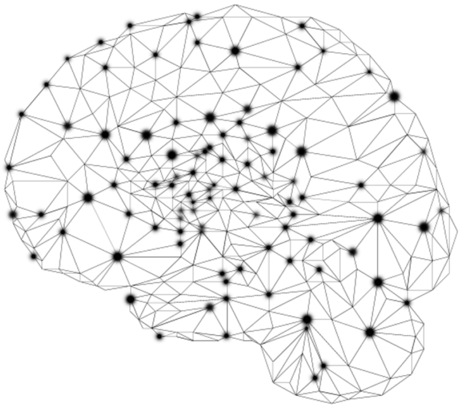

Neural Networks and Data Science

Lab #9

06.12.2023
Deadline: 13.12.2023, 12:10

Dr. Marcel Völschow

HAW
HAMBURG

Problem 1

Recreate your `testNet` neural network in Tensorflow and compare the performance of the two networks. Give possible reasons for their different performance.

Problem 2

Tensorflow's `fit` method returns a history object which in turn contains an attribut `history`. Extract it from the object. Use it to plot the validation accuracy, training accuracy and loss as a function of the epoch. Set up a network with a single fully connected layer with 256 nodes (ReLU activated) and train it on MNIST Fashion.

Problem 3

Tensorflow provides the `tf.math.confusion_matrix` method to create a simple confusion matrix. It returns a `tf.tensor` which can be converted into a regular Numpy array using `np.array`. Write a function `confusion_matrix` that takes a Tensorflow model and a test dataset, evaluates the test dataset, calculates the confusion matrix and turns it into something more readable, e.g. by providing labels, additional explanations, or even a nice graph via `plt.img`.

Problem 4

So far, we have been working with grayscale images.

a) Why are color images harder to process and cannot be directly fed into the neural networks that we have created up to this point?

b) In our shared folder, you will find a grayscale version of the famous CIFAR-10 dataset. It consists of a total of 60,000 images (32x32 pixels) of objects that each belong to one of ten classes (see `classNames.txt`). Load the data (provided as `*.npy` files) into a notebook.

c) Create a network with a single hidden layer with 256 nodes (ReLU activation) and a softmaxed output. Train the network for (up to) 50 epochs and discuss the performance of the network.

d) Calculate the fraction of correctly classified images as a function of the image class.

e) Create a network with two hidden layers with 256 nodes each (ReLU activation) and a softmaxed output. Train the network for (up to) 50 epochs. Did the performance improve?