

## Documentation

# Scientific Computing Project

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## 1 Task

The goal of this project was to code the model of a convolutional neural network and train it for the task of classifying images which consists of assigning them to one of 10 possible classes. The used training images are self-generated by the students of this course and collected into a database. A detailed description of the used training data can be found in chapter 2, whereas the architecture of the network is explained in chapter 3. Especially, the network should also be able to classify new images correctly. In chapter 4 we talk about the training process and the tuning of hyperparameters like learning rate, batch size or optimizer by using k-fold cross-validation. At the end in chapter 5, we evaluate the result of our work by looking at several performance measurements like the confusion matrix and the loss and accuracy curves. Finally, we discuss approaches for improvement.

## 2 Description of the Data Set

The data set that is used for training the network consists of 10 classes of images. These are

1. bottles
2. mugs/cups
3. spoons
4. knives
5. forks
6. shoes
7. t-shirts
8. plants
9. chairs
10. bikes

Every student had to contribute to this database by generating 15-20 pictures of pairwise disjoint objects for each class. In total there are approximately 400 images per class which yield a database of almost 4000 images. In the next step the image database was



(a) 10. bikes



(b) 2. mugs/cups



(c) 3. spoons

Figure 1: Example images of some classes

normalized (*by doing...*) to make the training possible. To enlarge the database and improve the training process, we used data augmentation techniques in the following manner (*insert detailed description....*).

TODO: insert example augmented images

As a result of this preprocessing procedure, we got a database of ... images for the training and testing of our neural network.

### **3 Architecture of the Network**

### **4 Training**

### **5 Results**