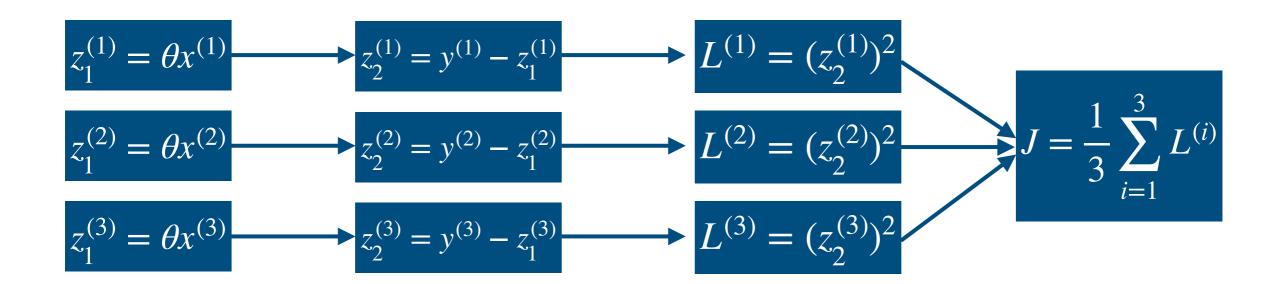
$$J(\theta) = \frac{1}{N} \sum_{i=1}^{N} L^{(i)} = \frac{1}{N} \sum_{i=1}^{N} (y^{(i)} - \theta x^{(i)})^2$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$



$$\frac{\partial J}{\partial \overrightarrow{L}}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

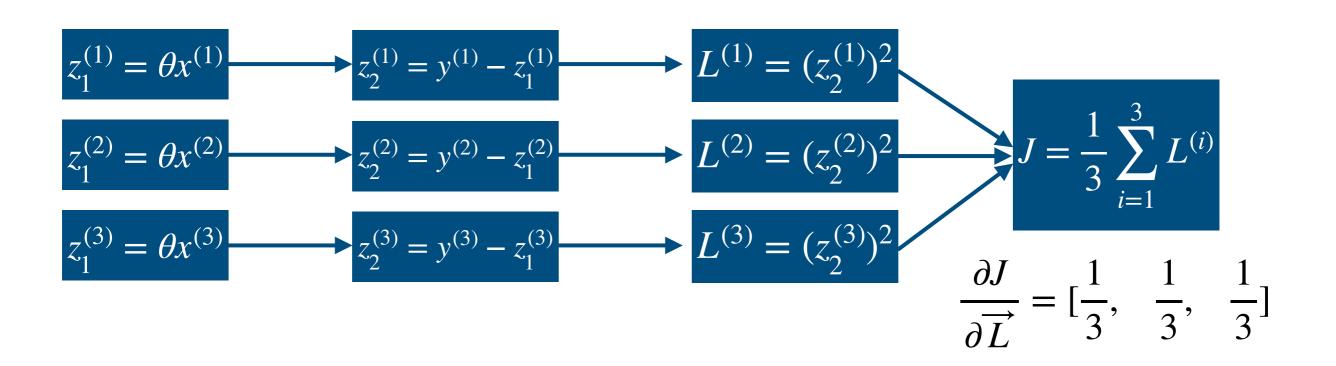
$$\frac{\partial J}{\partial \overrightarrow{L}} = \left[\frac{\partial J}{\partial L^{(1)}}, \frac{\partial J}{\partial L^{(2)}}, \frac{\partial J}{\partial L^{(3)}}\right]$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overrightarrow{L}} = \left[\frac{\partial J}{\partial L^{(1)}}, \quad \frac{\partial J}{\partial L^{(2)}}, \quad \frac{\partial J}{\partial L^{(3)}}\right] = \left[\frac{1}{3}, \quad \frac{1}{3}, \quad \frac{1}{3}\right]$$



