Neural Networks

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1 Introduction

In this write up we will be discussing the results from running different data on a neural network. The specificity of each set up will be discussed in each individual portion.

1.1 AND Data Set

I ran the AND Data set which contained 4 examples and 4 training examples.

Neural Net Specifications	
Desired % accuracy	100 %
Number of hidden neurons	2
Number of output neurons	2
Learning Rate	1.0

The average results after 10 trials are shown in the data table below:

Average Values for AND	
Average time per epoch	39.4 ms
Number of epochs	96.1
Testing accuracy	100%

2 XOR Data Set

I ran the XOR Data set which consisted of 4 training example and 4 testing examples and this resulted in the following results:

Neural Net Specifications	
Desired % accuracy	100 %
Number of hidden neurons	2
Number of output neurons	2
Learning Rate	0.05

The average results after 10 trials are shown in the data table below:

Average Values for AND	
Average time per epoch	122.5 ms
Number of epochs	43350.1
Testing accuracy	100%

3 Hand Written Digits

The Alpaydin and Kaynak's Handwritten Digits which consisted of the Training data which had 3823 examples and the Testing data which consisted of 1797 examples.These specifications were the benchmark done my a class mate — for comparison reasons the following specification were used

Neural Net Specifications	
Desired % accuracy	99 %
Number of hidden neurons	140
Number of output neurons	10
Learning Rate	0.06

Handwritten Digits Data Set	
Average time per epoch	4187 ms
Number of epochs	9.0
Testing accuracy	96.05%

The values shown above are for only one trial. Using the topology, earning rate etc... and only a different desired % accuracy I was able to ahceive it in a shorter number of epochs. I will highlight them in the table below:

Handwritten Digits Data Set more data	
Total time	772 ms
Number of epochs	1.0
Desired Training accuracy	90%
Testing accuracy	92.60%

Handwritten Digits Data Set more data	
Total time	1021 ms
Number of epochs	1.0
Desired Training accuracy	95%
Testing accuracy	93.88%

Handwritten Digits Data Set more data	
Total time	5242 ms
Number of epochs	12.0
Desired Training accuracy	99%
Testing accuracy	96.00%

4 MNIST Digits Data Set

The MNIST Digits Data Set consists of 60,000 training examples and 10,000 testing examples.

Neural Net Specifications	
Desired % accuracy	99 %
Number of hidden neurons	140
Number of output neurons	10
Learning Rate	0.06

Handwritten Digits Data Set	
Average time per epoch	9530617 ms $\approx$ 159 min
Number of epochs	137.0
Testing accuracy	97.25%

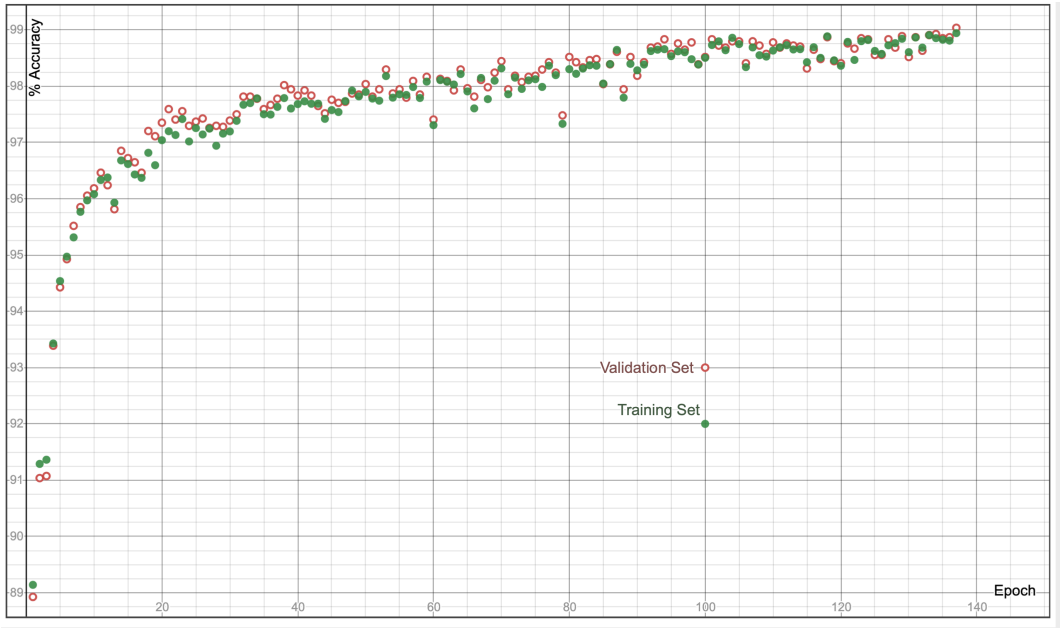

Figure 1: Training Validation Set vs. Epoch for MNIST Digits Data Set

5 Conclusion

My results do in fact show that my Neural Network is able to learn. While running my program I printed the epochs as well as the validation accuracy I

could see that overtime the validation set accuracy was increasing allowing me to determine that the neural net is in fact learning from the training set and resulting in improvement on the set aside testing data.