Short description:

-This project implements a neural network for classification of handwritten digits using the R language.

Data:

-The data used for this project is the MNIST data set which is a set of over 60000 labled images of handwritten digits.

File description:

-The code in "File loader.R" will download, gunzip, and help visualize the data.

-The code in "Neural network.R" contains the code for the training and trsting of the network.

-The rest of the files contain the code for the functions used in "Neural network.R"

Algorithm:

-The algorithm used is "stochastic gradient descent", which uses backpropagation

- The goal is to calculate the gradient of the cost function with respect to all weights and biases. The expression of the gradient's components are shown in (BP3) and (BP4). To calculate them we need to calculate the quantity "delta" for every neuron which is given in (BP1) for the last layer's neurons , and (BP2) for the neurons in the remaining of the layers.

- the proof of these equations is easy and can be found in the great book in the link below.

Summary: the equations of backpropagation

$$\delta^L = \nabla_a C \odot \sigma'(z^L) \qquad \text{(BP1)}$$

$$\delta^l = ((w^{l+1})^T \delta^{l+1}) \odot \sigma'(z^l) \qquad \text{(BP2)}$$

$$\frac{\partial C}{\partial b^l_j} = \delta^l_j \qquad \text{(BP3)}$$

$$\frac{\partial C}{\partial w^l_{j\,k}} = a^{l-1}_k \delta^l_j \qquad \text{(BP4)}$$

source: http://neuralnetworksanddeeplearning.com/chap2.html