Assignment no. 2

The hands-on workshop on November 4, 2024, is devoted to training fully connected neural networks for recognizing handwritten digits using a simple low-res data set (6×4).

Exercise 2 (20 points) Start from the notebook `ANN_Basics.ipynb` and perform the following steps:

1. Try at least 10 different configurations of traditional networks (only sigmoid activations in hidden layers, no dropout, stochastic gradient descent; modify only layers, learning rate, and number of epochs).

2. Try at least 10 different configurations of modern networks (any activation in hidden layers allowed, dropout allowed, any optimization algorithm allowed).

Document your settings and the resulting validation accuracies carefully. Discuss and interpret your results. Please hand in your notebook (including discussion of results) and an HTML dump of it.

Exercise 3 (30 points) Start from the notebook `ANN_ModelSelection.ipynb` and perform the following steps:

1. Choose suitable ranges and values for the hyperparameters. In particular, review and possibly adapt all settings in the function `create_hyperparams()`. For each set of hyperparameters, either leave the ranges/values as they are or make changes. Please argue with 1–2 sentences for each hyperparameter what you changed and why (or why you did not change anything). Write this argumentation as markup text into the notebook. Be aware that, if you add/remove hyperparameters to/from `create_hyperparams()`, you need to adapt the function `create_network()` accordingly, too.

2. Create a list of at least 100 different sets of hyperparameters, train the corresponding models and evaluate their validation accurary.

3. Identify the model that gave the best validation accuracy and train a model with the same hyperparameters on the entire training set. Save the final model to a file.

Please hand in the following:

1. Your best model under the exact file name `Surname_FirstName.hdf5` (insert your name; no special characters!). Please do not upload the model file to Moodle! Instead, an upload link will be shared in class via Teams.

2. Your notebook (including the notes of Step 1. above).

The best three models will receive three extra points.

Submission: electronically via Moodle; Deadline: Mon, Nov 25, 2024, 1:00pm.