NMFM402 – Mathematics of Non-Life Insurance 2

GLM 4 - variable reduction analysis

Practical 5

To review the necessary theory for this practicals, you may check the lecture notes on Moodle, [1], Chapter 2.3.3 For further reading, see [2], Chapter 3.

Exercise 1:
Consider a GLM with normal distribution and $w_m = 1$. Calculate the following quantities and compare them with corresponding concepts within classical linear regression.

(a) Deviance statistics (D);

(b) F-statistics for sub-model testing;

(c) Deviance residuals and Pearson's residuals;

(d) Two estimators of the dispersion parameter ($\widehat{\varphi}_P$, $\widehat{\varphi}_D$).

Exercise 2:
Consider a GLM with gamma distribution and $w_m = 1$. Calculate the following quantities:

(a) Deviance statistics (D);

(b) Deviance residuals and Pearson's residuals;

Exercise 3:
Recall Exercise 2 from Practical 4 : Consider the claim amounts ($S_{i,j}$) sorted into the table below according to the risk classes of the two risk factors (vehicle type and driver age).

	21-30y	31-40y	41-50y	51-60y
passenger car	2000	1800	1500	1600
delivery van	2200	1600	1400	1400
truck	2500	2000	1700	1600

Assume (for simplicity) unit exposure, i.e. number of claims are $v_{i,j} = 1$. Consider the following three GLM

- Gamma error distribution and logarithmic link function.
- Normal error distribution and logarithmic link function.
- Inverse Gaussian error distribution and logarithmic link function.

With these models:

(a) Choose the best one according to minimum AIC

(b) For the chosen model, assess the possibility to reduce variables by performing backward stepwise variable selection (use AIC criterion).

(c) Review the results of variable reduction analysis from (b) by performing F test for sub-models.

Reference

[1] L. Mazurová *Mathematics of Non-life Insurance 2 - lecture notes*.Version March 2021. Available online at Moodle: https://dl1.cuni.cz/pluginfile.php/1162656/mod_resource/content/2/MNP2LectureNotes.pdf

[2] E. Ohlsson, B. Johansson: *Non-Life Insurance Pricing with Generalized Linear Models*, 15 EAA Lecture Notes, DOI 10.1007/978-3-642-10791-7_2, Springer-Verlag Berlin Heidelberg, 2010