Assignment 09

Machine Learning, Summer term 2018
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June 11, 2018

Solutions due by June-25

Assignment 09.1 (Tensorflow Demo, 2+2 points)

The interactive demo at `playground.tensorflow.org` is a great tool to play with different (deep) neural networks. Please select a ratio of training to test data of 70%; Initially select 0% noise. Also select the "show test data" checkbox to visualize the training and test data.

a. For each of the four demo datasets provided, please try to find a "minimal" network architecture that achieves both a good training and test error on classification. That is, select the minimum number of features and try to reduce the number of layers and the number of neurons per layer.

   (Use either tanh or ReLU activiation, and select the learning rate and regularization parameters as you want. Note: the applet visualizes coupling strength on all connections; neurons that are mostly unconnected can probably be removed completely.)

   Take screenshots to document the network topology as well as the resulting loss and output curves. Are your solutions robust in case you re-generated the training patterns?

b. Now add 20% noise and regenerate the patterns. Again, test all four provided datasets; use ReLU activation and select regularization as you want.

   What are the best (minimal test error) networks now?

Assignment 09.2 (Install Keras and Tensorflow, 0 points)

While there are several established software libraries for deep learning, we will concentrate on the *Tensorflow* framework and the *Keras* frontend for the remainder of the lecture.

a. Please visit the Tensorflow homepage at `https://www.tensorflow.org` and then follow the instructions provided at `https://www.tensorflow.org/install/`.

   Tensorflow is a complex cross-platform system with many dependencies. Select the version matched to your system (CPU or GPU, operating system, python environment), run the installation, and validate that the library works.

The Tensorflow API is designed for efficiency, not for ease of use. Therefore, we will mostly use the *Keras* framework on top of Tensorflow. Keras provides a simple API to create and train deep networks.

b. Please visit the Keras homepage at `https://keras.io/` and follow the instructions to install Keras on your system (and Python environment).