ME 674 SOFT COMPUTING REPORT CODING ASSIGNMENT

KOSURI VINEETH SAI RAM VARMA
204103412 MTech Manufacturing science

Introduction:

The dataset I have used for this study is regarding the compressive strength of concrete by varying the composition and age of the concrete. This training data contains a total of 1311 observations which are separated into 1030 training patterns and 281 testing patterns.

This dataset contains total of 9 columns each represented as follows:

Column 1: Cement – Amount of cement (in kg) in m^3 of mixture

Column 2: Blast furnace slag – Amount of slag (in kg) in m^3 of mixture

Column 3: Fly Ash - Amount of Fly Ash (in kg) in m^3 of mixture

Column 4: Water - Amount of Water (in kg) in m^3 of mixture

Column 5: Plasticizer – It reduces the amount of water required in concrete

Column 6: Course Aggregate - Amount of Course Aggregate which is made of rock (in kg) in m^3 of mixture

Column 7: Fine Aggregate- Amount of Fine Aggregate which is made of rock (in kg) in m^3 of mixture

Column 8: Age – The age of concrete in days (1-365)

Column 9: Concrete Compressive strength in MPa

In the above data the first 8 columns are fed as input to the neural network and column 9 which is compressive strength is fed as output to the neural network.

Source of Data:

Original Owner and Donor Prof. I-Cheng Yeh, Department of Information Management

Chung-Hua University, Hsin Chu, Taiwan 30067, R.O.C.

Methodology:

The above problem is solved using a multilayer fully connected feed forward neural network. In this neural network both the activation functions of hidden and output neurons are chosen to be Log-sigmoid function. This function is chosen because it's a regression problem.

Initially the training pattern is split into different training and testing patterns and are read into the code. Where these input and output values are normalized between 0.1-0.9.

Weights are randomly initiated. Then these values are fed to the neural network using two functions namely ForPass and BackPass specifying forward and backward passes respectively. Using gradient descent method, the weights are updated by backpropagation of error.

At the end the model is tested for these updated weight values using testing pattern by calculating mean square error.

Results and Discussions:

The mean square error (MSE) is observed for various number of hidden neurons and various values of learning rate and the optimized number of hidden neurons are observed to be 4 with MSE as 145.11962281017378 and Absolute error as 13.843488734473395.

It was observed that with increase in number of hidden neurons the MSE sometimes decreases but it increases the amount of computational work. So optimal number of hidden neurons are chosen by optimizing these 2. And learning rate is also chosen the avoid local minima.

Conclusion:

It can be concluded that with increase in number of patterns the accuracy of model increases and also reduces the risk of overfitting the data. The model obtained by training in this study is reasonably good at estimating the strength of concrete as it has obtained absolute error as nearly 13, so the model is also not overfitted.

Reference:

I-Cheng Yeh, "Modeling of strength of high-performance concrete using artificial neural networks," Cement and Concrete Research, Vol. 28, No. 12, pp. 1797-1808 (1998)