

Praktikum Wissenschaftliches Rechnen / Scientific Programming Project Introduction Programming Project

Please implement a *convolutional neuronal network* (CNN) for image classification in **Pytorch**. The grade of the module will be determined by the submitted code, its performance and the oral presentation. Therefore, please submit the slides of the presentation, the python code of the tasks and any code or information that is necessary to reproduce your results. Then a date for the presentation will be set.

General information:

- The programming project can be worked on in groups of 2 to 3 people.
- The image database will be the same for each group. Each student has to contribute to the database, see below.
- For the image classification task, we have the 10 labels:

1. bottles	3. spoons	5. forks	7. T-shirts	9. chairs
2. mugs/cups	4. knives	6. shoes	8. plants	10. bikes
- Use data augmentation techniques to enlarge the database, e.g., cropping, flipping, and rotating of the images.
- Please make your program reproducible (also the data augmentation), e.g., set seeds for the random number generators.
- Please tune hyperparameter.
- Report your results, e.g., intermediate results, results of the hyperparameter tuning, different performance measurements and so on.
- Keep in mind that the hyperparameter tuning is with respect to the training data and **not** the test data. Use *k-fold crossvalidation* for hyperparameter tuning.
- Use a 80% of the database as your training data and the rest as test data.
- Prepare your python code in a way that you can handle complete new images for a classification task (plot the classified label and image), which will be handed to you at the time of your presentation.

Exercise 1

Each student has to contribute to the database:

1. Take 15-20 pictures of each class, see above. These pictures have to be from pairwise disjoint objects, i.e., not only the same object from different perspectives.
2. Take the pictures by your own and do not use pre-existing images from the internet.
3. There are no special requirements on the height or width of the pictures.

4. Send an e-mail to stephan.koehler@math.tu-freiberg.de. You will receive a link to Ownsky-Cloud (TU FREIBERG) where you can store your pictures. Store the images with the suffix *.jpeg and as raw images, i.e., do not store a zip or tar archive or any other compressed archive. Furthermore, you will receive a link where you can download the merged database.
5. Please store the pictures for each label in a separate subfolder named after the label.