MACHINE LEARNING 1: ASSIGNMENT 2

Tom Nick   340528
Niklas Gebauer 340942

Exercise 1

(a) With the definition $P(x_k \mid \sigma)$:

$$P(x \mid \sigma) = \begin{cases} \sigma & \text{if} x = \text{head} \\ 1 - sigma & \text{if} \quad x = \text{tail} \end{cases}$$

We can state the likelihood function $P(\mathcal{D} \mid \sigma)$:

$$P(\mathcal{D} \mid \sigma) = \prod_{k=i}^{n} P(x_k \mid \sigma)$$
$$= \sigma^5 \cdot (1 - \sigma)^2$$

(b) The maximum likelihood solution for σ is simply the sample mean:

$$\sigma = \frac{\#\{x = \text{head} \mid x \in D\}}{\#(D)} = \frac{5}{7}$$

With this we can compute $P(x_8 = \text{head}, x_9 = \text{head} \mid \sigma)$:

$$P(x_8 = \text{head}, x_9 = \text{head} \mid \sigma) = P(x_8 = \text{head} \mid \sigma)P(x_9 = texthead \mid \sigma) = \sigma^2 = \frac{25}{49} = 0.51$$