



$$L_i = \frac{1}{1 + \exp\{b_i \cdot (x - a_i)\}} \quad f_i = p_i x + g_i y + r_i \quad L^w = \frac{1}{2} (y^{(w)} - a^{(w)})^2$$

Parameters (p, g, r)

$$\frac{\partial L^{(k)}}{\partial p_i} = \frac{\partial L^{(k)}}{\partial a^{(k)}} \cdot \frac{\partial a^{(k)}}{\partial h_i} \cdot \frac{\partial h_i}{\partial f_i} \cdot \frac{\partial f_i}{\partial p_i}$$

$$\frac{\partial L^{(k)}}{\partial a^{(k)}} = -(y^{(k)} - a^{(k)}) \quad \frac{\partial h_i}{\partial f_i} = \frac{w_i}{\sum w_i}$$

$$\frac{\partial a^{(k)}}{\partial h_i} = 1 \quad \frac{\partial f_i}{\partial p_i} = x$$

$$\frac{\partial L^{(k)}}{\partial p_i} = -(y^{(k)} - a^{(k)}) \cdot \frac{w_i}{\sum w_i} \cdot x$$

$$\frac{\partial L^{(k)}}{\partial r_i} = -(y^{(k)} - a^{(k)}) \cdot \frac{w_i}{\sum w_i}$$

$$\frac{\partial L^{(k)}}{\partial g_i} = -(y^{(k)} - a^{(k)}) \cdot \frac{w_i}{\sum w_i} \cdot y$$

✓

$$\frac{\partial L_i}{\partial x_i} = -b_i \cdot L_i \cdot (1 - L_i)$$

$$L_i = \frac{1}{1 + e^{b_i(1-L_i)}}$$

$$h_i = f_i \bar{w}_i$$

$$S = \sum w_j$$

$$\bar{w}_i = \frac{w_i}{\sum w_j} = \frac{w_i}{S}$$

$$w_i = L_i p_i$$

parameter a, c

$$\frac{\partial L^{(u)}}{\partial a_i} = \frac{\partial L^{(u)}}{\partial a^{(u)}} \sum_{j=1}^m \frac{\partial a^{(u)}}{\partial w_j} \frac{\partial w_j}{\partial L_j} \frac{\partial L_j}{\partial a_i}$$

$$\frac{\partial a^{(u)}}{\partial w_i} = f_i \quad \frac{\partial \bar{w}_i}{\partial w_i} = \frac{1}{S} - \frac{w_i}{S^2}$$

$$\frac{\partial \bar{w}_j}{\partial w_i} = -\frac{w_j}{S^2} \quad \frac{\partial w_i}{\partial L_i} = p_i$$

$$\frac{\partial L_i}{\partial a_i} = b_i \cdot L_i (1 - L_i)$$

$$\frac{\partial L^{(u)}}{\partial a_i} = \frac{\partial L^{(u)}}{\partial a^{(u)}} \left[\sum_{j=1}^m \frac{\partial a^{(u)}}{\partial w_j} \frac{\partial w_j}{\partial L_j} \frac{\partial L_j}{\partial a_i} + \frac{\partial a^{(u)}}{\partial w_i} \frac{\partial w_i}{\partial L_i} \frac{\partial L_i}{\partial a_i} \right]$$

$$= -(y^{(u)} - a^{(u)}) \left[- \sum_{j=1}^m f_j \frac{w_j}{S^2} p_j b_j L_j (1 - L_j) + f_i \left(\frac{1}{S} - \frac{w_i}{S^2} \right) p_i b_i L_i (1 - L_i) \right]$$

$$= -(y^{(u)} - a^{(u)}) \left[f_i \left(\frac{1}{S} - \frac{w_i}{S^2} \right) p_i b_i L_i (1 - L_i) - f_j \frac{w_j}{S^2} p_j b_j L_j (1 - L_j) \right]$$

parameter b, d

$$\frac{\partial L_i}{\partial b_i} = -(x - a_i) L_i (1 - L_i)$$

