Pattern Recognition Homework3

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1.

(a) $J = \sum_{k=1}^{c}[-t_k ln(z_k) - (1-t_k)ln(1-z_k)]$

$\frac{\partial J}{\partial w_{kj}} = \frac{\partial J}{\partial net_k}\frac{\partial net_k}{\partial w_{kj}}$

$\frac{\partial J}{\partial w_{kj}} = \frac{\partial J}{\partial z_k}\frac{\partial z_k}{\partial net_k}\frac{\partial net_k}{\partial w_{kj}}$

$\frac{\partial J}{\partial w_{kj}} = \frac{\partial J}{\partial z_k}f'(net_k)y_j$

$\frac{\partial J}{\partial w_{kj}} = \frac{-t_k+z_k}{z_k(1-z_k)}z_k(1-z_k)y_j$

$\frac{\partial J}{\partial w_{kj}} = -(t_k - z_k)y_j$

$\Rightarrow w_{kj} \leftarrow w_{kj} - \eta\frac{\partial J}{\partial w_{kj}} = w_{kj} + \eta(t_k - z_k)y_j$

(b)

$\frac{\partial J}{\partial w_{ji}} = \frac{\partial J}{\partial net_j}\frac{\partial net_j}{\partial w_{ji}}$

$\frac{\partial J}{\partial w_{ji}} = \frac{\partial J}{\partial y_j}\frac{\partial y_j}{\partial net_j}\frac{\partial net_j}{\partial w_{ji}}$

$\frac{\partial J}{\partial w_{ji}} = \frac{\partial J}{\partial net_k}\frac{\partial net_k}{\partial y_j}\frac{\partial y_j}{\partial net_j}\frac{\partial net_j}{\partial w_{ji}}$

$\frac{\partial J}{\partial w_{ji}} = \frac{\partial J}{\partial z_k}\frac{\partial z_k}{\partial net_k}\frac{\partial net_k}{\partial y_j}\frac{\partial y_j}{\partial net_j}\frac{\partial net_j}{\partial w_{ji}}$

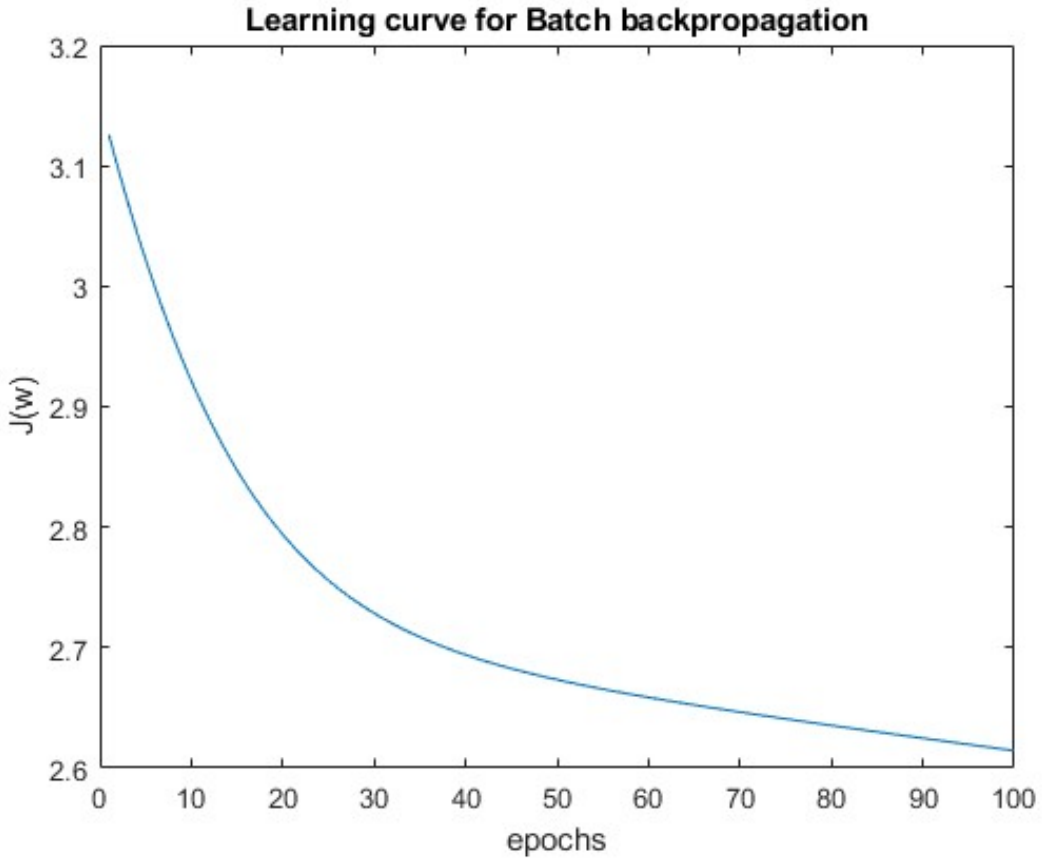
$\frac{\partial J}{\partial w_{ji}} = \sum_{k=1}^{c} -(t_k - z_k)w_{kj}f'(net_j)x_i$

$\frac{\partial J}{\partial w_{ji}} = \sum_{k=1}^{c} -(t_k - z_k)w_{kj}y_j(1-y_j)x_i$

$\Rightarrow w_{ji} \leftarrow w_{ji} - \eta\frac{\partial J}{\partial w_{ji}} = w_{ji} + \eta\sum_{k=1}^{c}(t_k - z_k)w_{kj}y_j(1-y_j)x_i$

2.

(a)



(b) $z = \begin{bmatrix} 0.7888 & 0.7063 & 0.7544 & 0.7544 \end{bmatrix}$

$$W1 = \begin{bmatrix} 0.4995 & 0.4995 & 0.4977 \\ 0.4995 & 0.4995 & 0.4977 \end{bmatrix}$$

$$W2 = \begin{bmatrix} 0.4878 & 0.4878 & 0.4817 \end{bmatrix}$$