Maximal Margin Classifier: The Math

5-22 HIII O IA

The maximal margin classifier solves a constrained optimization problem:

$$\max_{\beta_0,\beta_1,\ldots,\beta_p} M$$

subject to:

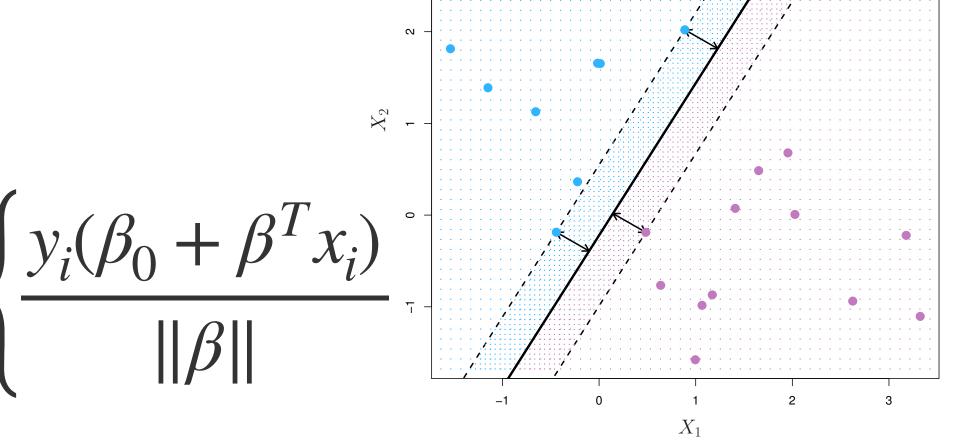
$$\|\beta\| = 1$$

 $y_i(\beta_0 + \beta^T x_i) \ge M, \quad \forall i = 1,..., n$

ensured each observation is on the correct side of the hyperplane and at least a distance M from the hyperplane, i.e., M is the margin of the hyperplane

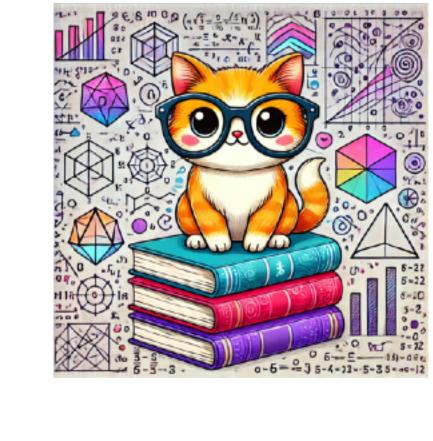
distance between x_i and line where

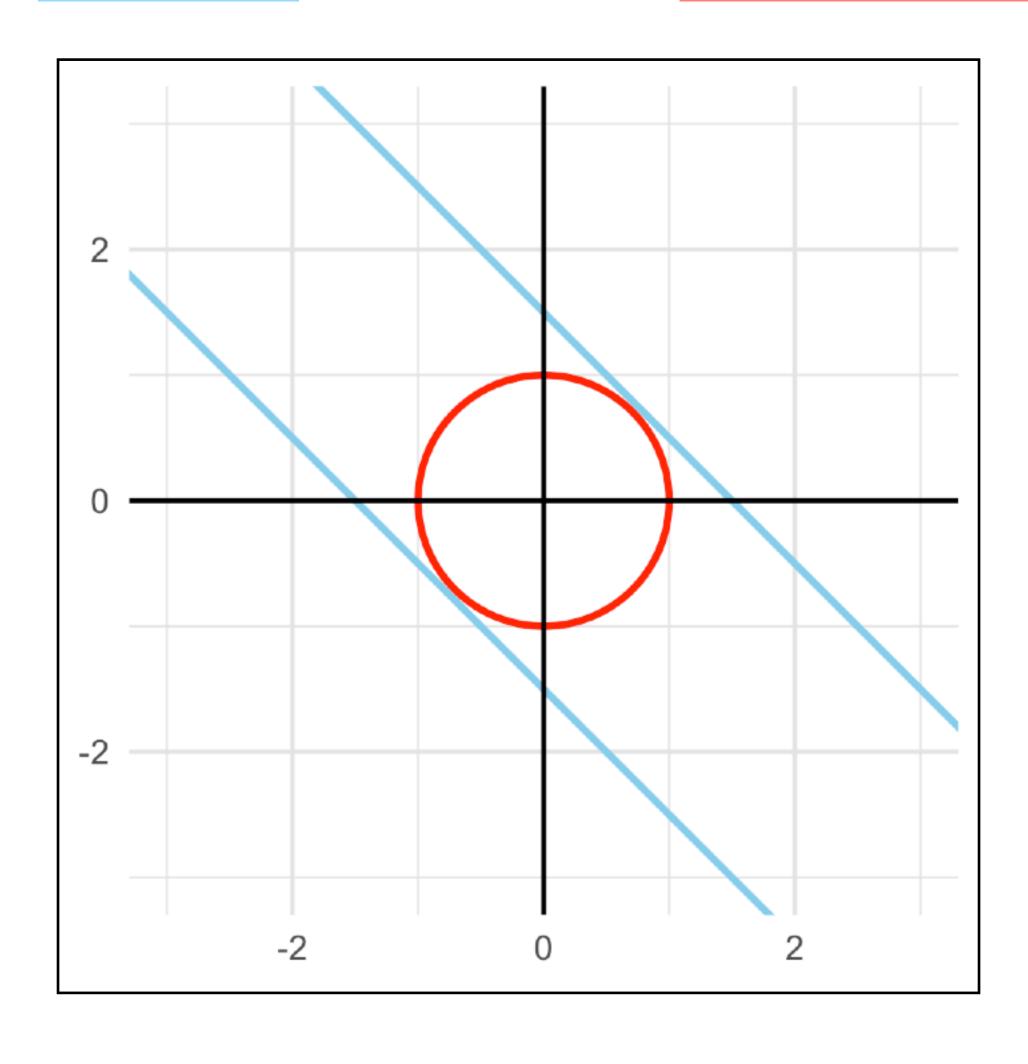
$$\|\beta\| = \sqrt{\sum_{j=1}^{p} \beta_j^2}$$
 is the Euclidean norm of β



What is a Constrained Optimization Problem?

Optimize
$$f(x, y)$$
 subject to $g(x, y) = k$





$$f(x, y) = 2x + y$$

 $g(x, y) = x^2 + y^2 = 1$