SML: Exercise 2

Rinor Cakaj, Patrick Nowak

Task 1.1: Density Estimation

We are given data C1 and C2, which we suppose to be generated by 2D-Gaussians with parameters μ_1, Σ_1 and μ_2, Σ_2, respectively.

1.1a)

Assume we are given iid. datapoints $x_i, i = 1, .., n$ which are generated by a 2D-Gaussian. Following the max-likelihood principle, we maximize the log-likelihood function

$$l(\mu, \Sigma, x_1, ..., x_n) = \ln(\prod_{i=1}^{n} p(x_i|\mu, \Sigma)) = \sum_{i=1}^{n} \ln(p(x_i|\mu, \Sigma))$$

for the Gaussian probability density

$$p(x|\mu, \Sigma) = \frac{1}{\sqrt{(2\pi)^k |\Sigma|}} \exp\left(-\frac{1}{2}(x-\mu)^T \Sigma (x-\mu)\right) \tag{1}$$