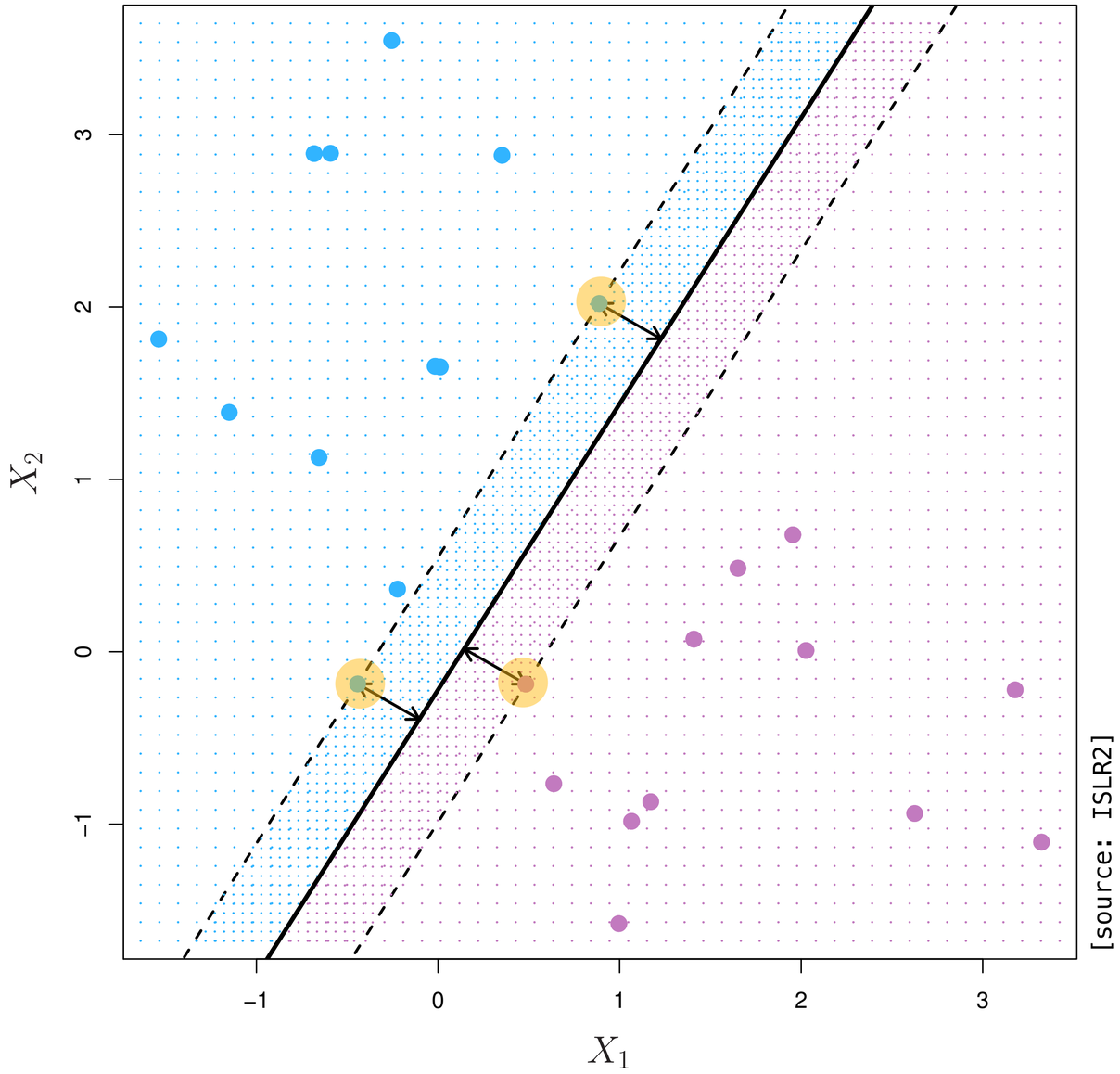
Maximal Margin Classifier



[source: ISLR2]

support vectors
the closest points from both classes

the margin
the distance from hyperplane to support vectors

Maximal Margin Classifier: The Math

The maximal margin classifier solves a constrained optimization problem:

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

subject to:

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

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

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

$$\left\{ \frac{y_i(\beta_0 + \beta^T x_i)}{\|\beta\|} \right.$$