# 7.7

ノートのタイトル 2016/02/21

ラグランジアンの式に(7.1)を入れる

$$L = C\sum(\xi_n+\hat{\xi}_n) + \frac{1}{2}\|w\|^2 - \sum(\mu_n\xi_n+\hat{\mu}_n\hat{\xi}_n) - \sum a_n(\varepsilon+\xi_n+w^T\phi(x_n)+b-t_n) - \sum\hat{a}_n(\varepsilon-\hat{\xi}_n-w^T\phi(x_n)-b+t_n)$$

これより ($\frac{\partial}{\partial x}\|x\|^2=2x$, $\frac{\partial}{\partial x}x^Ty=y$)

$$\frac{\partial L}{\partial w} = w - \sum a_n\phi(x_n) + \sum\hat{a}_n\phi(x_n) = 0$$

$$\therefore\ w = \sum(a_n-\hat{a}_n)\phi(x_n) \quad \cdots(7.57)$$

また

$$\frac{\partial L}{\partial b} = -\sum a_n + \sum\hat{a}_n = 0$$

$$\therefore\ \sum(a_n-\hat{a}_n) = 0 \quad \cdots(7.58)$$

また

$$\frac{\partial L}{\partial \xi_n} = C - \mu_n - a_n = 0$$

$$\therefore\ a_n+\mu_n = C \quad \cdots(7.59)$$

また

$$\frac{\partial L}{\partial \hat{\xi}_n} = C - \hat{\mu}_n + \hat{a}_n = 0$$

$$\therefore\ \hat{a}_n+\hat{\mu}_n = C \quad \cdots(7.60)$$

$(\sum v_n)^2 = \sum_i\sum_j v_iv_j$

$$\frac{1}{2}\|w\|^2 = \frac{1}{2}\sum_n\sum_m(a_n-\hat{a}_n)(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m)$$

(7.57), (7.58), (7.59), (7.60) より

$$L = C\sum\xi_n + C\sum\hat{\xi}_n + \frac{1}{2}\sum_n\sum_m(a_n-\hat{a}_n)(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m) - \sum\mu_n\xi_n - \sum\hat{\mu}_n\hat{\xi}_n$$

$$- \varepsilon\sum a_n - \sum a_n\xi_n - \sum_n a_n\sum_m(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m) - b\sum a_n + \sum a_nt_n$$

$$- \varepsilon\sum\hat{a}_n + \sum\hat{a}_n\hat{\xi}_n + \sum_n\hat{a}_n\sum_m(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m) + b\sum\hat{a}_n - \sum\hat{a}_nt_n$$

$$= \underbrace{\left(C\sum\xi_n - \sum\mu_n\xi_n - \sum a_n\xi_n\right)}_{=0 \leftarrow C\sum\xi_n-\sum\mu_n\xi_n-\sum a_n\xi_n = \sum(C\xi_n-\mu_n\xi_n-a_n\xi_n) = \sum\xi_n(C-\mu_n-a_n)=0\ (7.59)}$$

$$+ \underbrace{\left(C\sum\hat{\xi}_n - \sum\hat{\mu}_n\hat{\xi}_n + \sum\hat{a}_n\hat{\xi}_n\right)}_{=0 \leftarrow (7.60)}$$

$$+ \left\{\frac{1}{2}\sum_n\sum_m(a_n-\hat{a}_n)(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m) - \sum_n\sum_m a_n(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_n) + \sum_n\sum_m\hat{a}_n(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_n)\right\}$$

$$- \varepsilon\sum(a_n+\hat{a}_n) - b\underbrace{\sum(a_n-\hat{a}_n)}_{=0\ (7.58)} + \sum(a_n-\hat{a}_n)t_n$$

$$= -\frac{1}{2}\sum_n\sum_m(a_n-\hat{a}_n)(a_m-\hat{a}_m)\phi(x_n)^T\phi(x_m) - \varepsilon\sum(a_n+\hat{a}_n) + \sum(a_n-\hat{a}_n)t_n \quad \cdots(7.61)$$

を得る。