Saarland University

The Elements of Stastical Learning

Assignement X

Due Date: xx.xx.xxxx

Thibault SCHOWING *Mat. 2571837*
Sarah MCLEOD *Mat. 2566398*
November 28, 2017

Problem 1

Problem 2

Problem 3

a

b

The difference between LDA and QDA is that in QDA, the response variables are still drawn from a Normal distribution but each class has its own covariance matrix. Thus, the posterior probability $Pr(Y = k|X = x)$ abbreviated $p_k(x)$ below, cannot be reduced. (4.11 ISLR)

$$p_k(x) = \frac{\pi_k \frac{1}{\sqrt{2\pi}\sigma_k} exp(-\frac{1}{2\sigma_k^2(x-\mu_k)^2})}{\sum_{l=1}^{k} \pi_l \frac{1}{\sqrt{2\pi}\sigma} exp(-\frac{1}{2\sigma_k^2(x-\mu_l)^2})}$$

The denominator here is still constant. It is a sum over all the classes. So, we have to maximize the numerator. We will here consider the log of the numerator and thus we have:

$$\delta_k(x) = log\left(\pi_k \frac{1}{\sqrt{2\pi}\sigma_k} exp\left(-\frac{1}{2\sigma_k^2(x-\mu_k)^2}\right)\right)$$

We expand the $exp()$ content and separate the log and get:

$$\delta_k(x) = log(\pi_k) - log(\sqrt{2\pi}\sigma_k) - \frac{x^2}{2\sigma_k^2} - \frac{\mu_k^2}{2\sigma_k^2} + \frac{x\mu_k}{2\sigma_k^2}$$

Problem 4