$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial L} = \begin{bmatrix} \frac{1}{3}, & \frac{1}{3}, & \frac{1}{3} \end{bmatrix}$$

$$\frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_2}}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_{2}^{(1)}}} = \begin{bmatrix}
\frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(3)}} \\
\frac{\partial L^{(2)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(3)}} \\
\frac{\partial L^{(3)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(3)}}
\end{bmatrix}$$

$$\frac{\partial J}{\partial \overrightarrow{L}} = \left[\frac{1}{3}, \quad \frac{1}{3}, \quad \frac{1}{3}\right]$$

$$\frac{z_{1}^{(1)} = \theta x^{(1)}}{z_{1}^{(2)} = \theta x^{(2)}} + z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} + z_{1}$$

$$z_{1}^{(1)} = \theta x^{(1)}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)}$$

$$z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}$$

$$z_{1}^{(3)} = \theta x^{(3)}$$

$$z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}$$

$$z_{2}^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{L}} = [\frac{1}{3}, \frac{1}{3}, \frac{1}{3}]$$

$$\frac{\partial J}{\partial \overrightarrow{z_2}} = \frac{\partial J}{\partial \overrightarrow{L}} \frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_2}}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$z_1^{(3)} = \theta x^{(3)} \longrightarrow z_2^{(3)} = y^{(3)} - z_1^{(3)} \longrightarrow L^{(3)} = (z_2^{(3)})^2$$

$$\frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_{2}}} = \begin{bmatrix} \frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(3)}} \\ \frac{\partial L}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(3)}} \\ \frac{\partial L^{(3)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(3)}} \end{bmatrix} = \begin{bmatrix} 2z_{2}^{(1)} & 0 & 0 \\ 0 & 2z_{2}^{(2)} & 0 \\ 0 & 0 & 2z_{2}^{(2)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \vec{z}_{2}} = \frac{\partial J}{\partial \vec{L}} \frac{\partial \vec{L}}{\partial \vec{z}_{2}} = \begin{bmatrix} \frac{1}{3}, & \frac{1}{3} \end{bmatrix} \begin{bmatrix} 2z_{2}^{(1)} & 0 & 0 \\ 0 & 2z_{2}^{(2)} & 0 \\ 0 & 0 & 2z_{2}^{(2)} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_{2}}} = \begin{bmatrix} \frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(2)}} \\ \frac{\partial L}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(3)}} \\ \frac{\partial L^{(3)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(3)}} \end{bmatrix} = \begin{bmatrix} 2z_{2}^{(1)} & 0 & 0 \\ 0 & 2z_{2}^{(2)} & 0 \\ 0 & 0 & 2z_{2}^{(2)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \vec{z_2}} = \frac{\partial J}{\partial \vec{L}} \frac{\partial \vec{L}}{\partial \vec{z_2}} = \begin{bmatrix} \frac{1}{3}, & \frac{1}{3} \end{bmatrix} \begin{bmatrix} 2z_2^{(1)} & 0 & 0 \\ 0 & 2z_2^{(2)} & 0 \\ 0 & 0 & 2z_2^{(2)} \end{bmatrix}
= \begin{bmatrix} \frac{1}{3} 2z_2^{(1)}, & \frac{1}{3} 2z_2^{(2)}, & \frac{1}{3} 2z_2^{(3)} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overrightarrow{z_{2}}} = \left[\frac{1}{3} 2z_{2}^{(1)}, \frac{1}{3} 2z_{2}^{(2)}, \frac{1}{3} 2z_{2}^{(3)}\right]$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \left[\frac{1}{3}2z_{2}^{(1)}, \frac{1}{3}2z_{2}^{(2)}, \frac{1}{3}2z_{2}^{(3)}\right]$$

$$\frac{\partial \overrightarrow{z_2}}{\partial \overrightarrow{z_1}}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial \overline{z_{2}^{(1)}}}{\partial \overline{z_{1}^{(1)}}} = \begin{bmatrix}
\frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(3)}} \\
\frac{\partial \overline{z_{2}^{(2)}}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(3)}} \\
\frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \\
\frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}}
\end{bmatrix}$$

