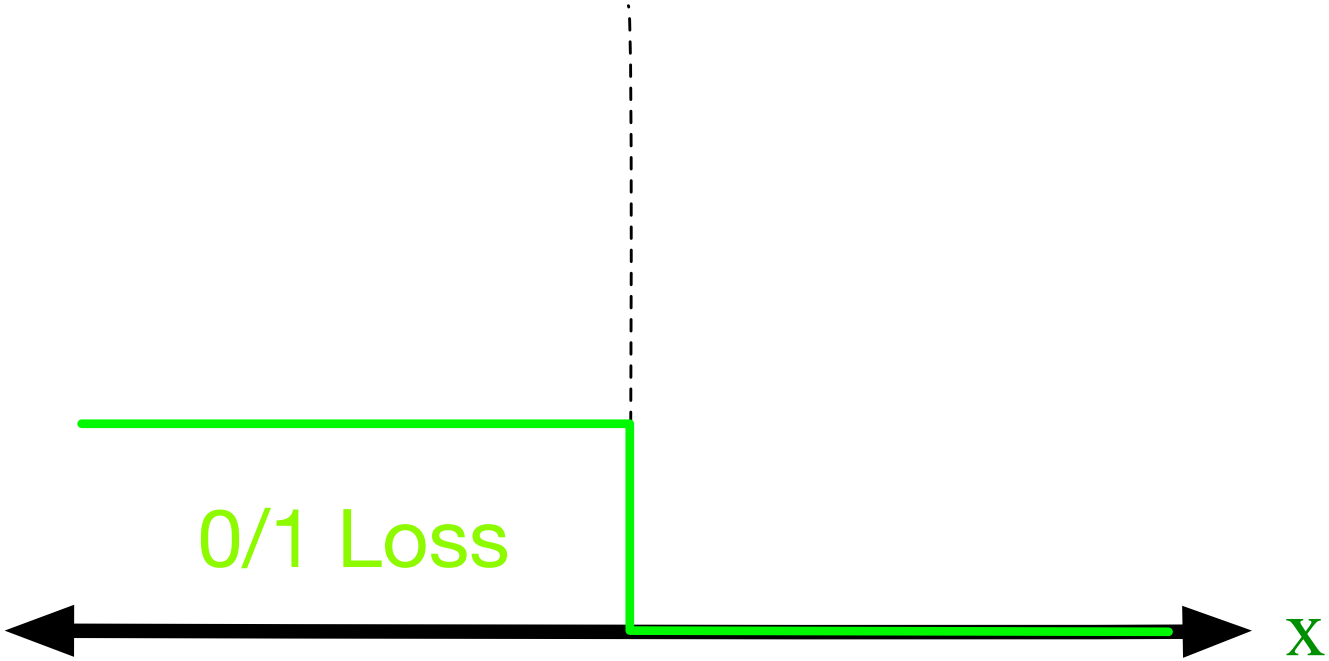

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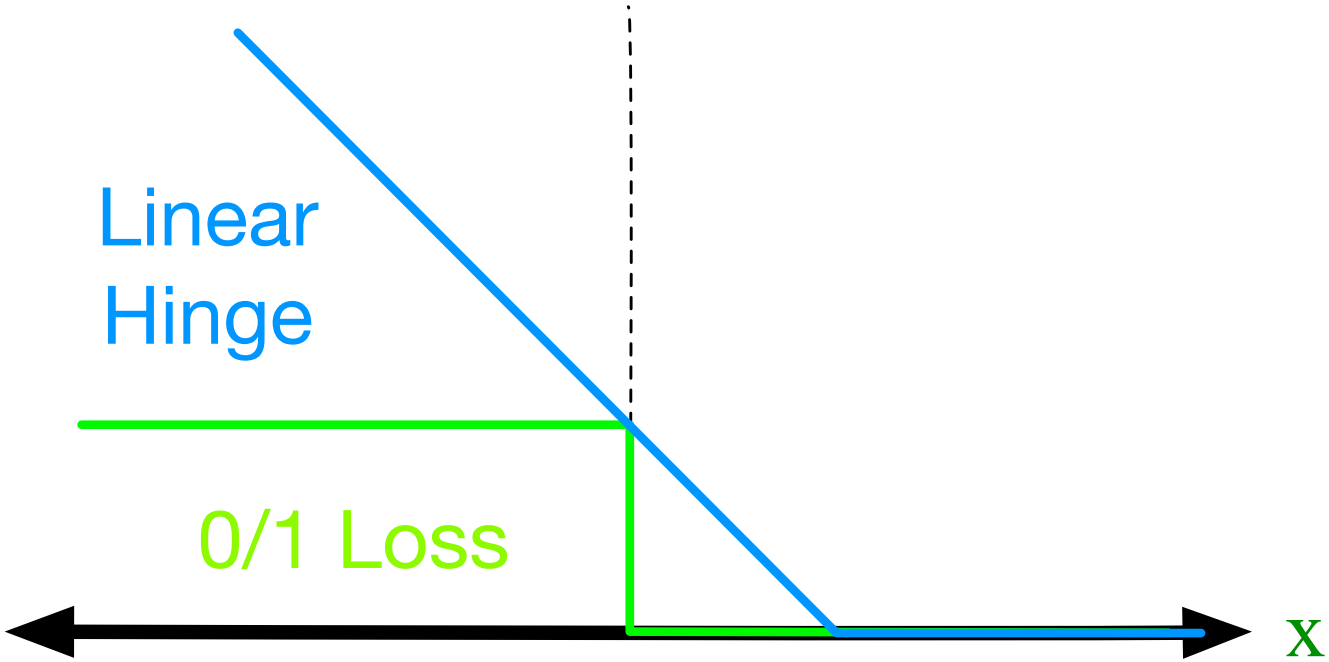

