CSE 574 Machine Learning - Programming Assignment 1

Hand-written Digit Recognition using Neural Networks

Report by,

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Introduction

The multi layer perceptron neural network is implemented in this project to recognise hand-written digits. The neural network learns from the training data which has been subjected to optimizations such as normalization and feature selection. While normalization brings uniformity to the data by converting all values to lie in the range of 0 to 1, feature selection helps in omitting those details which do not have any effect on the prediction of the digits. In the case of training data used, 65 features are reduced after carrying out feature selection.

The neural network learns from the Feed Forward Pass of this normalized training data and the Back Propagation of the errors observed. Optimum values of the hyper parameters - number of hidden nodes and the regularization parameter, lambda - are determined by experimentation. The results and analysis of variations of these hyper parameters is given below.
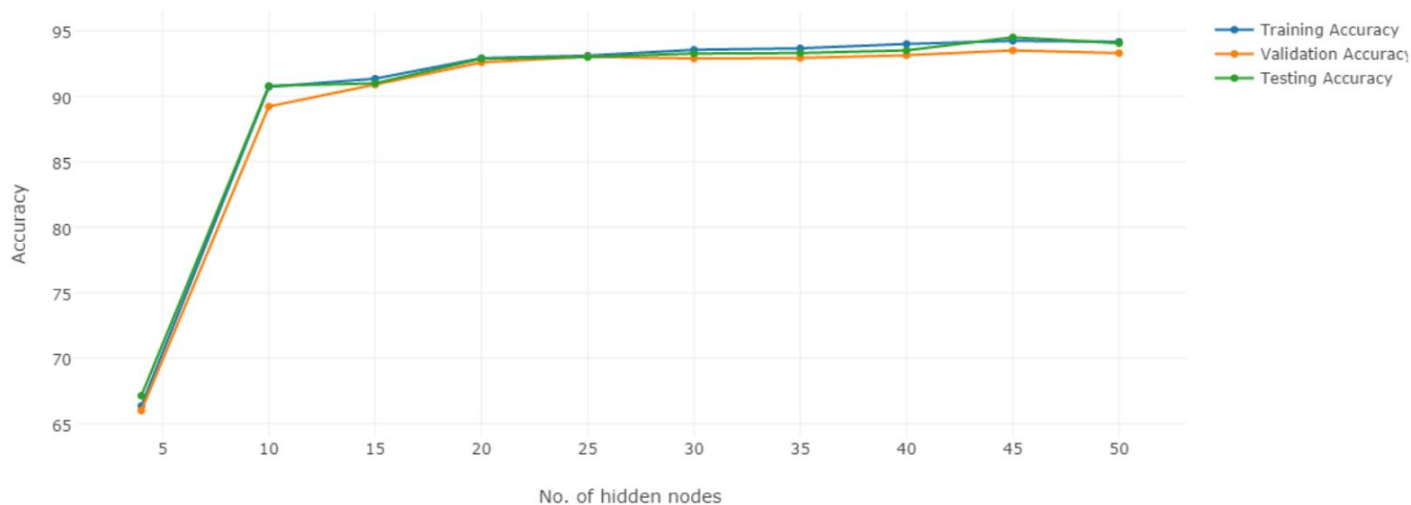
Lambda v.s. Accuracy :

Varying the value of number of lambda from 0.1 to 1 while keeping the number of hidden nodes constant at 50, the following results are obtained.
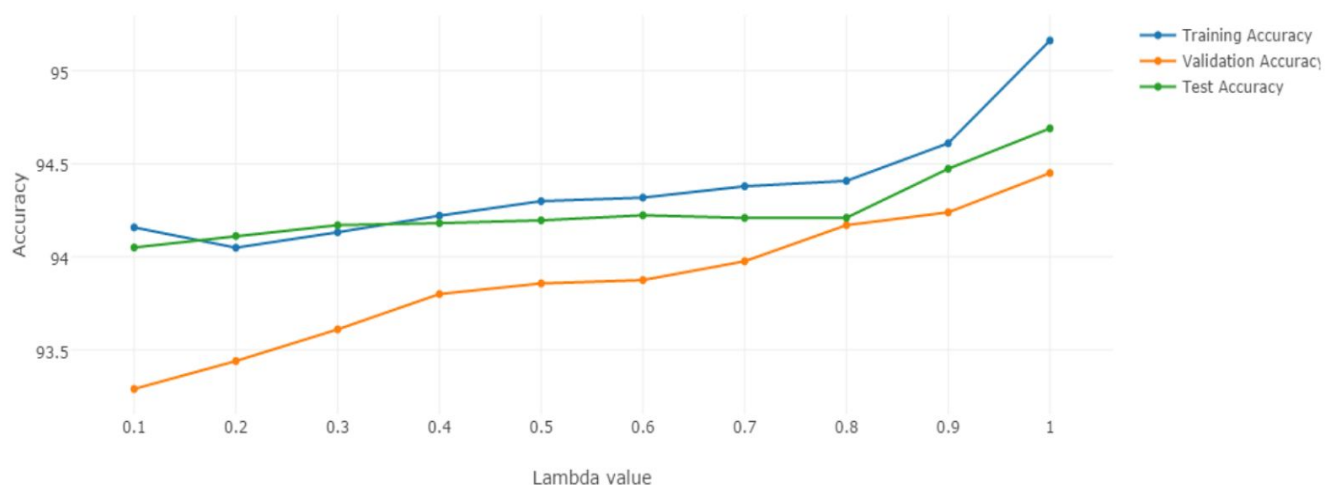
As can be seen from the graph, the results for accuracy of digit recognition are observed to be better for higher values of lambda.

Hidden Nodes v.s. Accuracy :

Changing the number of hidden nodes for each run, while keeping the value of lambda constant at 0.1, the following results are obtained.

As can be seen from the graph, the change in accuracy by varying lambda from 0.1 to 0.9 is not very significant.

Conclusion

The experiments were conducted on the UB CSE server Metallica, and the program takes advantage of Python functionalities to reduce run time as much as possible. It can be clearly concluded from the experiments that the number of hidden nodes are chosen in such a way that there is balance between network accuracy and time taken by the neural network, while the regularization value is chosen from a set of values between 0 and 1 such that the training and testing accuracies are close to each other.