$A = 1$

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$$\sum_m \sum_s p(\vec{s}|\vec{y}) \left[ \frac{y_d \cdot A(\vec{s}) \cdot (1-\tilde{\pi}(\vec{s})) - (1-y_d) A(\vec{s}) \tilde{\pi}(\vec{s})}{\tilde{\pi}(s) \cdot (1-\tilde{\pi}(s))} \right]$$

$$= \sum_m \sum_s p(s|y) \left[ \frac{y_d A(s) - y_d \cdot A(\vec{s}) \tilde{\pi}(\vec{s}) - A(\vec{s}) \tilde{\pi}(\vec{s}) + y_d A(s) \tilde{\pi}(\vec{s})}{\tilde{\pi}(s) - \tilde{\pi}(\vec{s})^2} \right]$$

$$= \sum_m \sum_s p(\vec{s}|\vec{y}) \left[ \frac{y_d A(s) - A(\vec{s}) \tilde{\pi}(\vec{s})}{\tilde{\pi}(s) - \tilde{\pi}^2(\vec{s})} \right] \overset{!}{=} 0$$

$$= \sum_n \sum_{\vec{s}} p(s|y) \frac{A(\vec{s})}{\tilde{\pi}_d(s) - \tilde{\pi}_d^2(s)} \left( y_d - \tilde{\pi}_d(\vec{s}) \right) \overset{!}{=} 0 \qquad (*)$$

with: $\tilde{\pi}_d(\vec{s}) = \frac{1}{1 + \exp\left[ \left( -\sum_h w_{dh} s_h \right) + \Theta_d \right]}$

and $A(\vec{s}) = s_n \exp\left[ \left( -\sum_n w_{dh} s_n \right) + \Theta_d \right] \cdot \tilde{\pi}(\vec{s})^2$

solve $(*)$ for $w_{dh}$ !