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Artificial Neural Networks, B. Mehlig
Homework 3

Convolutional networks (2020)

The below tables were calculated from a confusion matrix of each dataset.

Network 1

Digit	Train % Error	Validation % Error	Test % Error
0	0.06%	0.14%	0.11%
1	0.09%	0.14%	0.11%
2	0.10%	0.12%	0.13%
3	0.12%	0.30%	0.09%
4	0.08%	0.15%	0.08%
5	0.12%	0.20%	0.14%
6	0.05%	0.14%	0.19%
7	0.11%	0.11%	0.18%
8	0.15%	0.29%	0.23%
9	0.16%	0.28%	0.25%
Total	**1.04%**	**1.87%**	**1.51%**

The hardest digits for this network to classify are 8 and 9, together accounting for almost a third of the errors across all datasets. The easiest are 0 and 4, together accounting for only 14%.

Network 2

Digit	Train % Error	Validation % Error	Test % Error
0	0.06%	0.09%	0.03%
1	0.08%	0.11%	0.04%
2	0.12%	0.16%	0.12%
3	0.13%	0.15%	0.15%
4	0.11%	0.12%	0.08%
5	0.08%	0.10%	0.12%
6	0.05%	0.12%	0.18%
7	0.10%	0.12%	0.16%
8	0.13%	0.22%	0.10%
9	0.13%	0.20%	0.24%
Total	**0.99%**	**1.39%**	**1.22%**

The hardest digits for this network to classify are 8 and 9 again, together accounting for 28% of the total errors. The easiest are 0 and 1, together accounting for only 11%.

This network beats the previous network in all datasets, and didn't take any longer to train. This suggests that additional layers can compensate for fewer epochs in regards to classification accuracy and training time.