SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE UNIVERSITY
DELHI NCR

Department of Electrical and Computer Engineering
AIML (ECE304) - Spring 2025

Instructor: Prof. Vinod Sharma

ASSIGNMENT-4

1. Consider the given dataset *DataSet_4.csv*, which has a conditional distribution of

$$\Pr(x_1, x_2, \ldots, x_m|\mu) = \prod_{i=1}^{m} \frac{1}{\sqrt{2\pi}\ \det(\Lambda)} \exp\left(\frac{(x_i-\mu)^T \Lambda^{-1}(x_i-\mu)}{2}\right), \tag{1}$$

where $x_i = [x_i(1),\ x_i(2)], i = 1, \ldots, m$, $\mu = [\mu_1,\ \mu_2]$, and $\Sigma = \begin{bmatrix} \sigma_1^2 & 0 \\ 0 & \sigma_2^2 \end{bmatrix}$. Derive the estimate $\hat{\mu}$ of μ in MLE.

2. Suppose we have a sample of N pairs $x_i,\ y_i$ drawn i.i.d. from the distribution characterized as:

$$\begin{aligned} &x_i \sim Uniform(0,\ 3) \\ &y_i = m_0(x_i) + \varepsilon_i,\ m_0(x) = 2sin(x) \text{ is the nonlinear regressor function} \\ &\varepsilon_i \sim \mathcal{N}(0, \sigma^2),\ \sigma^2 = 0.25. \end{aligned} \tag{2}$$

Estimate the regression function $\hat{m}_0(x)$ at $x = [0,\ 0.35,\ 0.70,\ 1.05,\ 1.40,\ 1.75,\ 2.10,\ 2.45,\ 2.80,\ 3.14]$ using KNN and Random Forest regression methods. Plot the estimated function values $\hat{m}_0(x)$ at given x.

Note:

- Students can use in-built library functions or can do from scratch.
- Use the nomenclature with the format $Name's\_Roll's\_ASGN4.extension$
- Submit the file in html format(you can download Jupyter-Notebook(.ipy) as html file).

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