Quiz 5

2023-07-25

Question 1

In this task we look at a fictive data example. We have continuous predictors x_1, x_2 and x_3 and a count data response Y . In order to analyze the data we perform a Poisson regression. Attached is the R-Output

```
Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)   1.7719     0.8910   1.989   0.0467 *
X1            1.6350    15.3774   0.106   0.9153
X2            1.0897     0.1035  10.528   <2e-16 ***
X3           -4.1656    30.7287  -0.136   0.8922

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 269.730  on 19  degrees of freedom
Residual deviance:  16.068  on 16  degrees of freedom
AIC: 73.272

Number of Fisher Scoring iterations: 5
```

(a) Write down the Poisson regression model for this case

(b) Look at the following R-Output. What is R^2?

(c) According to the fitted model from above, estimate $E[Y^*]$ for a new observation with $x_1^* = 3, x_2^* = 3$ and $x_3^* = 1$

(d) Now we look at the model where we drop the predictor x_2. See the following R-output. Do we have under or overdispersion in this model?

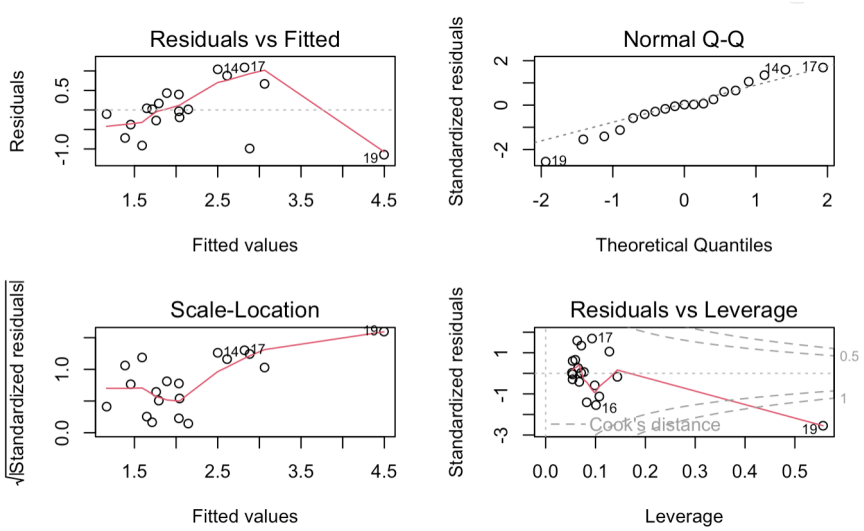
```
Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)   -0.8354     0.5813  -1.437    0.151
X1            68.8018    14.2170   4.839 1.30e-06 ***
X3          -136.0553    28.5669  -4.763 1.91e-06 ***

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 269.73  on 19  degrees of freedom
Residual deviance: 190.89  on 17  degrees of freedom
AIC: 246.10

Number of Fisher Scoring iterations: 6
```

(e) How would you solve the problem in part (d)? Name two solutions.

(f) How does the dispersion parameter ϕ in general impact the inference in the case of overdispersion? Comment on confidence interval and significance of parameters.

Question 2

The following figure is the diagnostic plot for a linear model



(a) Name the issue you identified in the figure

(b) Propose your solution to the problem

(c) Sketch the corrected diagnostic plot after your take the solution in part (b)