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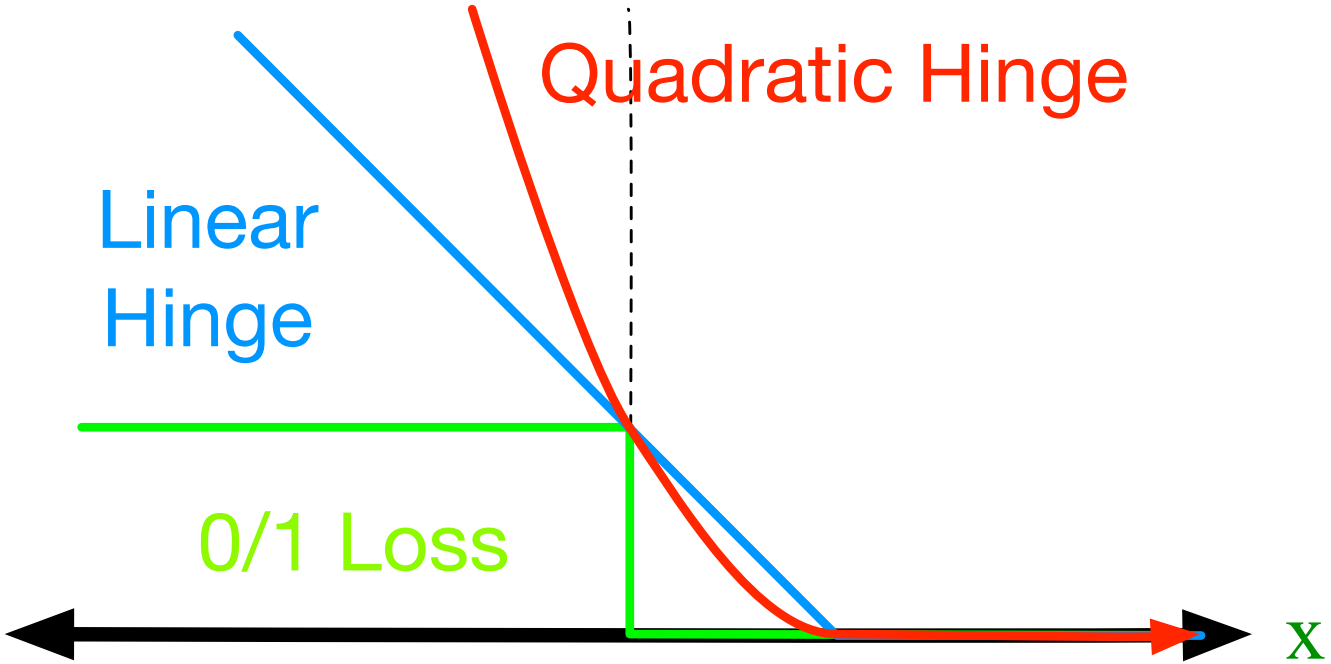

