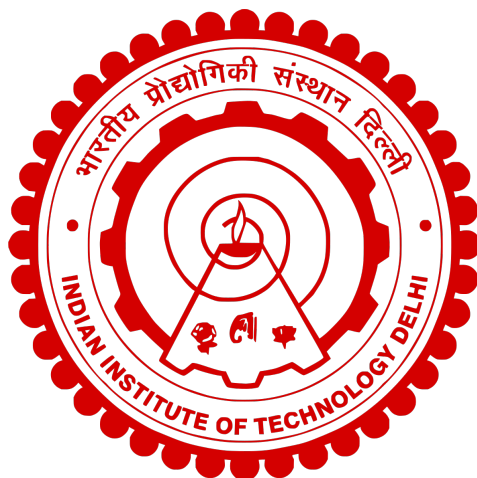


Indian Institute of Technology Delhi



COL334 - Computer Networks

Assignment 1

Understanding Network and Packet Analysis and the Architecture of the Internet

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§1 Question 1

§1.1 Subpart a.

The learning rate used was $\eta = 0.01$.

The stopping criteria was if the difference in absolute error was $< 10^{-11}$. The final set of parameters were:

$$\theta = [-5.99244196 \times 10^{-14} \quad 6.55045094 \times 10^{-1}]$$
$$\bar{\theta} = [0.9959931, 7.7777112 \text{ times } 10^{-5}]$$

where θ is the parameters for normalised input and $\bar{\theta}$ is the parameters for unnormalised input.

§1.2 Subpart b.

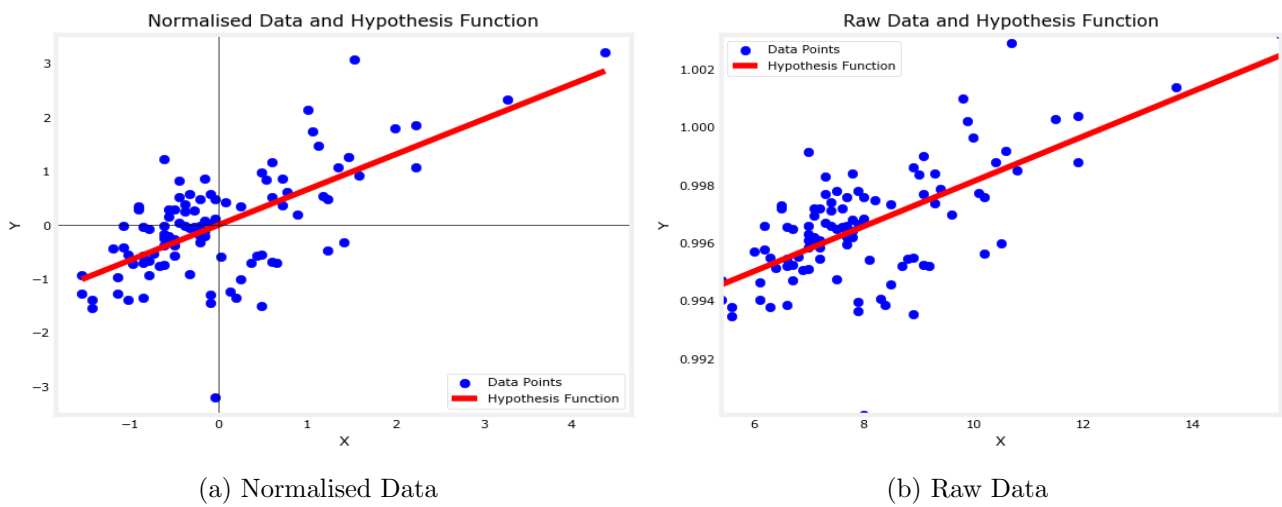


Figure 1: The data and the hypothesis function

§1.3 Subpart c.

The animations are in the directory.

§1.4 Subpart d.

The animations are in the directory.

§1.5 Subpart e.

The animations are in the directory.

§2 Question 2

§2.1 Subpart a.

The data points were sampled using `np.random.normal`

§2.2 Subpart b.

In each case, I observed the error for 10 iterations and checked if their average was less than some *conv_crit*, or the convergence criteria.

For lesser batch sizes, it was 0.1 but for bigger batch sizes it was closer to 1 (.95).

§2.3 Subpart c.

§3 Question 3

§3.1 Subpart a.

Newton's method clearly converged way faster since it converged in 10 iterations in my case. The final parameter values obtained are:

$$\theta = [0.40125316, 2.5885477, -2.7255884]$$

§3.2 Subpart b.

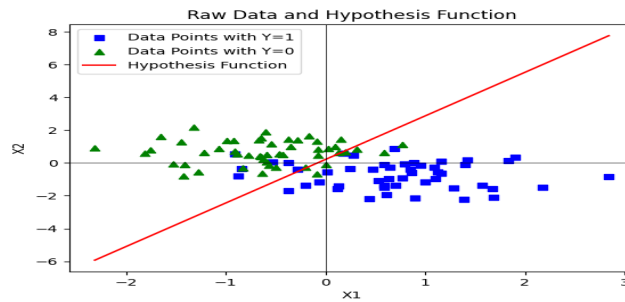


Figure 2: The Data Points and the Decision Boundary

§4 Question 4

§4.1 Subpart a.

The values of the different parameters are given by

$$\begin{aligned}\mu_0 &= [0.75529433, -0.68509431] \\ \mu_1 &= [-0.75529433, 0.68509431] \\ \sigma &= [[0.42953048, -0.02247228], \\ &\quad [-0.02247228, 0.53064579]]\end{aligned}$$

§4.2 Subpart b.

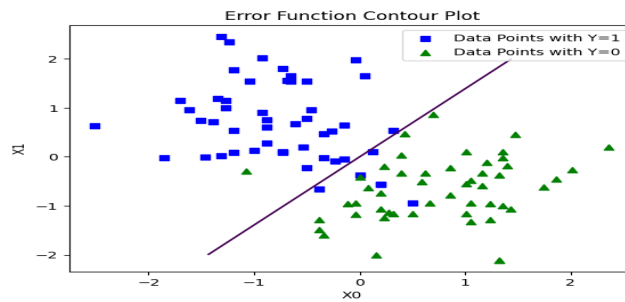


Figure 3: The Decision Boundary for Linear GDA

§4.3 Subpart c.

The equation of linear boundary:

$$\theta^T x = 0 \text{ where } \theta = [\theta_0, \theta_1, \theta_2]$$

$$\theta_0 = \mu_1^T \Sigma^{-1} \mu_1 - \mu_0^T \Sigma^{-1} \mu_0$$

and,

$$[\theta_1, \theta_2] = 2 * \Sigma^{-1} (\mu_0 - \mu_1)^T$$

§4.4 Subpart d.

§4.5 Subpart e.

$$x^T (\Sigma_1^{-1} - \Sigma_0^{-1}) x + 2 * x^T (\Sigma_0^{-1} \mu_0 - \Sigma_1^{-1} \mu_1) + (\mu_1^T \Sigma_1^{-1} \mu_1 - \mu_0^T \Sigma_0^{-1} \mu_0) = 0$$

§4.6 Subpart f.

§5 Acknowledgements

We have used the style file from here¹ to produce this document.

¹<https://github.com/vEnhance/dotfiles/blob/main/texmf/tex/latex/evan/evan.sty>