

No relationship between rate of learning and other parameters of Neural Network - a matlab experience

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Abstract— Neural Network has some important parameters like rate of learning, activation function, weights etc. Among those rate of learning is one of the free parameters of neural network. It has been tried to obtain the relationships between rate of learning and other parameters like number of iterations, best validation performance etc. According to the experiment carried out and data analysis, no relationship has been found among them.

Keywords—Neural Network; Back-propagation; training; testing; rate of learning

I. INTRODUCTION

Artificial Neural Networks are the artificial mimic of human brain [1]. Human beings learn with the presence of teacher or guide which is a common learning paradigm [2]. Whatever the inputs received by the receptor of human being, another person tells him/her what the objects should be that is output is defined by the teacher. While this paradigm is subject to be mimicked artificially, the target output is assigned by supervisor for each corresponding inputs to the neural network. Computed output also called actual output is not same as given output or target output because inputs are multiplied by some random weight values in the neural network. In that case, weight values are changed by back-propagation [3]. The process is repeated until computed output becomes same as target output. In the weight adjustment formula, there is a free parameter called rate of learning.

Al-Aziz et. al. (2021) simulated neural network using Matlab to check the performance of different neural networks with different number of hidden layers and tried to obtain the behavior pattern for different number of hidden layers. No regular behavior pattern found by them [4]. The aim of this research work is to find relationship between performance, iterations executed and rate of learning for varying number of rate of learning.

II. METHOD

A neural network consists of 10 neurons in a hidden layer, 1 neuron in input and 1 neuron in output layer has been considered for this experiment. The

network is fully connected. The neural network is shown in Figure 1. Each and every edge is connecting the input layer nodes and hidden layer nodes also hidden layer nodes and output nodes consist of weight values. The weights are updated by various back-propagation learning algorithms.

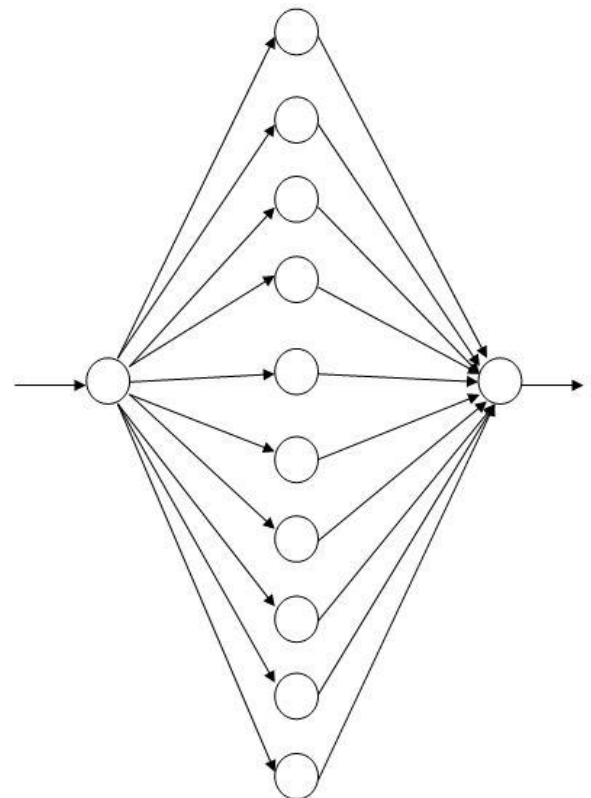


Figure 1: Neural network with input layer, output layer and hidden layer with 10 neurons

III. EXPERIMENT

The experiment has been conducted using Matlab. The neural network is created using 'nnfeedforward' built-in function. The algorithm used for this experiment is 'Levenberg-Marquardt' back-propagation'. The activation function in the hidden layer is 'logsig' and at the output layer is 'purelin'. All back-propagation learning algorithms are given same dataset as input for training and testing. 800 data have been used for training and 200 data for testing from Australian Rain

Dataset. Best validation performances are shown from Figure 2 to Figure 11 for different rate of learning. Table 1 summarizes the data collected from experiment and Figure 12 depicts the summary.