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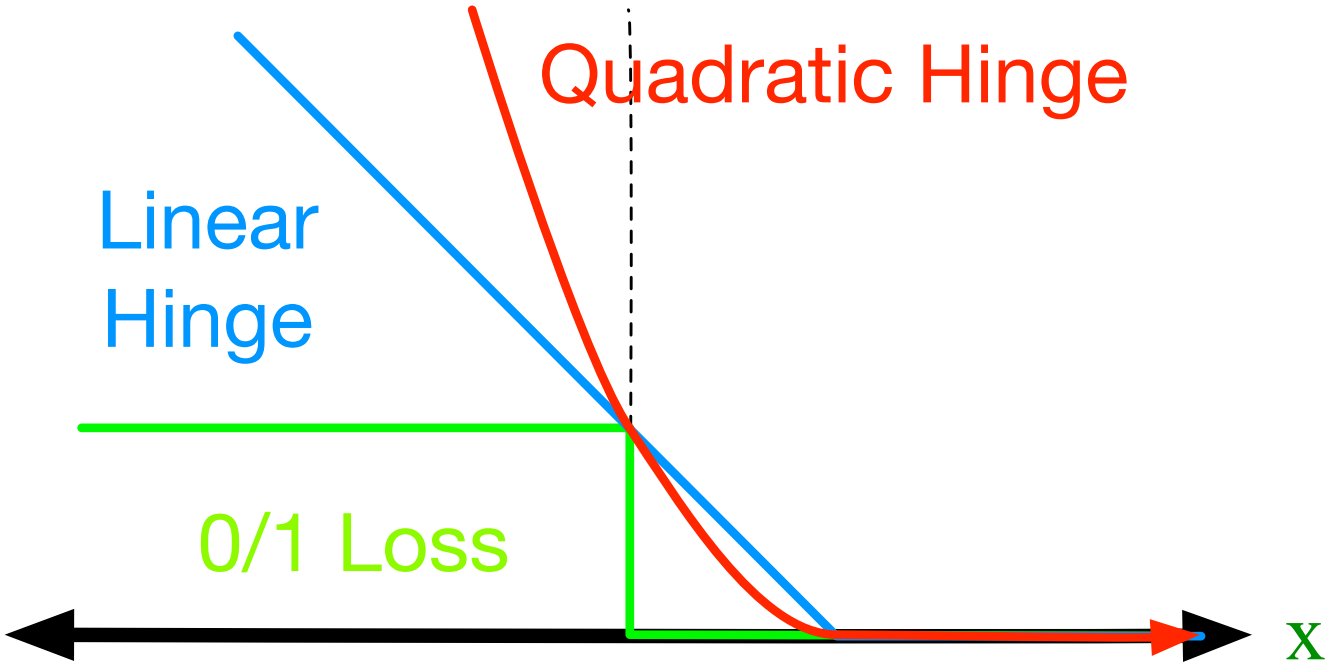

We'll focus on linear hinge loss

Wrapup

- Adding slack variables don't break the SVM problem
- Very popular algorithm
  - SVMLight (many options)
  - Libsvm / Liblinear (very fast)
  - Weka (friendly)
  - pyml (Python focused, from Colorado)