ALGORITHMS FOR IMAGE PROCESSING

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Hints for Problem Sheet 4

Problem 1

Two-layer fully connected network.

- Make yourself clear that many parts are similar to the linear Softmax classifier. Note that even major parts for computing the gradient of the loss w.r.t. the weights are similar.

- As a rule of thumb, initialize the weight matrices by a centered normal distribution with $\sigma = 10^{-4}$, (and keep in mind that there are more advanced strategies for that.)

- Concerning the decay rate for learning: apply the decay after every epoch of learning. (Recall that an epoch consists of dealing with a number of samples in the size of the training set; concretely, in the CIFAR 10 setting when you learn on say 49000 images, the first epoch is over, when learning has seen the first 49000 (randomly chosen) images. Then, the first decay takes place.)

- Learning rates at scale $10^{-2}, 10^{-3}$, regularization at scale 1, rearning rate decay 0.9 or 0.95 should be a good starting point.

Problem 2

Optional: Own small convolutional network in Pytorch.

- You may want to look up the Pytorch tutorial on setting up a basic CNN on CIFAR-10 data at `https://pytorch.org/tutorials/beginner/blitz/cifar10_tutorial.html`

- You may want to add more convolution kernels, i.e., increasing the depth of the first layers.

- You may also want to add more layers, and potentially use padding.

- Another idea is to replace pooling by using a stride.

- Enjoy trying out and increasing your accuracy.

Problem 3

Transfer learning on the CIFAR-10 dataset.

- You may potentially use the file attached as a starting point.

- You have to choose an optimizer to make the script run: we suggest to use SGD with momentum (take learning rate lr=0.001 and momentum=0.9)

- You further should adapt the second to last fully connected layer to have 1024 neurons (since CIFAR-10 has less classes.)

- If you don't have graphics card support, one epoch may take several hours. After about four epochs you should have reached an accuracy of 80%. If you prefer to stop then, it is perfectly OK.

- You are not the first one to do transfer learning. Search the internet to get further inspiration.