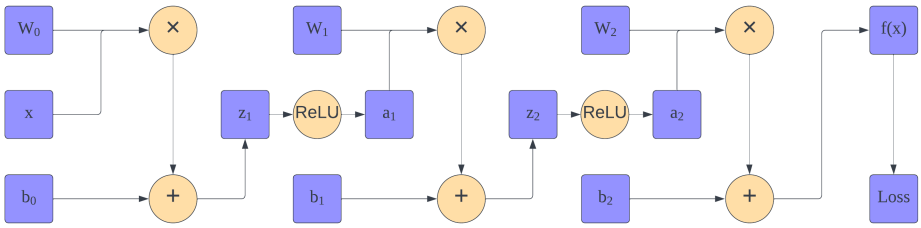
Pattern Recognition and Machine Learning: Homework 9, Zhengzuo Liu

Problem 1

Answer:



Problem 2

Answer:

$$\frac{\partial J}{\partial f(x)} = f(x) - y$$

$$\frac{\partial J}{\partial b_2} = \frac{\partial J}{\partial f(x)}\frac{\partial f(x)}{\partial b_2} = \frac{\partial J}{\partial f(x)}$$

$$\frac{\partial J}{\partial W_2} == \frac{\partial J}{\partial f(x)}\frac{\partial f(x)}{\partial W_2} = \frac{\partial J}{\partial f(x)}a_2$$

$$\frac{\partial J}{\partial a_2} == \frac{\partial J}{\partial f(x)}\frac{\partial f(x)}{\partial a_2} = \frac{\partial J}{\partial f(x)}W_2$$

$$\frac{\partial J}{\partial b_1} = \frac{\partial J}{\partial a_2}\frac{\partial a_2}{\partial b_1} = \frac{\partial J}{\partial a_2}ReLu'(z_2)$$

$$\frac{\partial J}{\partial W_1} = \frac{\partial J}{\partial a_2}\frac{\partial a_2}{\partial W_1} = \frac{\partial J}{\partial a_2}ReLu'(z_2)a_1$$

$$\frac{\partial J}{\partial a_1} = \frac{\partial J}{\partial a_2}\frac{\partial a_2}{\partial a_1} = \frac{\partial J}{\partial a_2}ReLu'(z_2)W_1$$

$$\frac{\partial J}{\partial b_0} = \frac{\partial J}{\partial a_1}\frac{\partial a_1}{\partial b_0} = \frac{\partial J}{\partial a_1}ReLu'(z_1)$$

$$\frac{\partial J}{\partial W_0} = \frac{\partial J}{\partial a_1}\frac{\partial a_1}{\partial W_0} = \frac{\partial J}{\partial a_1}ReLu'(z_1)a_1$$

$$\frac{\partial J}{\partial x} = \frac{\partial J}{\partial a_1}\frac{\partial a_1}{\partial x} = \frac{\partial J}{\partial a_1}ReLu'(z_1)W_0$$

Problem 3

Answer:

The final training loss is 0.08231186011178608, test loss is 0.09323730870865322