

Practical Data Science/Analytics (Parameter Estimation)

Write R Scripts or use R to perform any mathematical operations while solving the following problems.

Problem 1: MLE for Poisson Distributed Data

Let x be a discrete random variable characterized by a Poisson distribution, i.e.,

$$f(x|\theta) \sim \frac{\theta^x}{x!} e^{-\theta}, \quad x = 0, 1, 2, \dots$$

Given a set of observations of $\{x_1, \dots, x_n\}$ drawn independently according to $f(x, \theta)$, find the maximum likelihood estimate of θ .

Problem 2: MLE for Uniform Distributed Data

Let x have a uniform density

$$p(x|\theta) \sim U(0, \theta) = \begin{cases} \frac{1}{\theta} & 0 \leq x \leq \theta \\ 0 & \text{otherwise.} \end{cases}$$

Suppose that n samples $\{x_1, \dots, x_n\}$ are drawn independently according to $p(x|\theta)$, find the maximum-likelihood estimate for θ . (Hint: Is the maximum element in D useful?)

Problem 3: MLE for Exponential Distributed Data

A simple random sample $\{x_1, \dots, x_n\}$ is drawn from an exponentially distributed population with an unknown parameter $\lambda > 0$:

$$f(x|\lambda) = \lambda \cdot e^{-\lambda x}, \quad x \geq 0$$

Derive the maximum likelihood (ML) estimator for λ .