Support Vector Machine

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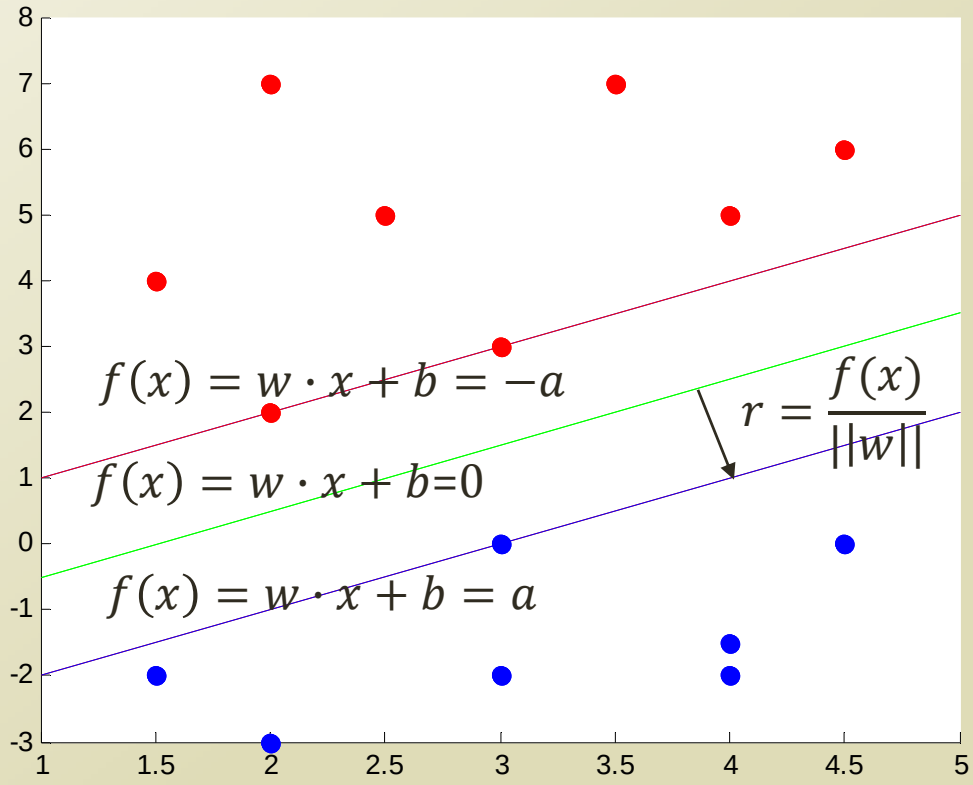
Maximizing the Margin

- Good decision boundary?
  - Maximum margin!
  - $r = \frac{a}{||w||}$
  - Need to consider the both side
- Optimization problem?
  - $max_{w,b} 2r = \frac{2a}{||w||}$
    $s.t. (wx_j + b)y_j \geq a, \forall j$
- a is an arbitrary number and can be normalized
  - $min_{w,b} ||w||$
    $s.t. (wx_j + b)y_j \geq 1, \forall j$



This becomes a quadratic optimization problem. Why?

Support Vector Machine with Hard Margin

- Support Vector Machine (SVM)
  - Constructs a set of hyperplanes to have the largest distance to the nearest training data point of any class.
- Hard margin
  - No error cases are allowed
  - What If there is an error case?
- Let's implement the hard margin SVM
  - $min_{w,b}||w||$
    $s.t.(wx_j + b)y_j \geq 1, \forall j$