Submission for Deep Learning Exercise 2

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1 Pen and Paper MLP

$$z^{(1)} = (W^{(1)})^T \cdot X + b^{(1)} = \begin{bmatrix} -2 & 2 & -3 \\ 1 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 3 \\ 2 & 4 \\ 3 & 5 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} -4 & -10 \\ 4 & 8 \end{bmatrix} \tag{1}$$

$$h^{(1)} = g^1(z^{(1)}) = ReLU(z^{(1)}) = ReLU(\begin{bmatrix} -4 & -10 \\ 4 & 8 \end{bmatrix}) = \begin{bmatrix} 0 & 0 \\ 4 & 8 \end{bmatrix} \tag{2}$$

$$z^{(2)} = (W^{(2)})^T \cdot h^{(1)} + b^{(2)} = \begin{bmatrix} -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0 & 0 \\ 4 & 8 \end{bmatrix} + \begin{bmatrix} -3 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 5 \end{bmatrix} \tag{3}$$

$$h^{(2)} = g^{(2)}(z^{(2)}) = Sigmoid(\begin{bmatrix} 1 & 5 \end{bmatrix}) = \begin{bmatrix} 0.73105858 & 0.99330715 \end{bmatrix} \tag{4}$$

The Cross Entropy loss is given by

$$\mathscr{L}(\hat{y}, y) = \frac{1}{N} \Sigma_{i=1}^{2} ((-y_i \log(\hat{y}_i) - (1 - y_i) \log(1 - \hat{y}_i)) \tag{5}$$

$$= \frac{1}{2}(-1 \cdot \log(0.99330715) - (1 - 0) \cdot \log(1 - 0.73105858)) = \frac{1}{2}(0.006715 + -1.313261) = 0.65998 \tag{6}$$

2 Experiments

The maximum accuracy we can get with logistic regression is 50%.