Deep Learning for Image Analysis

DL4IA – Report for Assignment 2

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1 Partial Derivatives in the Neural Network

Exercise 1.1 deriving $\frac{\partial J}{\partial b_m}$

$$\frac{\partial J}{\partial b_m} = \sum_{i=1}^{n} \frac{\partial J}{\partial z_{im}} \frac{\partial z_{im}}{\partial b_m} \text{ by chain rule}$$

Exercise 1.2 deriving $\frac{\partial J}{\partial w_{mj}}$

$$\frac{\partial J}{\partial w_{mj}} = \sum_{i=1}^{n} \frac{\partial J}{\partial z_{im}} \frac{\partial z_{im}}{\partial w_j} \text{ by chain rule}$$

2 One layer neural network

2.1 Code

See NN.ipynb

2.2 Evaluation

Exercise 2.2.1 Cost and accuracy graphs for one layer neural network

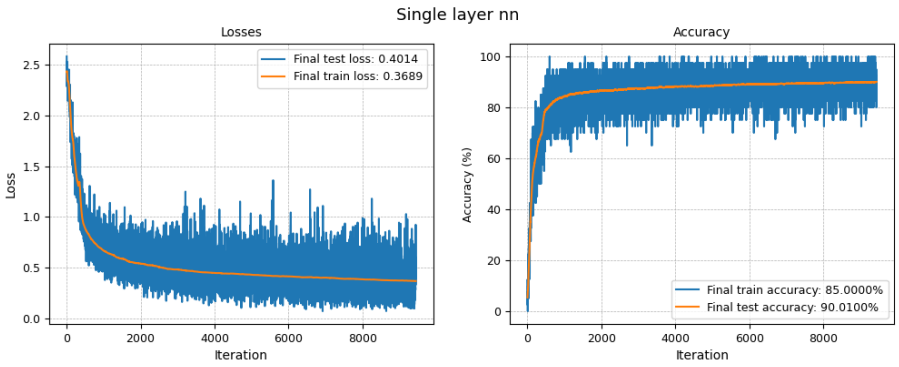

Figure 1: Single layer loss

Exercise 2.2.2 Visualising weights of single layer neural network

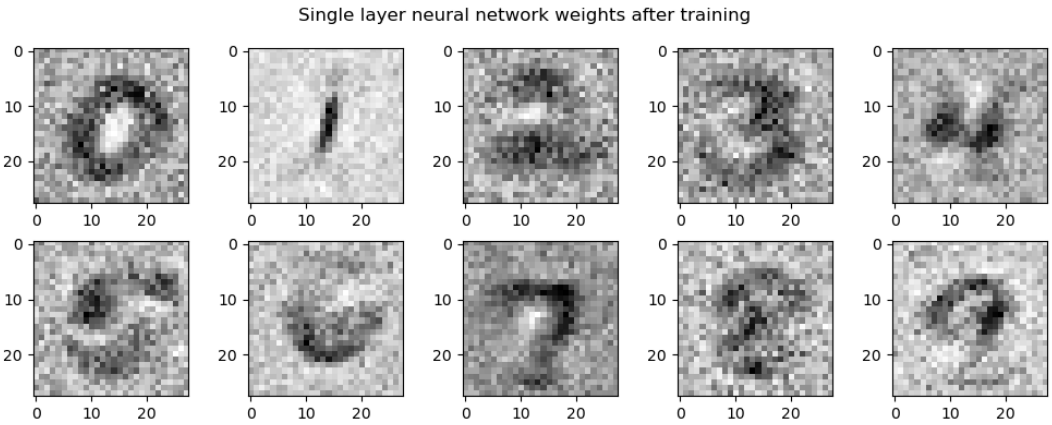

Figure 2: Single layer weights

The images in figure 2 show the final trained weights for the single layer neural network. In these weights the outlines of the respective digits are visible in the dark areas. These dark areas represent high weight areas. This is to be expected as each of these output layers is detecting one digit so we should see the weights corresponding to the respective digit. It is interesting to note that the weights are stronger in the more distinct regions of the number for example in the double curve of the three, or the sharp edge in the seven.

3 Multi layer neural network

3.1 Code

See NN.ipynb

3.2 Evaluation

Exercise 3.2.1 Graphs of loss and accuracy for multi layer neural network

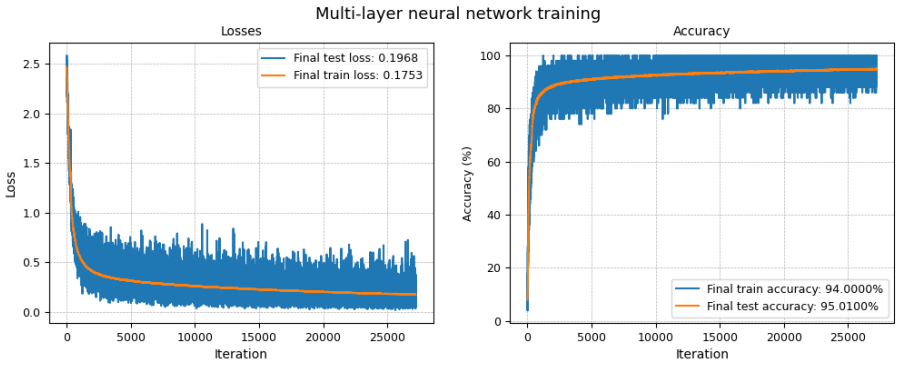

Figure 3: Multi layer losses and accuracy