Assignment-3

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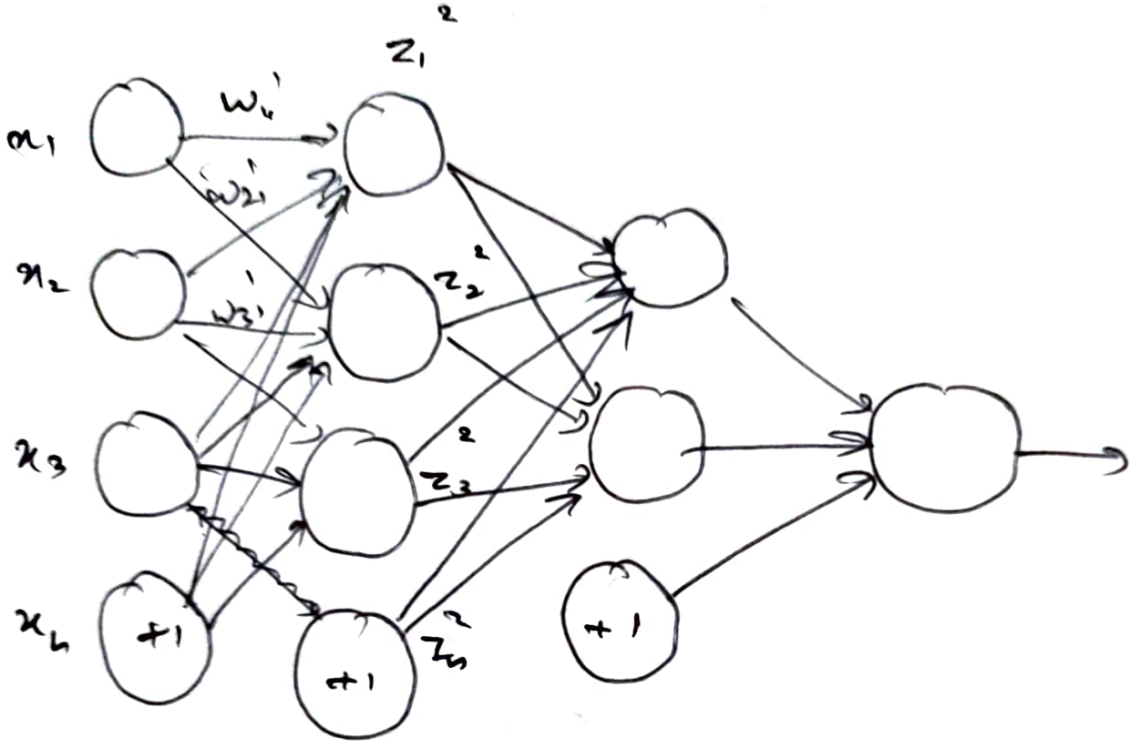

Soln:

$$z_1^{(2)} = \sum_{i=1}^{n} \sum_{j=1}^{3} w_{ij}^{(1)} x_i + b_i$$

So $z^{(2)} = w^{(1)T} x + B_1$ → Making eqn of 1st layer

$$\frac{\partial z^{(2)}}{\partial w_{ij}} = \frac{\partial w^{(1)T}}{\partial w_{ij}} + \frac{\partial x}{\partial w_{ij}} w^{(1)T}$$

$$+ \frac{\partial B_1}{\partial w_{ij}}$$

$$\frac{\partial z^{(3)}}{\partial w_{ij}^{(1)}} = \int$$

lets say

$$x_{ij} = \begin{bmatrix} w_{11}' & w_{12}' & w_{13}' & w_{14}' \\ w_{21}' & w_{22}' & w_{23}' & w_{24}' \\ w_{31}' & w_{32}' & w_{33}' & w_{34}' \\ w_{41}' & w_{42}' & w_{43}' & w_{44}' \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

$$a^2 = b^2(z^2)$$

$$\frac{\partial a^2}{\partial w_{ij}^{(1)}} = \frac{\partial b^2(z^2)}{\partial w_{ij}}$$

$$= \frac{\partial b^{(2)}(z^{(2)})}{\partial z^{(2)}} = \frac{\partial z^{(2)}}{\partial w_{ij}}$$

$$= \frac{\partial b^{(2)}(z^{(2)})}{\partial z^{(2)}} x_{ij} = b^{2'}(z) x_{ij}$$

$$z^{(3)} = w^{(2)} a^{(1)} + b^{(2)}$$

$$\frac{\partial z^{(3)}}{\partial w_{ij}^{(1)}} = \frac{\partial w^{(1)}}{\partial w_{ij}} a^{(1)} + 0 + w^{(1)} \frac{\partial a^{(1)}}{\partial w_{ij}^{(1)}}$$

$$= \frac{\partial z^{l+1}}{\partial w_{ij}^{l}} = \frac{\partial w^{l} \cdot a^{l}}{\partial w_{ij}^{l}} + w^{l} \frac{\partial a^{l}}{\partial w_{ij}^{l}}$$

$$\frac{\partial \cdot a^{l}}{\partial w_{ij}^{l}} = \frac{\partial b^{l}(z)}{\partial z} * \left(\frac{\partial w^{l-1}}{\partial w_{ij}^{l}} a^{l-1} + w^{l-1} \frac{\partial a^{l-1}}{\partial w_{ij}^{l}} \right)$$

$$= h^{l}(\theta, x)$$

$$a^{l} = f^{l}(w^{l} a^{l-1} + b^{l-1})$$

$$L(\theta) = \frac{1}{m} \sum_{i=1}^{m} L(\theta; x^{i}, y^{i})$$

$$= \frac{1}{2m} \sum_{i=1}^{m} \| h_{\theta}(x^{i}) - y^{i} \|^{2}$$

$$L(\theta) = \frac{1}{2m} \sum_{i=1}^{m} \| a^{be}(x^{i}) - y_{i} \|^{2}$$

$$L(\theta) = \frac{1}{m} \sum_{i=1}^{m} \| a^{br}(x^{i}) - y_{i} \|$$

$$L(\theta) = \sqrt{\frac{1}{m} \sum_{i=1}^{m} (a^{br}(x^{i}) - y_{i})^{2}}$$

$$\frac{\partial L(\theta)}{\partial w_{ij}^{n}} = \frac{1}{2} * 2 \left(\frac{1}{m} \sum_{i=1}^{m} \left(a^{be}(x_i) - y_i \right)^2 \right)^{-\frac{1}{2}}$$

$$\left(\frac{1}{m} \sum_{i=1}^{m} \frac{\partial a^{be}(x_i)}{\partial w_{ij}^{n}} \right)$$

and

$$\frac{\partial a^{be}(x_i)}{\partial w_{ij}^{n}} = \frac{\partial f^{be}(z)}{\partial z} \left(\frac{\partial}{\partial w_{ij}^{n}} w^{(be-1)} a^{(be-1)} \right.$$

$$\left. w^{(be-1)} \frac{\partial}{\partial w_{ij}^{n}} a^{(be-1)} \right)$$