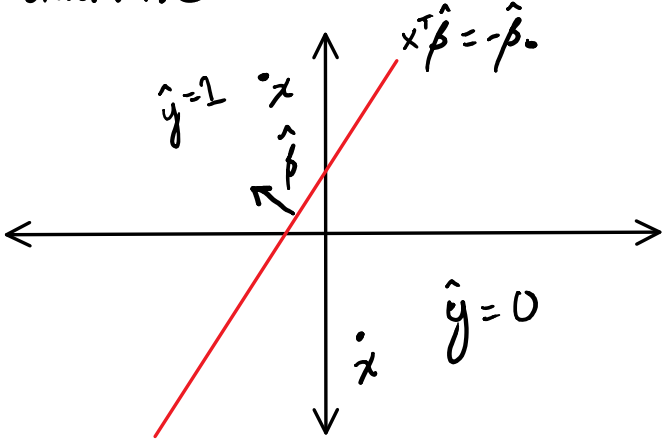
Margin Based Methods

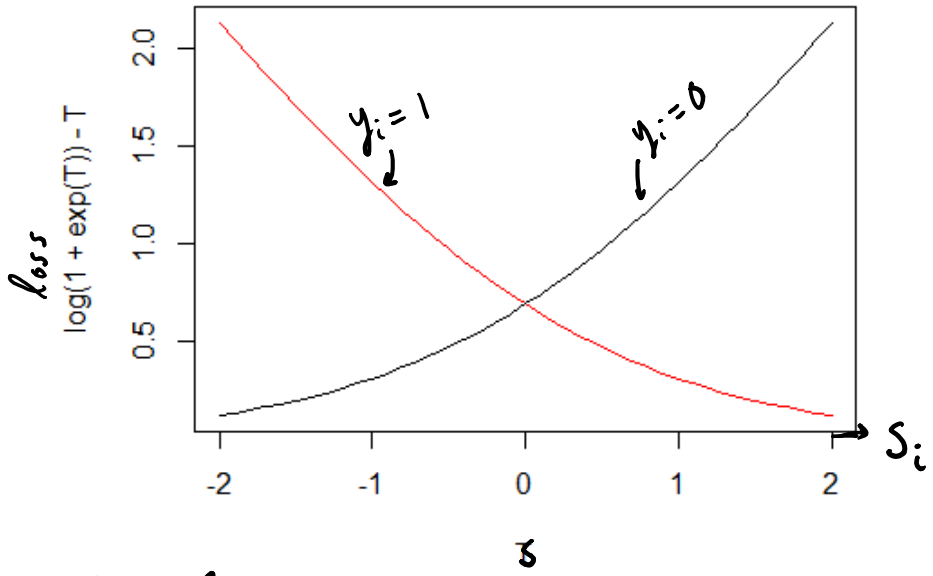
Tuesday, April 25, 2017 4:22 PM

$$\hat{y} = \begin{cases} 1, & \beta_0 + \beta_1 x_1 + \dots + \beta_p x_p \geq 0 \\ 0, & \text{otherwise} \end{cases}$$



Empirical Risk Minimization

$$\min_{\beta} \frac{1}{n} \sum_{i=1}^{n} \text{loss}(y_i, x_i, \beta)$$



$$s_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip}$$

0-1 loss $(y_i = 1)$

$$\text{loss}_{0\text{-}1} = \begin{cases} 1, & s_i < 0 \\ 0, & \text{otherwise} \end{cases}$$

logistic regression $(y_i = 1)$

$$\min \frac{1}{n} \sum_i \text{loss}_{0\text{-}1}(y_i, x_i, \beta)$$

is very hard to optimize!

Support vector machines

$$loss = \log(1 + e^{-s_i})$$

(for $y_i = 0$ switch $s_i \leftarrow -s_i$)

$$loss = \begin{cases} 1 - s_i, & s_i < 1 \\ 0, & s_i > 1 \end{cases}$$