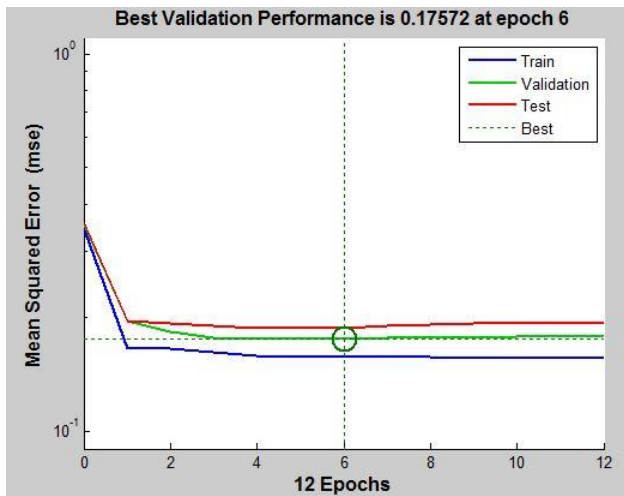


Figure 2: Best validation at rate of learning = 0.1

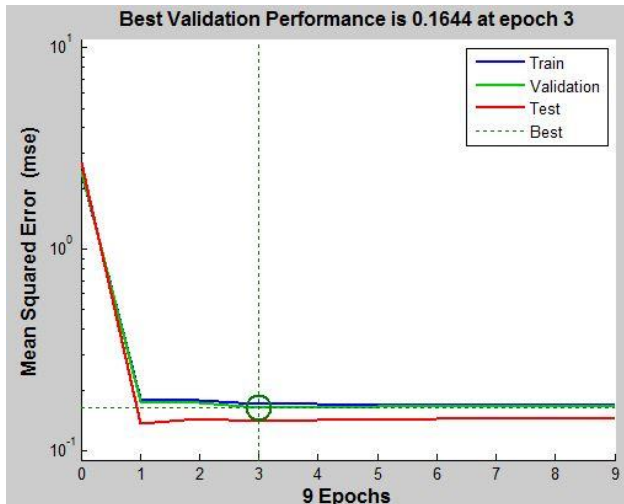


Figure 3: Best validation at rate of learning = 0.2

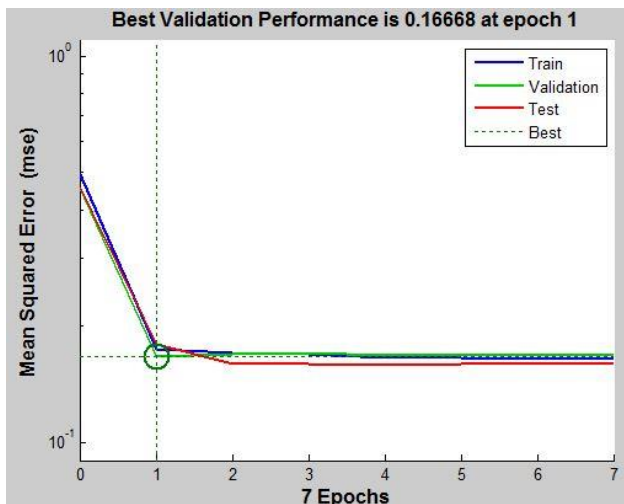


Figure 4: Best validation at rate of learning = 0.3

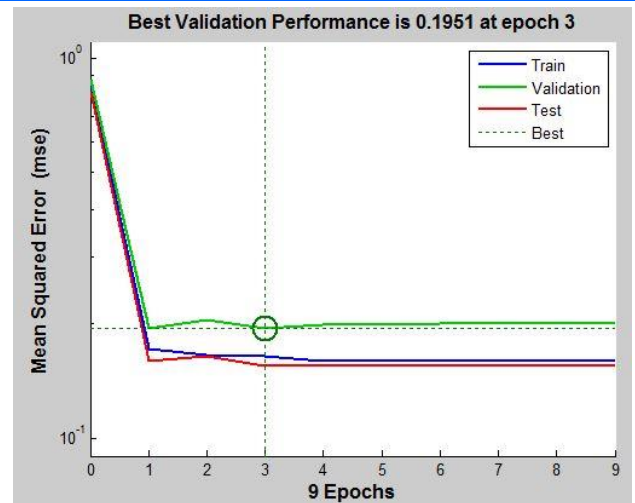


Figure 5: Best validation at rate of learning = 0.4

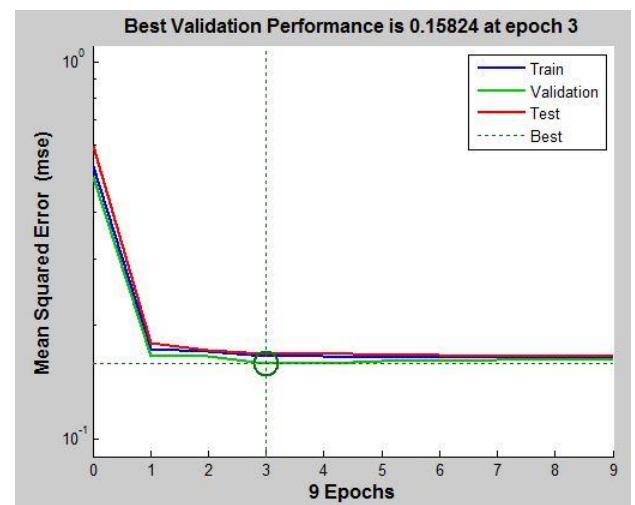


Figure 6: Best validation at rate of learning = 0.5

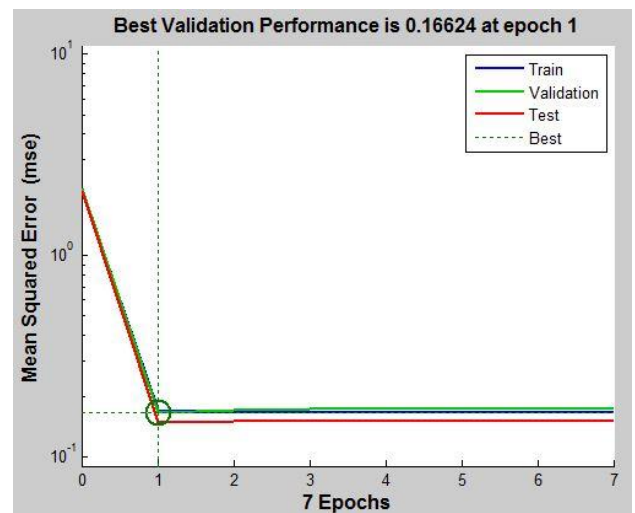


Figure 7: Best validation at rate of learning = 0.6

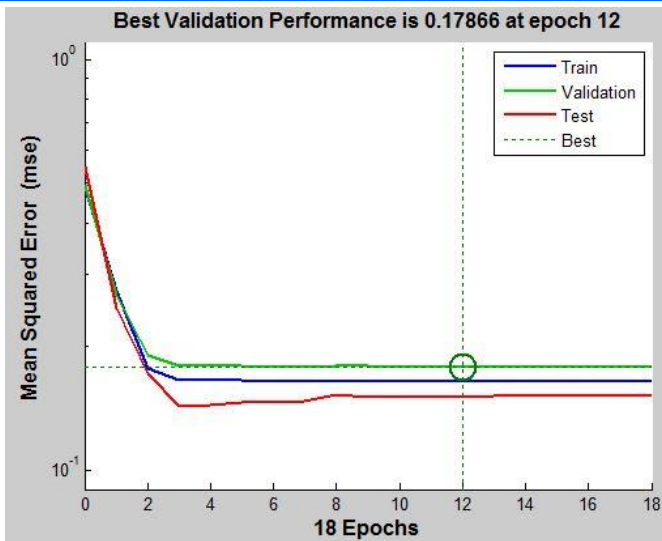


