Identify Handwritten Digits
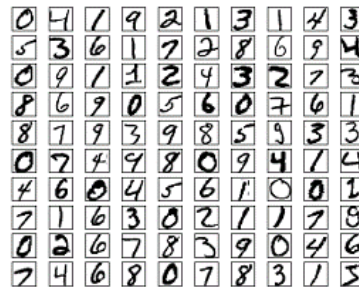

Figure 1: Small sample of handwritten Digits.

Model

Nowadays neuronal networks are part of most electrical devices or technology we use. It is more or less part of our life. The basic idea is to imitate the neural network of the human brain using articifal neurons.

In this example the task at hand is to create an algorithm which can identify the digits written from an image. In the *mnist dataset* the handwritten digits of various people of different age and education are gathered. There are 60000 train examples and 10000 test examples to evaluate the resulting algorithm.

ToDo's

Task 1

Create a small first neural network which then learns the following pattern.

$$\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix} \rightarrow \begin{pmatrix} 1 \\ 1 \\ 0 \\ 0 \end{pmatrix}$$

You might create additional test data to see if the network also works outside of the training set.

Task 2

Focusing on the task of handwritten digits, think about which architecture and type of neural network will be the right one. Define inputs outputs and their format for that network. The choice of the activation function is also an important point. Have a look at the provided dataset and see if the data structure fits the neural network. (The 'double' function of MatLab converts the image information into doubles.)

Task 3

Implement a neural network and train it with part or all of the provided training data and investigate how big the dataset has to be to classify 80% of the test data correctly.

Task 4

Implement a second neural network with a different structure. Compaire the results and performance of these two networks.

Task 5

Document the whole simulation experiment in a fully reproducible way. Comment your source code and upload all documents zipped to Tuwel.