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Exercise: Multiple observations

(2/2 points)

Consider a model involving multiple observations of the form $\mathbf{X}_i = \mathbf{c}_i \boldsymbol{\Theta} + \mathbf{W}_i$, $i = 1, 2, \dots, n$, where $\boldsymbol{\Theta}$, $\mathbf{W}_1, \dots, \mathbf{W}_n$ are independent (not necessarily normal) random variables and the \mathbf{c}_i 's are known nonzero constants. Assume that $\boldsymbol{\Theta}$ has positive variance.

a) Are the random variables \mathbf{X}_i , $i = 1, 2, \dots, n$, independent?

No ▼



Answer: No

b) Are the random variables \mathbf{X}_i , $i = 1, 2, \dots, n$, conditionally independent given $\boldsymbol{\Theta}$?

Yes ▼



Answer: Yes


Answer:

a) The \mathbf{X}_i 's are dependent because they are all affected by $\boldsymbol{\Theta}$. For a mathematical derivation, you can consider the zero mean case and check that $\mathbf{E}[\mathbf{X}_1 \mathbf{X}_2] = \mathbf{c}_1 \mathbf{c}_2 \mathbf{E}[\boldsymbol{\Theta}^2] \neq \mathbf{0}$, whereas $\mathbf{E}[\mathbf{X}_1] \mathbf{E}[\mathbf{X}_2] = \mathbf{0}$.


b) If we are given that $\boldsymbol{\Theta} = \boldsymbol{\theta}$, then $\mathbf{X}_i = \mathbf{c}_i \boldsymbol{\theta} + \mathbf{W}_i$. In the conditional universe, $\boldsymbol{\theta}$ is now a number. Furthermore, the \mathbf{W}_i 's are independent. Thus, the \mathbf{X}_i 's (which are equal to \mathbf{W}_i plus a number) are also (conditionally) independent.

You have used 1 of 1 submissions


Unit overview**Lec. 14:
Introduction to
Bayesian inference**

Exercises 14 due Apr
06, 2016 at 23:59 UTC 


**Lec. 15: Linear
models with
normal noise**

Exercises 15 due Apr
06, 2016 at 23:59 UTC 


Problem Set 7a

Problem Set 7a due
Apr 06, 2016 at 23:59
UTC 


**Lec. 16: Least
mean squares
(LMS) estimation**

Exercises 16 due Apr
13, 2016 at 23:59 UTC 

**Lec. 17: Linear
least mean
squares (LLMS)
estimation**

Exercises 17 due Apr
13, 2016 at 23:59 UTC 

Problem Set 7b

Problem Set 7b due
Apr 13, 2016 at 23:59
UTC 

Solved problems**Additional
theoretical
material****Unit summary**

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