Machine Learning

Assignment-2

K. Laxminarayana
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$$\ln p(t, x, w, \beta) = -\frac{\beta}{2}\sum_{i=1}^{N}[y(x_i, w) - t_i]^2 + \frac{N}{2}\ln\beta - \frac{N}{2}\ln 2\pi$$

Differentiating wrt w.

$$y = w_1 x + w_0$$

i) Differentiate wrt w_0 & equating it to 0.

$$\Rightarrow -\frac{\beta}{2} \times 2 \sum_{i=1}^{N}[y(x_i, w) - t_i] = -\beta\sum_{i=1}^{N}[w_1 x_i + w_0 - t_i]$$

Given $\beta = 1$,

$$\sum_{i=1}^{N} w_i x_i + \sum_{i=1}^{N} w_0 - \sum_{i=1}^{N} t_i = 0$$

$$w_i \sum_{i=1}^{N} x_i + \sum_{i=1}^{N} w_0 - \sum_{i=1}^{N} t_i = 0 \rightarrow (1)$$

ii) Differentiate wrt w_1 & Equating to 0

$$\Rightarrow \sum_{i=1}^{N}[y(x_i, w) - t_i] x_i = 0$$

$$\Rightarrow \sum_{i=1}^{N}[w_i x_i^2 + w_0 x_i - t_i x_i] = 0 \rightarrow (2)$$

Let $\sum_{i=1}^{N} x_i = A$, $\sum_{i=1}^{N} t_i = B$, $\sum_{i=1}^{N} x_i^2 = C$, $\sum_{i=1}^{N} t_i x_i = D$

from ① & ②

$$w_1 A + w_0 N - B = 0 \rightarrow ③ \times A$$

$$w_1 C + w_0 A - D = 0 \rightarrow ④ \times N$$

$$w_1 A^2 + w_0 AN - AB = 0$$

$$w_1 CN + w_0 AN - DN = 0$$

$$w_1 (A^2 - CN) = BA - dN$$

$$w_1 = \frac{BA - dN}{A^2 - CN}$$

$$w_1 = \frac{BA - DN}{A^2 - CN}$$

from ④

$$w_0 = \frac{d - w_1 C}{N}$$