Sheet III: Neural Networks

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January 11, 2021

1 Self organizing maps

A one dimensional self organizing map (SOM) can be used to solve the so called *traveling salesman problem*. In this exercise, find the shortest possible route for visiting the beergardens of Regensburg. By placing neurons with an internal one-dimensional structure into the two-dimensional coordinate-space, they will behave like an elastic ring, and can be able to find useful solutions to the traveling salesman problem. You find the GPS coordinates of the beergardens in the data folder on the GRIPS server (*rgbg_beergardens.txt*).

2 Multi layer perceptron

2.1 Regression

Multi layer perceptrons (MLPs) are able to learn non-linear relationships between its input and output variables. Use a MLP to approximate the function $f(x)$, of some data points x, with $x \in [0, 20]$, provided in the data folder. Use different number of hidden layers and hidden neurons. Plot the true values of the function and the values estimated by the MLP. What impact have number of hidden layers and number of neurons on the performance and the complexity of the model?

2.2 Classification

Pick one dataset you used in exercise sheet II, and now use a MLP for classification. Find a suitable number of hidden layers and neurons to optimize the accuracy of your model. Compare your results to those obtained with support vector machine (SVM) and random forest (RF).

Note:

Here are some useful tools:

- https://github.com/DiegoVicen/ntnu-som

  You can simply copy the beergarden locations into the asstes directory. You probably need to change the initializations in *som.py* to match the range of your GPS data.

- https://scikit-learn.org/stable/modules/neural_networks_supervised.html

  https://pytorch.org/

  https://www.tensorflow.org/

Please send your report, as well as those from the other exercises, to either simon.wein@ur.de or elmar.lang@ur.de (ideally until the end of this semester term).