Log-Likelihood for the Poisson Exponential Family

1/1 point (graded)

Consider the GLM for the Poisson exponential family. Assume for simplicity that $n = 1$. What is the log-likelihood function $\ell(\mathbf{Y}, \mathbb{X}, \boldsymbol{\beta})$ with the canonical link function?

Use **X** for X_1^T, **Y** for Y_1, and **c** for the constant term. Do not use ϕ and instead use the actual value of ϕ for the Poisson exponential family. To input a dot product $a^T b$, write it as **a*b**.

$\ell(\mathbf{Y}, \mathbb{X}, \boldsymbol{\beta}) =$ Y*X*beta-e^(X*beta)+c ✔ **Answer:** Y*X*beta-exp(X*beta) + c

$Y \cdot X \cdot \beta - e^{X \cdot \beta} + c$

STANDARD NOTATION

Solution:

The function $b(\theta) = e^{\theta}$ for the Poisson exponential family. Further, $\phi = 1$ for the Poisson exponential family. Therefore, the log-likelihood function

$$\ell_n(\mathbf{Y}, \mathbb{X}, \boldsymbol{\beta}) = \sum_i \frac{Y_i h(X_i^T \boldsymbol{\beta}) - b(h(X_i^T \boldsymbol{\beta}))}{\phi} + c$$

becomes

$$\ell_n(\mathbf{Y}, \mathbb{X}, \boldsymbol{\beta}) = \sum_i \left(Y_i X_i^T \boldsymbol{\beta} - e^{X_i^T \boldsymbol{\beta}} \right) + c.$$

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Answers are displayed within the problem

Discussion

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Topic: Unit 7 Generalized Linear Models:Lecture 22: GLM: Link Functions and the Canonical Link Function / 5. Log-Likelihood for Exponential Families: Preparation for Estimation of Beta in GLMs