Exercise 2 in Computer Vision: Deep Learning
Discussion on 10/28/2019 at 10.00 am – 12.00 am (NB 3/57)

In this exercise you should define a linear classifier to seperate the 10 classes from the CIFAR dataset. Download the dataset from `https://www.cs.toronto.edu/~kriz/cifar.html` and use the module `DLCVDatasets`, in particular the function `get_dataset`, provided in moodle to parse the data. You will need to change `cifar_path` to the path to which you downloaded CIFAR.

The linear classifier that will be used does not have an offset ($b = 0$ in the lecture) and is just defined as

$$y = Wx \text{ with } x \in \mathbb{R}^{3072}, W \in \mathbb{R}^{10\times 3072}, y \in \mathbb{R}^{10}$$

The index of y carrying the maximum element yields the prediction of the classifier for the image x. In order for this classifier to work properly you must transform the dataset to have zero mean. Be careful to backtransform it properly when plotting.

1. Think about how you can compute / estimate the rows of W by using training data. Today there will not be any optimization technique involved, yet.
2. Retransform the rows of W to images and plot them to gauge what is being learned.
3. Compute the performance of your classifier on training and test data. Is the classifier overfitting? Why?

You may want to use the `matplotlib.pyplot` module for visualization purposes. In particular the functions `figure()`, `subplot()`, `imshow()`, `title()`, `show()` may be useful. Please be aware that `imshow()`'s behaviour is depending on the data type (`float`, `uint8`) of the input arguments.