Tutorial 1: Wednesday May 3, 15:15-17:00

1. Logistic Regression

Notebook: Tutorial1_1.ipynb

A simple problem to illustrate the use of logistic regression to classify Iris flowers is given in the accompanying notebook (as was briefly discussed in class on 28/4). Here the sklearn package is also used and we will consider only the case of two classes (Versicolor, Setosa).

a.
Go through the notebook, understand the code structure and identify the hyper parameters.

b.
Study the performance of the classifier on the test data for different values of the number of epochs (for fixed other hyper parameters).

c.
Study the performance of the classifier on the test data for different values of the regularization parameter (for fixed other hyper parameters).

d.
Study the performance of the classifier on the test data for different values of the learning rate parameter (for fixed other hyper parameters).

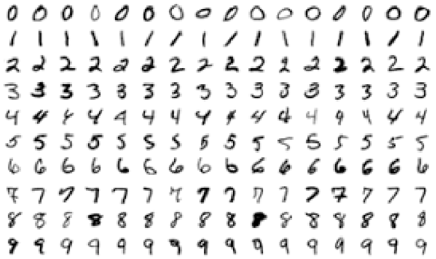
2. Handwriting Classification with a MLP

Notebook: Tutorial1_2.ipynb

The classification of handwriting digits is one of the classics in machine learning. In this tutorial, we will apply a MLP on the MNIST data set (see example data in the figure below) for this task. The Python code given is not the most efficient one, but it shows explicitly all the steps involved (including the back-propagation algorithm).

a.
Go through the notebook, understand the code structure, in particular that of the MLP, and identify the hyper parameters.

b.
For the standard values of the hyper parameters, how many epochs are needed to obtain a training error of 5%? What is test accuracy in this case? How would you recognise overfitting in this MLP?



c.
What is the effect of the learning rate on the training error? Is there an optimal value?

d.
Study the behaviour of the training error (for a fixed value of the number of epochs and the learning rate) versus the number of hidden layers in the MLP. Is there an optimal value?

e.
How would you determine the global optimum of the hyper parameters? **Extra: implement such an optimalization algorithm in the notebook.**