COL774-Assignment-1

Soham Gaikwad, 2018CS10394

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1 Linear Regression

Learning rate used is 0.001. Stopping criteria is when the absolute difference in consecutive losses is less than $\epsilon = 10^{-8}$. For part (e), It can be observed that gradient descent converged for learning rate of 0.001 but for learning rate of 0.025 and 0.1, gradient descent overshoot the minima and diverged away.

2 Sampling and Stochastic Gradient Descent

For checking converge, consecutive difference in all theta values is less than some epsilon (=1e-5 or 1e-6) was checked for k = 3 consecutive turns. For values of r as 1, 100, and 10000, the stochastic gradient descent converged to nearly the same values which were close to the given theta. However, for r = 1000000, the algorithm seemed overshoot even for lower values of the learning rate. Also the algorithm converged within a few seconds for r=1, 100 but took around 5 minutes whereas r=1000000 didn't converge. It took around 9900 iterations in first epoch for r=1. It took around 300 iterations in first epoch for r=100. It took around 8 epochs and 800 iterations for r=10000 and r=1000000 didn't converge. The values of learning rate and epsilon were modified accordingly to achieve convergence in some cases.

3 Logistic Regression

In logistic regression, the values of theta obtained were as follows: $\theta_0 = 0.40125316, \theta_1 = 2.5885477, \theta_2 = -2.72558849$. This was done using newton's method using the hessian matrix.

4 Gaussian Discrmimant Analysis

The equations for the linear and quadratic boundary were solved as descrived in class and then corresponding roots were used to draw the decision boundaries in GDA. In case of quadratic boundary, Since we have a quadratic equation in x1 for each x2, we can see 2 quadratic curves out of which one is out quadratic boundary. The quadratic boundary seems to be a little better fit but mostly the linear boundary also resembles the quadratic boundary.

The various plots/observations for each parts can be found in the output directories.