SML

Practice

Q1. We derived NP criteria using Gaussians. Now consider the case where a matching is needed, for instance matching faces to determine a criminal, matching unique ID number such as Aadhar, finding a transmitted radio signal in a noisy environment. In all these cases, there are two possibilities, a match or no match, that is two categories. Suppose when there is no match this class is ω_1, and when match happens it is class ω_1. One can have several samples and obtain the distribution of these two classes. Let $p(x|\omega_1)$ is standard Gaussian and $p(x|\omega_2)$ is exponential pdf $\theta e^{-\theta x}$ for $x \geq 0$, and 0 otherwise, $\theta = 0.5$. Suppose the error rate for the case when observed sample x belong to ω_1 but is classified as ω_2 is $E_1 = 0.1$. Find the error rate when observed sample x belongs to ω_2 but is classified as ω_1.

Q2. Consider following data matrices for two classes:

$$X_1 = \begin{pmatrix} 1 & 0 & 0 \\ -1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$$

$$X_2 = \begin{pmatrix} 1 & -1 & 1 \\ 1 & -1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$

Here, $X \in R^{d \times N}$ form. Find the class of sample $x = [1,\ 1,\ -1,\ 1]^\top$.

Q3. Derive MLE for arbitrary distribution $p(x) = \mathcal{N}(\mu, 1)exp(\mu)$, that is the distribution is product of Gaussian with variance 1, and exponential pdf with parameter μ.