ComS 474
Homework 6

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9) $W^{(0)} : 3 \times 3,\ \ W^{(1)} : 4 \times 2,\ \ W^{(2)} : 3 \times 2$

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10) $x^1 = \phi \left[\begin{pmatrix} 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right] = \begin{pmatrix} 0.3 \\ 0.3 \\ 0.3 \end{pmatrix}$

$x^2 = \phi \left[\begin{pmatrix} 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 0.3 \\ 0.3 \\ 0.3 \end{pmatrix} \right] = \begin{pmatrix} 3.8 \\ 3.8 \end{pmatrix}$

$x^3 = \phi \left[\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 3.8 \\ 3.8 \end{pmatrix} \right] = \begin{pmatrix} 8.6 \\ 8.6 \end{pmatrix}$

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11) $\delta^{(3)} = \begin{pmatrix} 8.6 \\ 8.6 \end{pmatrix} - \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 7.6 \\ 8.6 \end{pmatrix}$

$\delta^{(2)} = \begin{pmatrix} 0(1-0) \\ 3.8(1-3.8) \\ 3.8(1-3.8) \end{pmatrix} \circ \left(\begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} 7.6 \\ 8.6 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ -172.368 \\ -172.368 \end{pmatrix}$

$\delta^{(1)} = \begin{pmatrix} 0(1-0) \\ 0.3(1-0.3) \\ 0.3(1-0.3) \\ 0.3(1-0.3) \end{pmatrix} \circ \left(\begin{pmatrix} 2 & 2 \\ 2 & 2 \\ 2 & 2 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} -172.368 \\ -172.368 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ -144.789 \\ -144.789 \\ -144.789 \end{pmatrix}$

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12) $\nabla^{(2)} = x^{(2)}(\delta^{(3)})^T = \begin{pmatrix} 1 \\ 3.8 \\ 3.8 \end{pmatrix} [7.6, 8.6] = \begin{pmatrix} 7.6 & 8.6 \\ 28.88 & 32.68 \\ 28.88 & 32.68 \end{pmatrix}$

$$\nabla^{(1)} = x^{(1)}(\delta^{(2)})^T = \begin{pmatrix} 1 \\ 0.3 \\ 0.3 \\ 0.3 \end{pmatrix} [-172.368, -172.368] = \begin{pmatrix} -172.368 & -172.368 \\ -51.71 & -51.71 \\ -51.71 & -51.71 \\ -51.71 & -51.71 \end{pmatrix}$$

$$\nabla^{(0)} = x^{(0)}(\delta^{(1)})^T = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} [-144.789, -144.789, -144.789] = \begin{pmatrix} -144.789 & -144.789 & -144.789 \\ -144.789 & -144.789 & -144.789 \\ -144.789 & -144.789 & -144.789 \end{pmatrix}$$

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13) $\mathbb{W}^2 \leftarrow \mathbb{W}^2 - \rho\nabla^{(2)} = \begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{pmatrix} - \begin{pmatrix} 7.6 & 8.6 \\ 28.88 & 32.68 \\ 28.88 & 32.68 \end{pmatrix} = \begin{pmatrix} -6.6 & -7.6 \\ -27.88 & -31.68 \\ -27.88 & -31.68 \end{pmatrix}$

$$\mathbb{W}^1 \leftarrow \mathbb{W}^1 - \rho\nabla^{(1)} = \begin{pmatrix} 2 & 2 \\ 2 & 2 \\ 2 & 2 \\ 2 & 2 \end{pmatrix} - \begin{pmatrix} -172.368 & -172.368 \\ -51.71 & -51.71 \\ -51.71 & -51.71 \\ -51.71 & -51.71 \end{pmatrix} = \begin{pmatrix} 174.368 & 174.368 \\ 53.71 & 53.71 \\ 53.71 & 53.71 \\ 53.71 & 53.71 \end{pmatrix}$$

$$\mathbb{W}^0 \leftarrow \mathbb{W}^0 - \rho\nabla^{(0)} = \begin{pmatrix} 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.1 \end{pmatrix} - \begin{pmatrix} -144.789 & -144.789 & -144.789 \\ -144.789 & -144.789 & -144.789 \\ -144.789 & -144.789 & -144.789 \end{pmatrix} =$$

$$\begin{pmatrix} 144.889 & 144.889 & 144.889 \\ 144.889 & 144.889 & 144.889 \\ 144.889 & 144.889 & 144.889 \end{pmatrix}$$
