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AI VIII – Serious Games

UNIVERSITÄT BAYREUTH

Exercises for **Programming, Data Analysis, and Deep Learning in Python** (SoSe 2021)

Exercise Sheet no. 12, *Deadline*: Monday, July 12, 10:15

Notes

- Pay attention to the notes on the previous sheet.

(If you are using your own Python installation, make sure that `tensorflow` *(version* $\geq 2.0.0$*) is installed:* `import tensorflow as tf; print(tf.__version__)`*)*

Exercise 33 Tensorflow – MNIST (programming exercise) (12 points)

a) Briefly explain the role of the following degrees of freedom (parameters). You may use the MNIST code example from the lecture.
i) activation (function), *ii*) optimizer, *iii*) loss (function), *iv*) metric(s), *v*) epochs, and *vi*) batch size.

b) Add a confusion matrix to the MNIST code example from the lecture. Make sure the `epochs` parameter is set to 5. Do not modify the code otherwise. Explain which entry of the matrix yields the number of ones (the number 1) that are falsely recognized as eights (the number 8). (If you use indices in your explanation, use the Python index notation, i.e., start at zero.) Run your code a few times. Is the confusion matrix always the same? Briefly explain.
Hint: For this data with 10 categories, the confusion matrix is a 10×10 matrix.

Exercise 34 Predicting Diabetes with ML (programming exercise) (12 points)

Download the associated files from E-Learning. In your Python script, do the following:

a) Briefly explain what "layers" and "neurons" are in the context of neural networks.

b) Load the training (`x_train`, `y_train`) and test data (`x_test`, `y_test`) by importing the appropriate `.npy` files. (The data is a scaled version of the data used in Exercise 32.)

c) Code a "sequential network" in Keras that resembles the logistic regression from Exercise 32, i.e., a single logistic regression unit. Set the `activation`, `loss`, and `metrics` parameters to values accordingly. Train your network. Test your model on the test data and output the confusion matrix. (To get the labels from the predictions, you might need to round the predictions to the nearest integer.)

d) To predict Diabetes from the data, code another sequential, fully connected ("dense") network that consists of one input layer, one output layer and two additional hidden layers. The first hidden layer should have 12 neurons, the second 10 neurons. Both should use the `relu` activation function. The output layer should be chosen appropriately for binary classification. Train this network, plot the loss, and output the confusion matrix. In the loss plot, what is an indicator that increasing the number of `epochs` would likely yield a better fit?