EE 7630: Detection and Estimation Theory

Quiz Three, Spring of 2007

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5:45-7:00 PM, March 28, 2007

1. Let

$$r = a + n,$$

where r is the observation, a is the unknown nonrandom parameter to be estimated and n is the additive noise. We assume that n is the random process with the probability density function

$$f_N(n) = \frac{\beta}{2} \exp\left(-\beta|n|\right), \beta > 0, -\infty < n < \infty.$$

   (a) Derive the *a priori* density function $f_{R|A}(r|a)$ in terms of σ_n, a, β and r.

   (b) Obtain the maximum-likelihood estimate $\hat{a}_{ml}(r)$ according to (a).

   (c) Is the estimate $\hat{a}_{ml}(r)$ in (b) biased or unbiased? Justify it.

   (d) Calculate the Cramer-Rao lower bound for all the unbiased estimates $\hat{a}(r)$.

Solution: