Tutorial 08: Autoencoders

The goal of this exercise is to understand and apply Autoencoders. We will develop an autoencoder for the CIFAR10 data set (low-resolution images of 10 classes), which were already mentioned on exercise sheet 06.

Please submit your code and results by 16th Dec 23:59 to manuel.milling@informatik.uni-augsburg.de. You can submit your solutions alone or in Teams of 2 (please indicate all names with the submission).

CIFAR 10 Data Set

The loading of the CIFAR 10 data set is already implemented. The data set contains a train and test set of 50 000 and 10 000 pictures with 32×32 pixels and 3 color channels and according classification labels for 10 classes `https://www.cs.toronto.edu/~kriz/cifar.html`.

1 Autoencoder (10P)

Implement and train an autoencoder with a maximum representation size of 512 and a maximum reconstruction error of 0.002 (MSE). Use the provided code to visualise some of the reconstructed images and to compare them to the original. The reconstructed images should look similar to the original ones, though some differences can be spotted.
Note: Convolutional layers are quite effective for this task. However, for the decoding step upsampling is necessary. Look into Transposed Convolutions for this.

2 Encoder (2P)

Encode the data set using only the encoder part of your autoencoder.

3 Classification (4P)

Train a classifier on the encoded data, which achieves above 50% test accuracy.

4 Denoiser (4P)

Add random normal noise to the images with a standard deviation of $\sigma = 0.06$ and train your autoencoder as a denoiser, i.e., it should reconstruct the noise-less images from the noisy images. Beat a reconstruction error (MSE) of 0.0025. Use the provided code to visualise the noise-less images, the noisy images and the reconstructed images.