Slide 42 - 43 (Logistic Regression)

$W = [\boxed{w_0, w_1}, \dots, \underline{w_D}]$. ∇ depends on all features.

$D-1$

$\langle W, b \rangle \Leftrightarrow \theta$

$\psi_1(x)\cdot 0 + \psi_2(x)\cdot 0 + \psi_3(x)\cdot 0 = 0 \Rightarrow 0 < 0.$

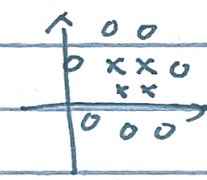
$\underline{x_3} = x_1 x_2.$ $\quad \psi_1(x)\cdot 0 + \psi_2(x)\cdot 1 + \psi_3(x)\cdot 0 \le \cancel{0} 1 \Rightarrow \psi_2(x) \ge 1$

$\psi_1(x)\cdot 1 + \psi_2(x)\cdot 0 + \psi_3(x)\cdot 0 \le 1 \Rightarrow \psi_3(x) \ge 1$

$\psi_1(x)\cdot 1 + \psi_2(x)\cdot 1 + \psi_3(x)\cdot 1 = 0 \Rightarrow \psi_1(x) + \psi_2(x) < 0.$

k classes. $y = \underbrace{[1, 0, 0, \dots, 0]}_{k \text{ classes}}$, label belong to the 1st class.

8 □ 8, dimensionality $= 8\cdot 8 = 64$. $\quad [\underbrace{[\,\dots\,]}_{64}]$



tutorial

$x^{(i)} \Rightarrow x_i \quad y^{(i)} \Rightarrow y_i \quad x_j^{(i)} = x_{ij}$

$\theta^T x = wx \qquad \theta_0 x_0 + \cancel{x}\,\theta_1 x_1 + \dots + \theta_d x_d = \langle \theta, x \rangle$

$\text{sign}(\theta^T x) = \text{sign}(\langle \theta, x \rangle)$

slide 17

$h_\theta(x) = y$ (from previous lectures)

$$\min \mathcal{L} = \sum_{i=1}^{N} [y_i \log(h_\theta(x_i)) + (1-y_i)\log(1-h_\theta(x_i))] +$$

$$\frac{1}{2}\sum_{j=1}^{d} \theta_j^2 = \frac{1}{2}\|\theta\|_2^2$$

$\theta = [\theta_1, \theta_2, \dots \theta_d]$

$\|\theta\|_2^2 = \sqrt{\theta_1^2 + \theta_2^2 + \dots + \theta_d^2}$

Slide 19 ~ 21

$$\min_{\theta} \mathcal{L}\ \underset{\downarrow}{C} \sum_{i=1}^{N} \left(y_i \, \mathrm{cost}_1(\theta^T x_i) + (1-y_i)\,\mathrm{cost}_0(\theta^T x_i) \right) + \frac{1}{2}\sum_{j=1}^{d} \theta_j^2$$

Constant

$\theta^T x_+ = 1 \Rightarrow$ +/positive support vectors.

$\theta^T x_- = -1 \Rightarrow$ −/negative support vectors.

$\Rightarrow \boxed{|\theta^T x_+ - \theta^T x_-|} = 1-(-1) = 2.$ (magnitude)

$\hat{n} = \dfrac{\theta}{\|\theta\|_2^2}$ ⟶ point at direction of the hyperplanes' difference

$\|\theta\|_2^2 \rightarrow$ length.

$\Rightarrow$ margin $= \hat{n} \cdot \Delta x = \hat{n} \cdot (x_+ - x_-) = \dfrac{2}{\|\theta\|_2^2}$

$\|\theta\|_2^2 \Leftrightarrow \|\theta\|_2 \Leftrightarrow \|\theta\|$