

Quiz3: MLE, Clustering

Max marks: 30

Max time: 40 minutes

Date: 21 Jun 2022

Give formal notation for full credit.

1. List the steps in finding out the maximum likelihood estimate for parameters of a distribution, given the data set χ . (2)
2. Given the distribution $f(x) = \lambda e^{-\lambda x}$, find the MLE for the parameter λ . (8)
if you can't do this, try doing the following to salvage your score....
Find the MLE for the parameters μ and σ^2 for the Gaussian distribution. (4)
3. Given the training set χ drawn from the population with density $f(x, \theta)$. Let $d = d(\chi)$ denote the estimator of θ . Give one-line explanation for each of the following. (4)
 - (a) $d(\chi) - \theta$
 - (b) $E[d(\chi) - \theta]$
 - (c) $E[d(\chi) - \theta]^2$
 - (d) $E[(d(\chi) - E[d(\chi)])^2]$
4. E step in EM algorithm is expressed as $Q(\phi|\phi^l) = E[\mathcal{L}(\phi|\chi, Z)|\chi, \phi^l]$. Explain the meaning of each symbol used in the expression. (6)
5. Consider 2-dimensional Gaussian data. Consider the following four cases
 - (i) Variance of both features is equal and Covariance is 0,
 - (ii) Variance of both features is different and Covariance is 0,
 - (iii) Variance of both features is different and Covariance is positive,
 - (iv) Variance of both features is different and Covariance is negative.Draw isoprobability contour for each case and show the corresponding Σ . (10)