Estimating Conditional Probabilities

[Friedman, Hastie & Tibshirani]

- often want to estimate probability that $y = +1$ given x
- AdaBoost minimizes (empirical version of):

$$\mathrm{E}_{x,y}\left[e^{-yF(x)}\right] = \mathrm{E}_x\left[\Pr\left[y = +1|x\right] e^{-F(x)} + \Pr\left[y = -1|x\right] e^{F(x)}\right]$$

  where x, y random from true distribution

- over all F, minimized when

$$F(x) = \frac{1}{2} \cdot \ln\left(\frac{\Pr\left[y = +1|x\right]}{\Pr\left[y = -1|x\right]}\right)$$

  or

$$\Pr\left[y = +1|x\right] = \frac{1}{1 + e^{-2F(x)}}$$

- so, to convert F output by AdaBoost to probability estimate, use same formula