10. MLE for Gaussian Distribution

Exercises due Apr 19, 2023 08:59 -03 Completed

MLEs for Gaussian Distribution

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MLE for the Gaussian Distribution

1/1 point (graded)

In this problem, we will derive the maximum likelihood estimates for a Gaussian model.

Let X be a Gaussian random variable in d-dimensional real space (R^d) with mean μ and

Note that μ, σ are the parameters of a Gaussian generative model.

Recall from the lecture that, the probability density function for a Gaussian random vari

$$f_X(x|\mu, \sigma^2) = \frac{1}{(2\pi\sigma^2)^{d/2}} e^{-\|x-\mu\|^2/2\sigma^2}$$

$$= -\frac{nd}{2}\log(2\pi\sigma^2) - \frac{1}{2\sigma^2}\sum_{t=1}^{n}\|x^{(t)}$$

Compute the partial derivative $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu}$ using the above derived expression for lo

Choose the correct expression from options below.

- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu} = -\frac{1}{\sigma^2}\sum_{t=1}^{n}(x^{(t)}-\mu)$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu} = \frac{1}{\sigma^2}\sum_{t=1}^{n}(x^{(t)}-\mu)$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu} = \frac{1}{\mu^2}\sum_{t=1}^{n}(x^{(t)}-\mu)$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu} = -\frac{1}{\mu^2}\sum_{t=1}^{n}(x^{(t)}-\mu)$

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MLE for the Mean

1/1 point (graded)

Use the answer from the previous problem in order to solve the following equation

$$\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial\mu} = 0$$

Compute expression for $\hat{\mu}$ that is a solution for the above equation.

Choose the correct expression from options below

- $\hat{\mu} = \prod_{t=1}^{n} x^{(t)}$

1/1 point (graded)

Compute the partial derivative $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2}$ using the above derived expression for log

restated below as well:

$$\log P(S_n|\mu,\sigma^2) = -\frac{nd}{2}\log(2\pi\sigma^2) - \frac{1}{2\sigma^2}\sum_{t=1}^{n}\|x^{(t)}-\mu\|^2$$

Choose the correct expression from options below.

- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2} = \frac{nd}{2\sigma^2} + \frac{\sum_{t=1}^{n}\|x^{(t)}-\mu\|^2}{2(\sigma^2)^2}$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2} = -\frac{nd}{2\sigma^2} + \frac{\sum_{t=1}^{n}\|x^{(t)}-\mu\|^2}{2(\sigma^2)^2}$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2} = \frac{nd}{2\sigma^2} - \frac{\sum_{t=1}^{n}\|x^{(t)}-\mu\|^2}{2(\sigma^2)^2}$
- $\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2} = \frac{\sum_{t=1}^{n}\|x^{(t)}-\mu\|^2}{2(\sigma^2)^2}$

✓

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MLE for the Variance II

1/1 point (graded)

Using the answer from the previous problem in order to solve the equation

$$\frac{\partial \log P(S_n|\mu,\sigma^2)}{\partial \sigma^2} = 0$$

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Compute expression for σ^2 that is a solution for the above equation.

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Discussion

Topic: Unit 4. Unsupervised Learning (2 weeks) :Lecture 15. Generative Models / 10. MLE for Gaussian Distribution

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Partial derivative or gradient?

? What is the sequence of the steps we are doing for the generative models?

? What is MLE?
Sorry for the stupid question but I'm bad with abbreviations