

Programming with neural networks: Exercise sheet 6

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Exercise sheet: 6

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Task 1: MNIST-CNN and extended evaluation

- (a) Implement and evaluate LeNet on the MNIST data.

- (b) Determine the number of parameters of LeNet and compare to
Check your calculated number with the result of `model.count_params()` or `model.summary()`.
- (c) On the test data, calculate the 25 worst-scoring examples (ie lowest probability) and plot them as 5×5 grids (subplots). Put the respective title so that Prediction (with probability) and GT (with probability) are given. Can you understand that the neural network makes these mistakes?
- (d) Determine the accuracy top-2, that is, that the correct prediction is below is the most likely two predictions.

Task 2: MNIST regularization and pre-training

- (a) Reduce the number of training examples for each digit noticeably (e.g. only 50 per digit) and determine the accuracy. Which digit will be used on worst recognized, what can be the reason? Don't use one here yet
Regularization techniques such as B. Dropout. For the training are total fewer iterations / epochs required.
- (b) Implement and evaluate dropout and optionally the l_2 norm. Improvement
Are you interested in the results?
- (c) Implement data augmentation for digits. What operations

are valid and useful? How does the data augmentation affect the results from?

- (d) Use the original LeNet model again. Build models for Fashion MNIST¹ and CIFAR-100² and use this as a pre-trained Model for digit recognition. What can you observe?

¹https://www.tensorflow.org/api_docs/python/tf/keras/datasets/fashion_mnist

²https://www.tensorflow.org/api_docs/python/tf/keras/datasets/cifar100