$$\frac{\partial J}{\partial \vec{z}_2} = \left[\frac{1}{3} 2z_2^{(1)}, \quad \frac{1}{3} 2z_2^{(2)}, \quad \frac{1}{3} 2z_2^{(3)} \right]$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial \overline{Z}_{2}}{\partial \overline{Z}_{1}} = \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(3)}} \\ \frac{\partial \overline{Z}_{2}}{\partial \overline{Z}_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overrightarrow{z_{2}}} = \begin{bmatrix} \frac{1}{3} 2z_{2}^{(1)}, & \frac{1}{3} 2z_{2}^{(2)}, & \frac{1}{3} 2z_{2}^{(3)} \end{bmatrix} = \begin{bmatrix} \frac{\partial J}{\partial \overrightarrow{z_{2}}} & \frac{\partial Z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial Z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial Z_{2}^{(1)}}{\partial z_{1}^{(3)}} \\ \frac{\partial Z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial Z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial Z_{2}^{(2)}}{\partial z_{1}^{(3)}} \\ \frac{\partial Z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial Z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial Z_{2}^{(3)}}{\partial z_{1}^{(3)}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$\frac{\partial J}{\partial \overrightarrow{z_{2}}} = \begin{bmatrix} \frac{1}{3} 2z_{2}^{(1)}, & \frac{1}{3} 2z_{2}^{(2)}, & \frac{1}{3} 2z_{2}^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \overrightarrow{z_1}} = \frac{\partial J}{\partial \overrightarrow{z_2}} \frac{\partial \overrightarrow{z_2}}{\partial \overrightarrow{z_1}} = \begin{bmatrix} \frac{1}{3} 2z_2^{(1)}, & \frac{1}{3} 2z_2^{(2)}, & \frac{1}{3} 2z_2^{(3)} \end{bmatrix} \begin{bmatrix} -1 & 0 & 0\\ 0 & -1 & 0\\ 0 & 0 & -1 \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \begin{bmatrix} \frac{1}{3} 2z_{2}^{(1)}, & \frac{1}{3} 2z_{2}^{(2)}, & \frac{1}{3} 2z_{2}^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \begin{bmatrix} \frac{1}{3} 2z_{2}^{(1)}, & \frac{1}{3} 2z_{2}^{(2)}, & \frac{1}{3} 2z_{2}^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \overline{z_{1}^{(1)}}} = \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \begin{bmatrix} \frac{\partial J}{\partial \overline{z_{2}}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \\ \frac{\partial J}{\partial z_{2}^{(1)}} & \frac{\partial J}{\partial z_{2}^{(2)}} & \frac{1}{2} 2z_{2}^{(2)} & \frac{1}{2} 2z_{2}^{(3)} \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$\frac{\partial J}{\partial \overrightarrow{z_1}} = \frac{\partial J}{\partial \overrightarrow{z_2}} \frac{\partial \overrightarrow{z_2}}{\partial \overrightarrow{z_1}} = \begin{bmatrix} \frac{1}{3} 2z_2^{(1)}, & \frac{1}{3} 2z_2^{(2)}, & \frac{1}{3} 2z_2^{(3)} \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}
= \begin{bmatrix} -\frac{1}{3} 2z_2^{(1)}, & -\frac{1}{3} 2z_2^{(2)}, & -\frac{1}{3} 2z_2^{(3)} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}}{\partial \overline{z_{1}}} &= \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(3)}} \\ \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(3)}}{\partial z_{1}^{(3)}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$\frac{\partial J}{\partial \overline{z_{2}}} = \begin{bmatrix} \frac{1}{3} 2z_{2}^{(1)}, & \frac{1}{3} 2z_{2}^{(2)}, & \frac{1}{3} 2z_{2}^{(3)} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

