**Final Project**

Name: Shraddha Manchekar

UID: 004945217

**2-layer Neural Network using relu and sigmoid activation function:**

C:\Users\shraddha\_m26\Desktop\Stats Programming\Assignments\Final>python 2\_layer\_nn.py

Training Accuracy at Iteration 0 : 0.459259259259

Testing Accuracy at Iteration 0 : 0.6

Training Accuracy at Iteration 50 : 0.762962962963

Testing Accuracy at Iteration 50 : 0.711111111111

Training Accuracy at Iteration 100 : 0.851851851852

Testing Accuracy at Iteration 100 : 0.777777777778

Training Accuracy at Iteration 150 : 0.9

Testing Accuracy at Iteration 150 : 0.888888888889

Training Accuracy at Iteration 200 : 0.907407407407

Testing Accuracy at Iteration 200 : 0.9

Training Accuracy at Iteration 250 : 0.933333333333

Testing Accuracy at Iteration 250 : 0.911111111111

Training Accuracy at Iteration 300 : 0.937037037037

Testing Accuracy at Iteration 300 : 0.922222222222

Training Accuracy at Iteration 350 : 0.948148148148

Testing Accuracy at Iteration 350 : 0.922222222222

Training Accuracy at Iteration 400 : 0.962962962963

Testing Accuracy at Iteration 400 : 0.933333333333

Training Accuracy at Iteration 450 : 0.962962962963

Testing Accuracy at Iteration 450 : 0.944444444444

Training Accuracy at Iteration 500 : 0.966666666667

Testing Accuracy at Iteration 500 : 0.944444444444

Training Accuracy at Iteration 550 : 0.966666666667

Testing Accuracy at Iteration 550 : 0.944444444444

Training Accuracy at Iteration 600 : 0.97037037037

Testing Accuracy at Iteration 600 : 0.944444444444

Training Accuracy at Iteration 650 : 0.974074074074

Testing Accuracy at Iteration 650 : 0.944444444444

Training Accuracy at Iteration 700 : 0.974074074074

Testing Accuracy at Iteration 700 : 0.944444444444

Training Accuracy at Iteration 750 : 0.974074074074

Testing Accuracy at Iteration 750 : 0.944444444444

Training Accuracy at Iteration 800 : 0.974074074074

Testing Accuracy at Iteration 800 : 0.944444444444

Training Accuracy at Iteration 850 : 0.977777777778

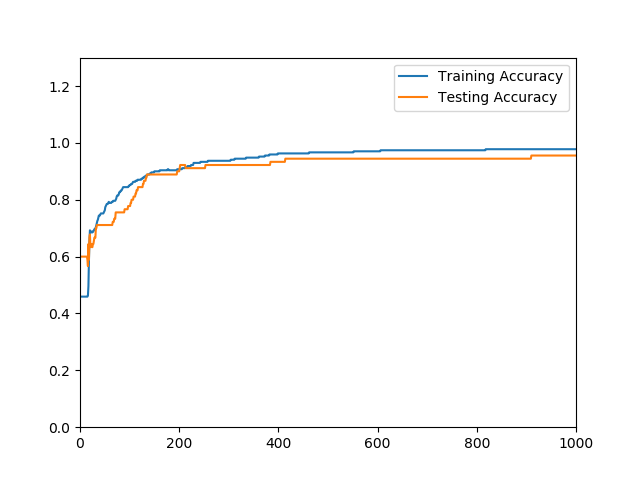
Testing Accuracy at Iteration 850 : 0.944444444444

Training Accuracy at Iteration 900 : 0.977777777778

Testing Accuracy at Iteration 900 : 0.944444444444

Training Accuracy at Iteration 950 : 0.977777777778

Testing Accuracy at Iteration 950 : 0.955555555556



**Observation**: Neural network is a non-linear classifier, as the hidden layers introduce complexity. Neural networks are also heavily parametric. As seen from the graph, neural networks converge last, but reliably reach the correct beta values, often local minimas. However, neural networks are prone to overfitting. The algorithm is complex, hence, it takes the most amount of time to converge.

**SVM:**

C:\Users\shraddha\_m26\Desktop\Stats Programming\Assignments\Final>python svm.py

Training Accuracy:

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Testing Accuracy:

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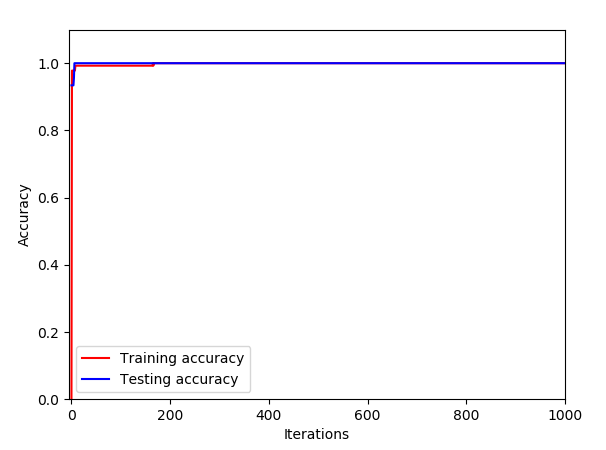
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**Observation**: SVM (support vector machine) constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks like outlier detection. SVM uses the closest points in different classes as “support vectors” to estimate a convex, yet optimal hyperplane separating the classes. SVM has a regularization parameter that avoids over fitting. As seen from the graph, SVM avoids over fitting and provides excellent results for the test accuracy. SVMs are resilient to noise and take the least time to train.

**Adaboost:**

C:\Users\shraddha\_m26\Desktop\Stats Programming\Assignments\Final>python svm.py

Training Accuracy:

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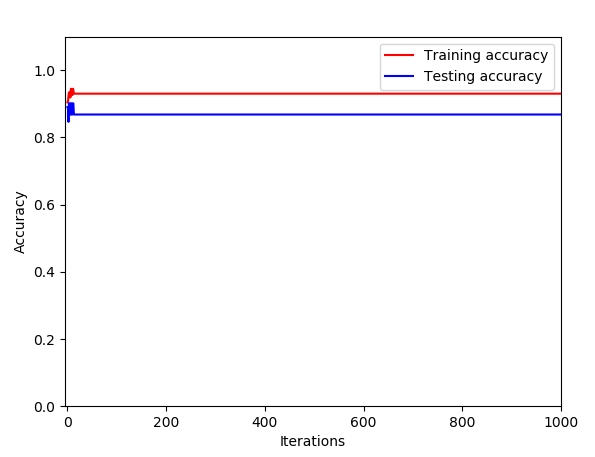
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**Observation**: Adaboost combines the output of the other learning algorithms ('weak learners') into a weighted sum that represents the final output of the boosted classifier. Adaboost can handle sparse dataset and hence, can work with weak classifiers. But, it shows some variations after it reaches peak classification correctness. AdaBoost can be sensitive to noisy data and outliers. As seen from the graph, Adaboost reaches an effective solution quickly, but in subsequent iterations, it becomes sensitive to noise. Adaboost is the least accurate for the given dataset. It should be used when there is a class imbalance in the dataset.