EE 434
02/15/06

faces are at
http://people.cs.uchicago.edu/~dinoj/vis/orl

iris:

http://nlpr-web.ia.ac.cn/english/irds/irisdatabase.htm

ftp://ftp.ph.tn.tudelft.nl/pub/bob/prtools/prtools3.1.7

back to back props:

$$\hat{F} = (t-a^M)^T(t-a^M) = [\;\text{---}\;]\,[\;|\;] \geq 0$$ we desire $= 0$ by training

desire $$\frac{\partial \hat{F}}{\partial w_{ij}^M} = \left(-\frac{\partial a^M}{\partial w_{ij}^M}\right)^T(t-a) + (t-a^M)^T\left(-\frac{\partial a^M}{\partial w_{ij}^M}\right)$$

[Eq. (11.40): $$s^M = -2\dot{F}^M(\cancel{a^M}\; n^M)(t-a^M)$$

$$= -2\left(\frac{\partial a^M}{\partial w_{ij}^M}\right)^T(t-a^M)$$

but $$a_k^M = f_k^M\left(\sum_{l=1}^{\#\text{ neurons in } M^{th}\text{ layer} = S^M} w_{kl}^M a_l^{M-1}\right) = f_k(n_k^M)$$

$$\frac{\partial a_k^M}{\partial w_{ij}^M} = \frac{d f(n_k^M)}{d n_k^M} \cdot \frac{\partial n_k^M}{\partial w_{ij}^M} \; ; \quad n_k^M = \sum_{l=1}^{S^M} w_{kl} \cdot a_l^{M-1}$$

here $\dfrac{\partial n_k^M}{\partial w_{ij}^M} = \delta_{ki} \cdot 1 \cdot a_j^{M-1}$; $\delta_{ki} = \begin{cases} 1 & \text{if } k = i \\ 0 & \text{if } k \neq i \end{cases}$

$$F^M = \begin{bmatrix} f_1^M(n_1^M) & 0 & \cdots & 0 \\ 0 & f_2(n_2^M) & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & f_{S^M}(n_{S^M}^M) \end{bmatrix}$$

is an $S^M \times S^M$ matrix; S^M = # of neurons in the last layer

$$\dot{F}^M = \begin{bmatrix} df_1^M(n_1^M)/dn_1^M & & 0 \\ & \ddots & \\ 0 & & \dfrac{df_{S^M}^M(n_{S^M}^M)}{dn_{S^M}^M} \end{bmatrix}$$

by def. $s_i^M = \dfrac{\partial \hat{F}}{\partial n_i^M} = -\left(\dfrac{\partial a^M}{\partial n_i}\right)^T (t - a^M) + (t - a^M)^T \left(-\dfrac{\partial a^M}{\partial n_i}\right)$

(11.37)

$$a_i^M = f_i^M(n_i^M) \rightarrow \dot{F}^M(n^M)$$