Technische Universität Berlin – Fachgebiet Maschinelles Lernen

Maschinelles Lernen 1 - Assignment 3

Technische Universität Berlin

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1 Biased Boundaries

b)

Our Maximum Likelihood function for $P(D_1|\mu_1)$:

$$l(\mu_1) = \ln P(D_1|\mu_1) = \sum_{i=1}^{n} \ln P(x_i|\mu_1)$$

Under the Gaussian generative assumtpion we get:

$$P(x_i|\mu_1) = \frac{1}{\sqrt{2\pi}\sigma} \exp^{-\frac{1}{2\sigma^2}(x_i-\mu_1)^2}$$

Applying the logarhitmus for convenience:

$$\ln P(x_i|\mu_1) = -\frac{1}{2}\ln 2\pi\sigma - \frac{1}{2\sigma^2}(x_i-\mu_1)^2$$

Computing the derivate:

$$\frac{d \ln P(x_i|\mu_1)}{d\mu_1} = \frac{1}{\sigma}(x_i - \mu_1)$$

For the dataset D we get:

$$\sum_{i=1}^{n} \frac{1}{\sigma}(x_i - \hat{\mu}_1) \stackrel{!}{=} 0$$

$$\rightarrow \hat{\mu}_1 = \frac{1}{n}\sum_{i=1}^{n} x_i \quad \square$$