

Logistic Regression and Perceptron Analysis of Handwritten Digits

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1 Logistic Regression Analysis

Summary: For this exercise, I used logistic regression to fit a set of parameters to the hand-written digit data set. The less than perfect performance of my implemented classifier is compared to the less than perfect R built in glm function in the tables below (which produces quite similar results!).

Below numberCorrect represents my logistic regression's output and builtInCorrect represents glm's output:

Digit	Y.test	numberCorrect	builtInCorrect
2	198	187.00	189.00
3	166	159.00	155.00

Table 1: 2's vs. 3's

Digit	Y.test	numberCorrect	builtInCorrect
4	200	194.00	195.00
5	160	158.00	151.00

Table 2: 4's vs. 5's

Digit	Y.test	numberCorrect	builtInCorrect
7	147	134.00	144.00
9	177	171.00	174.00

Table 3: 7's vs. 9's

2 Perceptron Analysis

Summary: For this exercise, I constructed a single unit neural network that fits a set of parameters to make a cut in the data-space for the classification of handwritten digits. This model uses a sigmoid function for squashing and is optimized up to .01 mean squared error for run-time's sake.

Below are the tables comparing the test data against the output, labeled numberCorrect. As intuition suggested the 7's and 9's were the most easily confused, most likely due to the largest overlap of the data-clouds in data-space.

Digit	Y.test	numberCorrect
2.00	198	188.00
3.00	166	158.00

Table 4: 2's vs. 3's

Digit	Y.test	numberCorrect
4.00	200	197.00
5.00	160	154.00

Table 5: 4's vs. 5's

Digit	Y.test	numberCorrect
7.00	147	138.00
9.00	177	160.00

Table 6: 7's vs. 9's