HW 3 Programming Report

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1 Results

1.1 Logistic Regression

The accuracy results for Logistic Regression model are:

max iteration testcase0:	Train accuracy: 83.472133	Test accuracy: 82.783019
max iteration testcase1:	Train accuracy: 92.440743	Test accuracy: 90.094340
max iteration testcase2:	Train accuracy: 96.668802	Test accuracy: 94.103774
max iteration testcase3:	Train accuracy: 97.373479	Test accuracy: 95.047170
learning rate testcase0:	Train accuracy: 96.668802	Test accuracy: 94.103774
learning rate testcase1	Train accuracy: 97.373479	Test accuracy: 95.047170
learning rate testcase2	Train accuracy: 97.885971	Test accuracy: 96.226415

1.2 3rd Order Logistic Regression

The accuracy results for 3rd Order Logistic Regression model are:

max iteration testcase0:	Train accuracy: 92.440743	Test accuracy: 89.858491
max iteration testcase1:	Train accuracy: 95.836003	Test accuracy: 94.103774
max iteration testcase2:	Train accuracy: 97.053171	Test accuracy: 94.811321
max iteration testcase3	Train accuracy: 97.501602	Test accuracy: 95.518868
learning rate testcase0	Train accuracy: 97.053171	Test accuracy: 94.811321
learning rate testcase1	Train accuracy: 97.501602	Test accuracy: 95.518868
learning rate testcase2	Train accuracy: 97.821909	Test accuracy: 96.462264

2 Conclusion

I implemented my linear model using the Logistic Regression algorithm found in *Learning From Data*, with the gradient implemented as:

$$g_t = \frac{1}{N}\sum_{n=1}^{N} -y_n x_n \theta(-y_n w^T x_n) \tag{1}$$

Better accuracy results were given when using the 3rd order polynomial transformation, thus I would use Logistic Regression with 3rd order polynomial transformation when delivering to the customer. It should be noted, 3rd order logistic regression has approximately a 9% increase for training accuracy and a 7% increase for testing accuracy in the max iteration test case 0. As then number of inputs increases, 3rd order will correctly classify more points than logistic regression without any transformations.