

Deep Learning KU (708.220) WS22

Assignment 2: Neural Networks: Regression

Problem description:

You have a set of data about social capital. You will design a regression problem on this dataset.

Then you will use Tensorflow 2.0 and Keras libraries to train a neural network for regression to predict the selected values. You will explore different models and comment on their applicability.

Data:

Download the data from:

<https://data.humdata.org/dataset/social-capital-atlas>

It is the same dataset as in Assignment 1.

For the tasks below create the appropriate code and discuss your experiences, findings and choices in your report.

Your tasks:

- a) **(3 points)** : State, which one of the four Social Capital datasets you are using. To create training and test datasets, separate the datapoints randomly, so that 80% of the points are in the training dataset and the remaining 20% are in the test dataset. Normalize the data if necessary.
- b) **(4 points)** : Design a regression problem on your dataset. Define, which are your input features, and which is your output variable. Explain, whether you left out any of the features, and why. Describe your output variable (what it means, in which units it is measured,...).
- c) **(6 points)** : You will use the test set only for final evaluations. Construct and use a validation set consisting of samples from the training data during the model selection process. Use no activation (i.e. linear activation) at the output layer. Optimize mean squared error by using mini-batches of suitable size. Test different architectures with varying numbers of hidden units and hidden layers. Compare and report validation set errors.

- d) (4 points) : Investigate different optimization procedures such as stochastic gradient descent (SGD), momentum SGD, and ADAM. Accordingly, test a number of learning rates and also try out adapting the learning rate during training by scheduling. Provide a table where training and validation set errors of various optimization hyper-parameters are compared.
- e) (3 points) : Summarize your final model once your architecture choices are fixed. You can perform the final training with the whole training set. Provide a plot where the evolution of the training error during training is shown throughout iterations. Report and comment on the final test error. Provide a plot in which you compare predictions to the real values (on the test set). Comment on this plot.

Total: 20 points

Present your results clearly and structured. Submit your commented code (a single .py file) and a report (.pdf) at TeachCenter. Do not provide one zip file with code and PDF, but submit them separately. Your code should be directly executable (assuming that the data files are present at the working directory). Provide the names of the group members and their matriculation numbers at the top of both files (the report and the code).

Assignment details:

- *Assignment issued:* November 9th, 2022, 08:00
- *Deadline:* November 30th, 2022, 08:00
- *Solution Submission:* Upload to TeachCenter one PDF (report) and a single .py (code) file, separately as explained above (i.e. not in a zip file)
- *Presentation session:* December 7th, 2022
- *Rules:* Groups of up to 3 students are allowed for this task. All group members will receive the same grade. At the presentation session, all group members must be prepared to answer questions about all parts of the Assignment. Copying of solutions (reports or code), or parts of solutions from other groups is strictly forbidden.