$$\frac{\partial J}{\partial \overline{z_1}} = \frac{\partial J}{\partial \overline{z_2}} \frac{\partial \overline{z_2}}{\partial \overline{z_1}} = \begin{bmatrix} \frac{1}{3} 2z_2^{(1)}, & \frac{1}{3} 2z_2^{(2)}, & \frac{1}{3} 2z_2^{(3)} \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}
= \begin{bmatrix} -\frac{1}{3} 2z_2^{(1)}, & -\frac{1}{3} 2z_2^{(2)}, & -\frac{1}{3} 2z_2^{(3)} \end{bmatrix}
= \begin{bmatrix} -\frac{1}{3} 2(y^{(1)} - z^{(1)}), & -\frac{1}{3} 2(y^{(2)} - z^{(2)}), & -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overrightarrow{z_{1}}} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), -\frac{1}{3} 2(y^{(2)} - z^{(2)}), -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right]$$

$$z_{1}^{(1)} = \theta x^{(1)}$$

$$z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)}$$

$$L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)}$$

$$L^{(2)} = (z_{2}^{(2)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial z_{1}} = [-\frac{1}{3}2(y^{(1)} - z^{(1)}), -\frac{1}{3}2(y^{(2)} - z^{(2)}), -\frac{1}{3}2(y^{(3)} - z^{(3)})]$$

$$\frac{\partial \overrightarrow{z_1}}{\partial \theta} = \begin{bmatrix} \frac{\partial z_1^{(1)}}{\partial \theta} \\ \frac{\partial z_2^{(2)}}{\partial \theta} \\ \frac{\partial z_3^{(3)}}{\partial \theta} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial z_{1}} = [-\frac{1}{3}2(y^{(1)} - z^{(1)}), \quad -\frac{1}{3}2(y^{(2)} - z^{(2)}), \quad -\frac{1}{3}2(y^{(3)} - z^{(3)})]$$

$$\frac{\partial \overrightarrow{z_1}}{\partial \theta} = \begin{bmatrix} \frac{\partial z_1^{(1)}}{\partial \theta} \\ \frac{\partial z_2^{(2)}}{\partial \theta} \\ \frac{\partial z_3^{(3)}}{\partial \theta} \end{bmatrix} = \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial z} = \int_{-2\pi}^{1} \frac{1}{2} \zeta_{1}(z_{2}^{(1)} - z_{1}^{(1)}) \qquad \frac{1}{2} \zeta_{2}(z_{2}^{(1)} - z_{1}^{(2)}) \qquad \frac{1}{2} \zeta_{2}(z_{2}^{(3)} - z_{1}^{(3)})$$

$$\frac{\partial J}{\partial \vec{z_1}} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), -\frac{1}{3} 2(y^{(2)} - z^{(2)}), -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right]$$

$$\frac{\partial \overrightarrow{z_1}}{\partial \theta} = \begin{bmatrix} \frac{\partial z_1^{(1)}}{\partial \theta} \\ \frac{\partial z_2^{(2)}}{\partial \theta} \\ \frac{\partial z_3^{(3)}}{\partial \theta} \end{bmatrix} = \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial \overrightarrow{z_1}} \frac{\partial \overrightarrow{z_1}}{\partial \theta}$$

$$z_{1}^{(1)} = \theta x^{(1)}$$

$$z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)}$$

$$z_{1}^{(2)} = \theta x^{(2)}$$

$$z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)}$$

$$z_{2}^{(3)} = \theta x^{(3)}$$

$$z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}$$

$$z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}$$

$$z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \vec{z_{1}}} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), -\frac{1}{3} 2(y^{(2)} - z^{(2)}), -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right]$$

$$\frac{\partial \overrightarrow{z_1}}{\partial \theta} = \begin{bmatrix} \frac{\partial z_1^{(1)}}{\partial \theta} \\ \frac{\partial z_2^{(2)}}{\partial \theta} \\ \frac{\partial z_3^{(3)}}{\partial \theta} \end{bmatrix} = \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial \vec{z_1}} \frac{\partial \vec{z_1}}{\partial \theta} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), -\frac{1}{3} 2(y^{(2)} - z^{(2)}), -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right] \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{z_{1}}} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), \quad -\frac{1}{3} 2(y^{(2)} - z^{(2)}), \quad -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right]$$