Figure 8: Best validation at rate of learning = 0.7

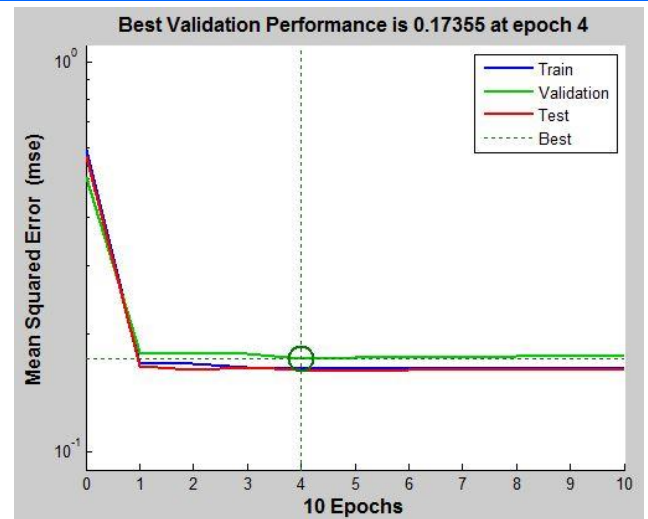


Figure 11: Best validation at rate of learning = 1.0

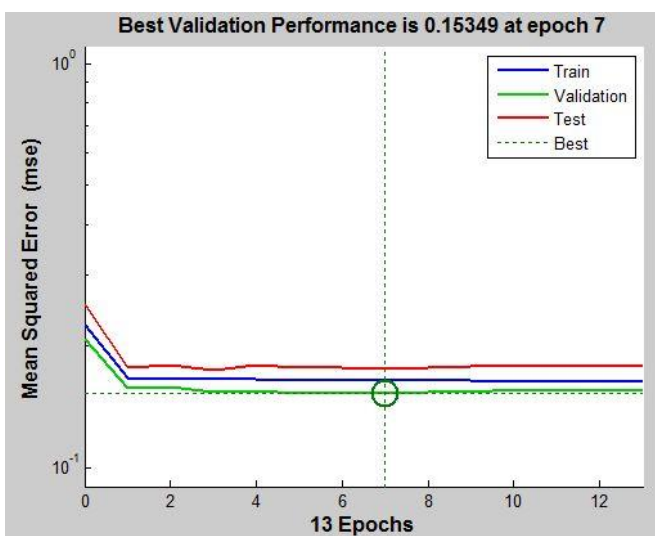


Figure 9: Best validation at rate of learning = 0.8

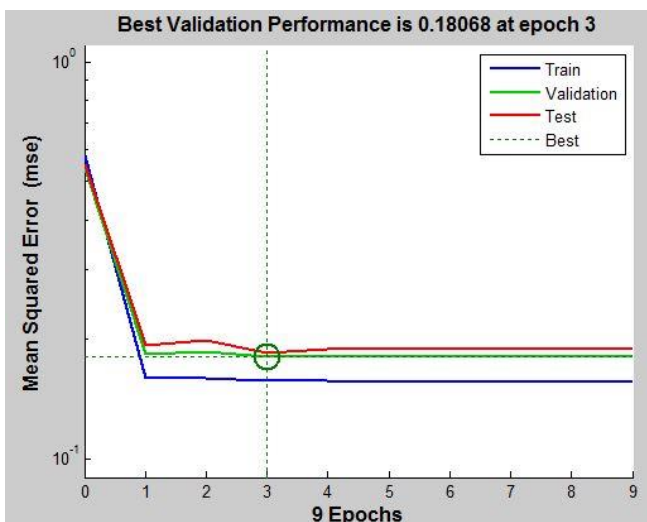


Figure 10: Best validation at rate of learning = 0.9

Table 1: Values of free and other parameters

Learning Rate	Iterations	Performance	Best validation
0.1	12	0.157	0.17572
0.2	9	0.169	0.1644
0.3	7	0.165	0.16668
0.4	9	0.16	0.1951
0.5	9	0.164	0.15824
0.6	7	0.165	0.16624
0.7	18	0.164	0.17866
0.8	13	0.164	0.15349
