30-09-2022 21:11 Quiz: Quiz: Quiz week 4

Quiz week 4

Started: 27 Sep at 20:11

Quiz instructions

Question 1	1	pt	-
Question i	- 1	ρι	3

Regarding least squares estimation (LSE), which of the following statement is False.

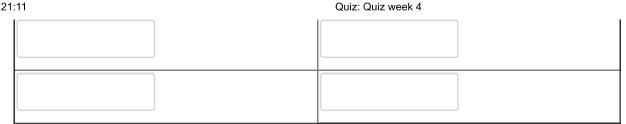
- \bigcirc By minimizing the cost function $J(heta)=\sum_{n=0}^{N-1}(x[n]-s[n; heta])^2$, the LSE estimate $\hat{m{ heta}}_{LS}$ can always be determined.
- \odot Suppose the model is linear as form $s[n; \theta] = H\theta$, the LSE can be formulated as $\hat{\theta}_{LS} = (H^T H)^{-1} H^T x$.
- As long as one signal model can further reduce the squared error, it presents a more accurate estimation.

Question 2 1 pts

Consider a fitting example where the model is $s_n(\theta) = An^2 + Bn$ for n = 0, 1, 2, 3, 4. We can use a weighted LSE to fit the model to a 5-samples data $\mathbf{x} = [-0.2, 1.3, 3, 5.2, 8.1]^T$ with specific weighting matrix $\mathbf{W} = \mathbf{diag}([2, 2, 2, 1, 1])$. Here, \mathbf{diag} denotes a diagonal matrix.

Construct the observation matrix \mathbf{H} .

 $\mathbf{H} =$



Question 3 1 pts

In the same situation as question 2, please use Matlab to calculate the weighted LSE $\hat{m{ heta}}_{ ext{WLS}} = [A,B]^T$. Which of the following estimation is correct?

$$\bigcirc \hat{\boldsymbol{\theta}}_{\mathrm{WLS}} = [0.245, 0.994]^T$$

$$\hat{m{ heta}}_{ ext{WLS}} = [0.255, 0.994]^T.$$

$$\hat{m{ heta}}_{ ext{WLS}} = [0.245, 1.004]^T.$$

$$\hat{m{ heta}}_{ ext{WLS}} = [0.255, 1.004]^T.$$

Non of the above answers is correct.

Question 4 1 pts

Consider an example of estimating DC level in AWGN noise. The conditional PDF is $p(x|A) = rac{1}{(2\pi\sigma^2)^{N/2}} ext{exp} \Big(-rac{1}{2\sigma^2} \sum_{n=0}^{N-1} (x_n - A)^2 \Big).$

The prior PDFs of A is assumed to be a Gaussian distribution with mean value of μ_A $p(A) = rac{1}{\sqrt{2\pilpha}} \exp\left[-rac{1}{2lpha}(A-\mu_A)^2\right].$

Which of the following expression correctly describes the maximum posterior estimator $\hat{A}_{\text{MAP}} = \arg \max p(A|\mathbf{x})$?

$$igcap \hat{A}_{ ext{MAP}} = rac{\sum_{n=0}^{N-1} x_n + rac{\mu_A}{lpha}}{N + rac{1}{lpha}}$$

$$\hat{A}_{ ext{MAP}}=rac{rac{\sum_{n=0}^{N-1}x_n}{\sigma^2}+rac{\mu_A}{lpha}}{rac{N}{\sigma^2}+rac{1}{lpha}}$$

$$igcirc$$
 $\hat{A}_{ ext{MAP}} = rac{\sum_{n=0}^{N-1} x_n}{N} + rac{\mu_A}{\sigma}$

$$\hat{A}_{ ext{MAP}} = rac{rac{\sum_{n=0}^{N-1} x_n}{\sigma} + rac{\mu_A}{lpha}}{rac{N}{\sigma} + rac{1}{lpha}}$$

Question 5 1 pts

Consider a posterior PDF of parameter $oldsymbol{ heta}$ given the evidence $oldsymbol{x}$:

$$p(heta|x) = \left\{egin{array}{ll} x^2 heta e^{- heta x} & ext{if } x>0 ext{ and } heta \geq 0 \ 0 & ext{else} \end{array}
ight.$$
 , which of the following expression

is the correct Bayesian minimum mean squared error estimation?

Hint: There is an known indefinite integral $\int y^2 e^{cy} dy = e^{cy} (rac{y^2}{c} - rac{2y}{c^2} + rac{2}{c^3})$.

- $\bigcirc \hat{\theta}_{\text{mmse}} = \frac{1}{x}$
- $\bigcirc \hat{\theta}_{\text{mmse}} = \frac{2}{r}$
- $\bigcirc \hat{\theta}_{\text{mmse}} = 1$
- $\bigcirc \; \hat{ heta}_{
 m mmse} = 2$

Not saved

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