$$\frac{\partial \overline{z_{1}}}{\partial \theta} = \begin{bmatrix} \frac{\partial z_{1}^{(1)}}{\partial \theta} \\ \frac{\partial z_{2}^{(3)}}{\partial \theta} \\ \frac{\partial z_{3}^{(3)}}{\partial \theta} \end{bmatrix} = \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial \overline{z_1}} \frac{\partial \overline{z_1}}{\partial \theta} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), -\frac{1}{3} 2(y^{(2)} - z^{(2)}), -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right] \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix} \\
= -\frac{1}{3} 2x^{(1)} (y^{(1)} - z^{(1)}) - \frac{1}{3} 2x^{(2)} (y^{(2)} - z^{(2)}) - \frac{1}{3} 2x^{(3)} (y^{(3)} - z^{(3)})$$

$$z_{1}^{(1)} = \theta x^{(1)} \qquad z_{2}^{(1)} = y^{(1)} - z_{1}^{(0)} \qquad L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \qquad z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \qquad L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \qquad z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \qquad L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \overline{z_{1}}} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), \quad -\frac{1}{3} 2(y^{(2)} - z^{(2)}), \quad -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right]$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial \overline{z_{1}}} \frac{\partial \overline{z_{1}}}{\partial \theta} = \left[-\frac{1}{3} 2(y^{(1)} - z^{(1)}), \quad -\frac{1}{3} 2(y^{(2)} - z^{(2)}), \quad -\frac{1}{3} 2(y^{(3)} - z^{(3)}) \right] \begin{bmatrix} x^{(1)} \\ x^{(2)} \\ x^{(3)} \end{bmatrix}$$

$$= -\frac{1}{3} 2x^{(1)}(y^{(1)} - z^{(1)}) - \frac{1}{3} 2x^{(2)}(y^{(2)} - z^{(2)}) - \frac{1}{3} 2x^{(3)}(y^{(3)} - z^{(3)})$$

$$= \frac{1}{3} \sum_{i=1}^{3} (-2x^{(i)}(y^{(i)} - z^{(i)}))$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial \theta}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial \theta}$$

$$\left[\frac{\partial J}{\partial L^{(1)}}, \frac{\partial J}{\partial L^{(2)}}, \frac{\partial J}{\partial L^{(3)}} \right] \begin{bmatrix} \frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(1)}}{\partial z_{2}^{(3)}} \\ \frac{\partial L^{(2)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(2)}}{\partial z_{2}^{(3)}} \\ \frac{\partial L^{(3)}}{\partial z_{2}^{(1)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(2)}} & \frac{\partial L^{(3)}}{\partial z_{2}^{(3)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \\ \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{2}^{(1)}} & \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial z_{2}^{(2)}}{\partial z_{2}^{(2)}} & \frac{\partial z_{2}^{(2)}}{\partial z_$$

$$\begin{bmatrix}
z_{2}^{(1)} & \partial z_{2}^{(1)} & \partial z_{2}^{(1)} \\
z_{1}^{(1)} & \partial z_{1}^{(2)} & \partial z_{1}^{(3)}
\end{bmatrix}
\begin{bmatrix}
\frac{\partial z_{1}^{(1)}}{\partial \theta} \\
\frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & \partial z_{2}^{(2)} \\
\frac{\partial z_{1}^{(1)}}{\partial \theta}
\end{bmatrix}
\begin{bmatrix}
\frac{\partial z_{1}^{(1)}}{\partial \theta} \\
\frac{\partial z_{2}^{(2)}}{\partial \theta} \\
\frac{\partial z_{2}^{(2)}}{\partial \theta}
\end{bmatrix}
\begin{bmatrix}
\frac{\partial z_{1}^{(1)}}{\partial \theta} \\
\frac{\partial z_{2}^{(2)}}{\partial \theta}
\end{bmatrix}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial \theta}$$

$$\left[\frac{\partial J}{\partial L^{(1)}}, \frac{\partial J}{\partial L^{(2)}}, \frac{\partial J}{\partial L^{(3)}} \right] \begin{bmatrix} \frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} & 0 & 0 \\ 0 & \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} & 0 \\ 0 & 0 & \frac{\partial L^{(3)}}{\partial z_{2}^{(3)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{2}^{(1)}}{\partial z_{1}^{(1)}} & 0 & 0 \\ 0 & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(2)}} & 0 \\ 0 & 0 & \frac{\partial z_{2}^{(2)}}{\partial z_{1}^{(3)}} \end{bmatrix} \begin{bmatrix} \frac{\partial z_{1}^{(1)}}{\partial \theta} \\ 0 & \frac{\partial z_{2}^{(2)}}{\partial \theta} \\ \frac{\partial z_{3}^{(3)}}{\partial \theta} \end{bmatrix}$$

$$\frac{z_{1}^{(1)} = \theta x^{(1)}}{z_{1}^{(2)} = \theta x^{(2)}} \xrightarrow{z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)}} \xrightarrow{L^{(1)} = (z_{2}^{(1)})^{2}} L^{(2)} = (z_{2}^{(2)})^{2}$$

$$\frac{z_{1}^{(2)} = \theta x^{(2)}}{z_{1}^{(3)} = \theta x^{(3)}} \xrightarrow{z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)}} \xrightarrow{L^{(3)} = (z_{2}^{(3)})^{2}} L^{(2)} = (z_{2}^{(2)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial L} \xrightarrow{\partial L} \xrightarrow{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial U}$$

$$\frac{\partial J}{\partial \theta} = np \cdot sum(\begin{bmatrix} \frac{\partial J}{\partial L^{(1)}} \\ \frac{\partial J}{\partial L^{(2)}} \\ \frac{\partial J}{\partial L^{(3)}} \end{bmatrix} * \begin{bmatrix} \frac{\partial L^{(1)}}{\partial z_{2}^{(1)}} \\ \frac{\partial L^{(2)}}{\partial z_{2}^{(2)}} \\ \frac{\partial L^{(2)}}{\partial z_{1}^{(3)}} \end{bmatrix} * \begin{bmatrix} \frac{\partial z_{1}^{(1)}}{\partial z_{1}^{(1)}} \\ \frac{\partial z_{2}^{(2)}}{\partial \theta} \\ \frac{\partial z_{3}^{(3)}}{\partial \theta} \end{bmatrix})$$

$$\frac{\partial J}{\partial \theta} = np \cdot sum(dL * dZ2 * dZ1 * d\Theta)$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial \theta}$$

$$\theta = \theta - \alpha \frac{\partial J}{\partial \theta}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial \overline{L}} \xrightarrow{\partial \overline{L}}$$

$$\theta = \theta - \alpha \frac{\partial J}{\partial \theta}$$

$$= \theta - \alpha \frac{\partial J}{\partial \overrightarrow{L}} \frac{\partial \overrightarrow{L}}{\partial \overrightarrow{z_2}} \frac{\partial \overrightarrow{z_2}}{\partial \overrightarrow{z_1}} \frac{\partial \overrightarrow{z_1}}{\partial \theta}$$

$$z_{1}^{(1)} = \theta x^{(1)} \longrightarrow z_{2}^{(1)} = y^{(1)} - z_{1}^{(1)} \longrightarrow L^{(1)} = (z_{2}^{(1)})^{2}$$

$$z_{1}^{(2)} = \theta x^{(2)} \longrightarrow z_{2}^{(2)} = y^{(2)} - z_{1}^{(2)} \longrightarrow L^{(2)} = (z_{2}^{(2)})^{2}$$

$$z_{1}^{(3)} = \theta x^{(3)} \longrightarrow z_{2}^{(3)} = y^{(3)} - z_{1}^{(3)} \longrightarrow L^{(3)} = (z_{2}^{(3)})^{2}$$

$$\frac{\partial J}{\partial \theta} = \frac{\partial J}{\partial L} \xrightarrow{\partial Z_{2}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial Z_{1}} \xrightarrow{\partial \theta}$$

$$\theta = \theta - \alpha \frac{\partial J}{\partial \theta}$$

$$= \theta - \alpha * np . sum(dL * dZ2 * dZ1 * d\Theta)$$