0.9	9	0.157	0.18086
1	10	0.163	0.17355

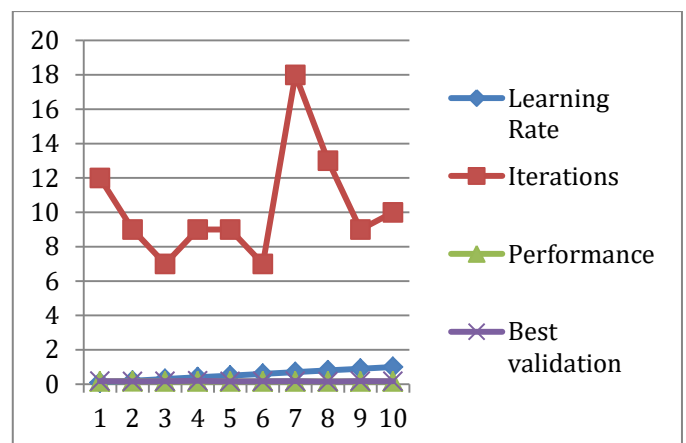


Figure 12: Graphical interpretation of Table 1 data

IV. CONCLUSION

As per the data analysis, it has been found that there is no relationship between rate of learning and number of iterations executed during training phase of the neural network. Even there is no relationship between best validation performance and rate of learning.

ACKNOWLEDGMENT

We acknowledge our friends who encouraged us to go through Artificial Neural Network and try to get in-depth knowledge on it.

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